

# FINAL LOCATION HYDRAULICS REPORT

## Northeast Connector Expressway - Phase I (From Cyrils Drive to Nova Road)

Osceola County, FL  
Project 599-228

Prepared for:

**CENTRAL  
FLORIDA  
EXPRESSWAY  
AUTHORITY**

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**May 2021**

# PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I am a registered professional engineer in the State of Florida practicing engineering with The Balmoral Group and that I have supervised the preparation of and approve the analysis, findings, opinions, conclusions and technical advice hereby reported for:

**PROJECT:** Northeast Connector Expressway – Phase I  
(from Cyrils Drive to Nova Road)  
Pond Siting Report  
Project 599-228  
Osceola County, Florida

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This report provides the results of the preliminary analysis of the existing drainage conditions and the analysis required for the estimation of cross drain sizes for the proposed improvements including the potential cross drain locations for the Project Development and Environment Study for Northeast Connector Expressway – Phase I (from Cyrils Drive to Nova Road). The results in this report are based on assumptions from existing permits and best available desktop data; no site-specific investigations were performed for this analysis. It is recommended that additional site-specific analysis be performed to finalize the report. I acknowledge that the procedures and references used to develop the results contained in this report are standard to the professional practice of hydrologic analysis and hydraulic engineering as applied through professional judgment and experience.

Any engineering analysis, documents, conclusions or recommendations relied upon from other professional sources or provided with responsibility by the client are referenced accordingly in the following report.

## FLORIDA REGISTERED ENGINEER:

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## EXECUTIVE SUMMARY

The Balmoral Group has subcontracted with RS&H, Inc. to provide Project Development and Environment (PD&E) drainage design services for the Central Florida Expressway Authority (CFX) which has commissioned a study for a new expressway connection between Cyrils Drive and Nova Road known as the Northeast Connector Expressway Phase I in Osceola County. The project is located in the Kissimmee River Watershed in the South Florida Water Management District (SFWMD) within the Lake Center Outlet basin. The project horizontal datum is NAD 1983 State Plane Florida East (US Feet), and the vertical datum is NAVD, which is 1.014 feet below NGVD (0.00 feet NGVD = -1.014 feet NAVD). The project site is within Township 25 South, Range 31 East (Sections 12, 13, 24, 25), and Township 25 South, Range 32 (Section 30).

Two alignments corridors, A and B, were evaluated for this project and Corridor A was ultimately selected. This decision was achieved through an extensive Alternatives Corridor Evaluation carried out in December of 2020 in which two corridors were evaluated. The selected corridor was found to have stronger stakeholder preference, less wetland impacts, and was determined to be a shorter route and lower construction costs.

The alignment corridor under analysis begins at the terminus of the planned SR 534 near Cyrils Drive and extends southwards until connecting to Nova Road, a distance of approximately 4.3 miles. One typical section is considered for the length of the project. The proposed typical section features two 12-foot travel lanes in each direction with 12-foot paved inside and outside shoulders. The proposed median width is 82 feet wide, which can accommodate future widening. The ultimate typical section features an eight-lane section and two potential multi-use lanes with a concrete median barrier wall. The alignment footprint is a 330 feet wide limited access right-of-way, which includes a border width of 88 feet on both sides of the Northeast Connector Expressway.

The Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) depicts Zones AE and X floodplain limits throughout the corridor from Lake Myrtle, Bullock Lake, Lake Joel and its associated channels and wetland sloughs. Zone AE has an established Base Flood Elevation (BFE) that has been approved by FEMA and ranges from 64.3 to 65.5 feet NAVD within the study area. Zone X is an area of minimal flood hazard and was not evaluated for floodplain impacts. There are no FEMA designated regulatory floodways within the study area.

Proposed cross drains for the four alternatives were evaluated. **Table ESI** below summarizes the cross drains and indicates whether the location is within a FEMA floodplain.

**TABLE ES I. PROPOSED CROSS DRAIN**

<b>Cross Drain (CD)</b>	<b>Pipe Size*</b>	<b>Flow Direction</b>	<b>Within a FEMA Floodplain</b>
<b>CD-1</b>	DBL - 48 "	East	No
<b>CD-2</b>	DBL - 48 "	East	Yes, mitigated within FPC pond
<b>CD-4</b>	DBL - 10' x 9'	East	Yes, mitigated within FPC pond
<b>CD-5</b>	QUAD – 6' x 3'	South	Yes, mitigated within FPC pond
<b>CD-6</b>	TRIP - 60"	East	No

\*DBL- Double

\*TRIP-Triple

\*QUAD - Quadruple

Floodplain impacts are not expected to occur within the contributing areas for cross drains CD-1 and CD-6. There is some encroachment of the existing 100-year FEMA floodplain at cross drain CD-2, CD-4 and CD-5 which will be mitigated by routing the floodplain impacted volume to the proposed stormwater management facility or floodplain compensation pond, as stated in the Pond Siting Report. Floodplain impacts at the footprint of the bridge over Canal 32C are not considered for the purposes of this report.

The proposed cross drains within the project limits were analyzed hydraulically using the Federal Highway Administration’s (FHWA) HY-8 (Version 7.50). Flow rates were calculated using the Rational Method for cross drains CD-1, CD-2, CD-4, CD-5, and CD-6 which have upstream contributing basins. Existing flow rates at CD-2, CD-5, and CD-6 were added to the flow. These flows were obtained from an available model associated with the Master Drainage Report Permit Application I West of C-30 Canal Post-Development Conditions for the Tavistock Development Company. Flows for CD-4 are derived directly from the previously permitted data. The proposed cross drain inverts are estimated from LiDAR. It is assumed that the final design team will perform a detailed survey of the existing cross drains to update the HY-8 calculations as necessary.

*This is a project on a new alignment with encroachments into the floodplain. Proposed cross drains and bridges will perform hydraulically in a manner equal to or greater than the existing condition, and backwater surface elevations are not expected to increase. Floodplain encroachments will be mitigated on a cup-for-cup basis in floodplain compensation sites and treatment/attenuation pond sites, which should result in no increase to the floodplain elevations. These changes will not result in any adverse impacts on the natural and beneficial floodplain values or any changes in flood risk or damage. There will not be a change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that the encroachment type for this study is classified as “minimal”.*

*It has been determined, through consultation with local, state, and federal water resources and floodplain management agencies that there is no regulatory floodway involvement on the project and that the project will not support base floodplain development that is incompatible with existing floodplain management programs.*

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## I Introduction

The Balmoral Group has subcontracted with RS&H, Inc. to provide Project Development and Environment (PD&E) drainage design services for the Central Florida Expressway Authority (CFX) which has commissioned a study for a new expressway connection between Cyrils Drive and Nova Road known as the Northeast Connector Expressway in Osceola County. The alignment corridor under analysis begins at the terminus of the planned SR 534 near Cyrils Drive and extends southwards until connecting to Nova Road, a distance of approximately 4.3 miles. The study area is located primarily on Deseret Ranches property. An overview map of the location is presented in **Figure I** in **Appendix A**.

The goal of the Northeast Connector Expressway is to enhance north-south mobility and provide connections between existing and future east-west corridors in the study area. Based on approved PD&E Study, the Northeast Connector Expressway will link the planned SR 534 with the planned Osceola/Brevard County Connector (OBCC), currently in the planning phase. These connections will promote regional connectivity, accommodate future growth, provide for transit opportunities, and enhance mobility in Osceola County. The link between the planned SR 534 and OBCC will also provide a seamless limited access, high-speed connection from the Orlando International Airport (OIA) to I-95 in Brevard County. In the interim, before the OBCC is constructed, the Northeast Connector Expressway will extend the limited access connection from Cyrils Drive to Nova Road, a major county road. This connection will be vital to providing a limited access, north-south facility within the Northeast District, a large master-planned development in northeast Osceola County owned by Deseret Ranches.

The Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) depicts Zones AE and X floodplain limits throughout the corridor from Lake Myrtle, Bullock Lake, Lake Joel and its associated channels and wetland sloughs. Zone AE has an established Base Flood Elevation (BFE) that has been approved by FEMA and ranges from 64.3 feet to 65.5 feet NAVD within the study area. Zone X is an area of minimal flood hazard and was not evaluated for floodplain impacts. There are no FEMA designated regulatory floodways within the study area.

The project is located within the Upper Kissimmee River Chain of Lakes in the South Florida Water Management District (SFWMD) and more specifically within the Lake Center Outlet waterbody identification (WBID) 3174F. The project site is within Township 25 South, Range 31 East (Sections 12, 13, 24, 25), and Township 25 South, Range 32 East (Section 30). The Kissimmee River Watershed is not an Outstanding Florida Waterbody (OFW).

## 2 Purpose

The purpose of this Location Hydraulics Report is to assess locations of off-site runoff towards the Northeast Connector Expressway mainline. The intent of the PD&E Study is to develop a proposed improvement strategy that is technically sound, environmentally sensitive, and publicly acceptable. The need for the project is to provide system linkage, multi-modal opportunities, and meet social demands. Analysis within this report determines potential impacts to floodplains and proposes mitigation strategies to be utilized in final design to offset those impacts. Additionally, the report provides estimated quantity and capacity of drainage features required to accommodate off-site runoff needs.

### 3 Cross Drain Analysis Methodology

The proposed Northeast Connector Expressway seen below in **Plate I** will introduce a new roadway alignment through an area with no existing roadway or development. This will significantly alter drainage patterns.



PLATE I. EXISTING DRAINAGE PATTERNS WITHIN THE PROJECT AREA

The proposed drainage patterns will follow the existing/historic drainage patterns as closely as possible. Cross drains will be proposed to convey existing ditches/streams or function as equalizer pipes for existing depressional areas.

Receiving water bodies for the corridor basin are Lake Joel, Bullock Lake, and Lake Myrtle. Lake Myrtle outfalls south to Lake Joel via Canal 32B. The ultimate outfall of the project study area is the Kissimmee River, which flows to Lake Okeechobee. The project area is confined to a single WBID, Lake Center Outlet (3174F). The project corridor traverses through wetlands that ultimately outfall to Lake Myrtle

and Bullock Lake. Further coordination with SFWMD will be necessary for canal right-of-way permit requirements.

Off-site contributing areas to the cross drains from existing drainage permits were adopted and refined from a review of topographic ridges, reviewing existing permits and plans, a field review of the project area, and reviewing surveyed drainage information. Relevant permit information is contained within **Appendix B**. A site visit to confirm the basin boundaries and cross drain locations was conducted on March 2, 2021. Field measurements, aerial imagery, Google Earth, LiDAR, and existing Environmental Resource Permit (ERP) information was used to determine the pipe size, length, inverts, and condition of existing culverts. Refer to **Figure 2** in **Appendix A** for the Digital Elevation Model (DEM) Map.

Proposed pipe locations were determined from field review, LiDAR, and other available information including FEMA floodplains, United States Geological Survey (USGS) topographic information, and permits for upstream or downstream culverts. Refer to **Figure 3** in **Appendix A** for the USGS Map and **Figure 4** for the Natural Resources Conservation Service (NRCS) Soils Map. Generally, proposed pipes were located where there are existing open channels or depressional areas. **Table I** provides the required storm events to be analyzed for each cross drain, per the Florida Department of Transportation (FDOT) Drainage Manual and Culvert Handbook requirements.

**TABLE I. STORM FREQUENCY CRITERIA**

<b>Storm Event Frequency</b>	<b>Type of Structure</b>
10-year	General Roadside Ditch Culverts Pedestrian and Trail Bridges Side Drains
25-year	Design Flood Event (Projected 20-year AADT < 1,500)
50-year	Cross Drains * Design Flood Event (Projected 20-year AADT > 1,500)
100-year	Cross Drains Base Flood Event
500-year	Cross Drains Greatest Flood Event

\*Project design storm

The proposed cross drains along the new alignment will be designed to allow the offsite flow to maintain existing drainage patterns.

All proposed cross drains are for a limited access interstate while existing cross drains have a smaller level of service than what would be required. For example, this is the case with CD-2 which runs across the proposed alignment and has a hydraulic connection to an existing CD-38 that conveys drainage into Lake Joel. Existing flows may be for a lower/smaller storm event and may allow for overtopping whereas the proposed roadway would require a 50-year event and would be designed for no roadway overtopping; therefore, the existing permitted flows cannot be used. However, the existing drainage patterns were considered, and the Sunbridge Northeast District drainage model and proposed plans were taken into

consideration for pertinent outfall locations and sizes. No further analysis was performed on these cross drains.

Therefore, the method adopted was to use the existing cross drains to calculate the existing peak flows through the proposed cross drains using the FDOT Rational Method to account for flow from the contributing basin plus the permitted upstream flow, if applicable. Refer to **Table B-2** in **Appendix D**.

The Rational Method was employed for cross drains CD-1, CD-2, CD-5, and CD-6 to calculate discharge rates for the Design Flood Event (50-year), Base Flood Event (100-year), and the Greatest Flood Event (500-year) extrapolated using a log-log graph. If the time of concentration was less than or equal to 180 minutes, the intensity for each storm event was calculated from the FDOT Intensity-Duration-Frequency (IDF) Equations for Zone 7 provided in the FDOT Hydrology Handbook. If the time of concentration was more than 180 minutes, intensities were attained directly from the IDF curve for Zone 7. Discharge rates for the 500-year event were extrapolated by plotting the calculated discharge rates for the 50-year and 100-year events on a log-log graph of frequency versus flow and forecasting for the 0.2% event frequency (500-year event).

Federal Highway Administration (FHWA) HY-8 (Version 7.50) software was used to determine peak stages associated with these flows and proposed pipe sizes. Pipe sizes were determined by providing a velocity of approximately three feet per second (fps) during the design storm to minimize risk of increasing stages for the surrounding properties. For the purpose of this study, it was assumed that a maximum pipe size of 48-inches would be used before creating multiple pipes at the cross drain unless permitted data utilized a larger pipe (i.e. CD-6) or box culverts were sized to convey larger flows. In all cases, overtopping for the basin was assumed to be the roadway for the mainline.

A preliminary proposed roadway profile was obtained and used to locate cross drains at low points in the road. At cross drain locations, the roadway was assumed to be five feet above the crown of pipe in an effort to provide dry bottoms in the roadside ditches. The roadway profile will be re-evaluated during final design. The crown of pipe was assumed to match either FEMA's BFE or the existing ground elevation provided by LiDAR data. The crown of pipe at the downstream end is used as the constant tailwater elevation for each cross drain in HY-8, as it was assumed this would be the condition where peak flow occurs.

If the 500-year discharge did not result in overtopping of the Northeast Connector Expressway, then the 500-year discharge and stage was entered in the Flood Data Box as the Greatest Flood. If a storm event of lower frequency than the 500-year discharge resulted in overtopping, then the frequency of the storm event was calculated using the log-log discharge estimate, and this result was recorded as the Overtopping Flood within the Flood Data Box. Refer to **Appendix D**.

It is assumed that during the design phase pipe sizes will be re-evaluated for any existing infrastructure (e.g. underground utilities) or topographic limitations that can influence pipe inverts, as well as the proposed profile that can limit the pipe height. It is also assumed that the basin overtopping analysis and floodplain stage increases will be evaluated in the design phase.

## 4 Existing Conditions

### 4.1 Previously Permitted Information

Existing drainage basin locations and previously permitted cross drains located upstream and downstream of the project were used to determine the sizing and flow of the proposed cross drains.

The Balmoral Group's (TBG) site visit on March 2, 2021 and permits were used to verify the cross drains found within the project boundaries. **Table 2** provides a list of SFWMD Environmental Resource Permits reviewed for cross drain information and locations along the project limits. The pre-development model from the permits was relied on to provide upstream flows.

Pre-development nodal conditions and field observations show that the surrounding basins are flowing towards the lakes, Lake Myrtle, Bullock Lake, and Lake Joel, which are acting as sinks. Refer to **Appendix B**.

TABLE 2. EXISTING PERMITS REVIEWED

Application Number	Project Name	Information reviewed
171106-4	Sunbridge Northeast District (NED) Phase I West of C-30 Canal – Phase I, Conceptual Permit	Upstream flow for cross drains
200622-3738	Sunbridge NED Master Drainage Report - Phase I, Conceptual Permit	Upstream flow for cross drains

### 4.2 Existing Cross Drains

TBG's field review resulted in the discovery of pertinent cross drains on Sungrove Lane and Nova Road. Field review notes are located in **Appendix C** and provide an overview of the existing cross drain locations in relation to the alignment. The direction of flow is determined from LiDAR, previously permitted data, and field visit observations. See **Figures 6** through **15** in **Appendix A**, for existing cross drain location exhibits. **Table 3** provides pertinent information for existing cross drains along Sungrove Lane and Nova Road obtained during the TBG field visit. Refer to the field visit notes and map in **Appendix C**.

TABLE 3. RELEVANT EXISTING CROSS DRAINS

Existing Cross Drain	Field Review Location Index	Hydraulically Connected Proposed Cross Drain	Size	Flow Direction	Source
C-16-1	1	--	10' x 7' Box Culvert	No flow (wildlife crossing)	Field review
C-19-1 & C-19-2	2	C-19	DBL 30"	North	Field review
<sup>1</sup> C-35	10	CD-1	36"	East/West	Field review
<sup>1</sup> C-36	9		36"	East/West	Field review
C-38	3	CD-2	36"	East	Field review
C-40-1, C-40-2 & C-40-3	6		DBL 36" 24"	East	Field review
<sup>1</sup> C-41	11	CD-4	36"	East/West	Field review
P NED 15-1	4	CD-6	36"	East	Field review
C-44-1 & C-44-2	5		DBL 48"	East	Field review
<sup>2</sup> P NED 15-2	7	CD-5	18"	South	ERP review

<sup>1</sup> C-35, C-36 and C-41 are cross drains across Sungrove Lane that discharge into C-32B or C-32C, which are regulated canals, through controlled weir structures

<sup>2</sup> P NED 15-2 was identified within Sunbridge NED (ERP Application 200-622-3738), but was not located during the field visit. See **Section 4.2.10** for additional information.

#### 4.2.1 C-16-1

Cross drain C-16-1 is a box culvert located approximately 451 feet west of station 948+93 on the mainline along Nova Road. A field review of this location established it as a wildlife crossing given it has been constructed as an overpass. Wildlife crossings are not included in cross drain estimates. It is assumed that coordination of wildlife crossings will be performed during the design phase.

**Figure 8 in Appendix A** and the location map in **Appendix C** show the location of C-16-1 and surrounding topography. **Plate 2** shows the condition of the cross drain.



PLATE 2. C-16-1 ALONG NOVA ROAD

#### 4.2.2 C-19-1 and C-19-2

C-19-1 and C-19-2 are 30-inch pipes located approximately 947 feet west of station 948+93 on the mainline along Nova Road. Offsite flow is north towards and into the adjacent wetlands. It is

assumed that this structure will be reconstructed in the future given the Tavistock development plans that include widening the road and adding ramps.

**Figure 7** in **Appendix A** and the location map in **Appendix C** show the location of C-19-1 and C-19-2 and the surrounding topography. **Plate 3** shows the condition of the cross drain.



**PLATE 3. C-19-2 ALONG NOVA ROAD**

#### 4.2.3 C-35

Cross drain C-35 is a submerged 36-inch galvanized steel pipe connecting weir PC-24 to Canal 32C from the east. The cross drain is connected to PC-24, a control structure with regulated flow in both directions between the wetland and the canal.

**Figure 9** in **Appendix A** and the location map in **Appendix C** show the location of C-35 including the surrounding topography. **Plate 4** shows the connecting weir structure PC-24 at the inlet of C-35.



**PLATE 4. WEIR PC-24 AT THE INLET OF C-35**

#### 4.2.4 C-36

Cross drain C-36 is a submerged 36-inch galvanized steel pipe connecting weir PC-25 to Canal 32C from the west. The cross drain is connected to PC-25, a control structure with regulated flow in both directions between the wetland and the canal.

**Figure 9** in **Appendix A** and the location map in **Appendix C** shows the location of C-36 including the surrounding topography. **Plate 5** shows the connecting weir structure PC-25 at the inlet of C-36.



**PLATE 5. WEIR PC-25 AT THE INLET OF C-35**

#### 4.2.5 C-38

Cross drain C-38 is a 36-inch galvanized steel pipe located on Sungrove Lane. Offsite flow is east towards the adjacent wetlands and Lake Joel. This structure was used to size and locate CD-2, which is 180 feet northeast from the location of C-38.



**PLATE 6. CROSS DRAIN C-38**

**Figure 10** in **Appendix A** and the location map in **Appendix C** shows the location of C-38 including the surrounding topography. **Plate 6** shows the condition of the cross drain.

#### 4.2.6 C-40-1, C-40-2 and C-40-3

Cross drains C-40-1, C-40-2, and C-40-3 are located just north of Lake Joel on Sungrove Lane. These cross drains are included within the field notes for the field review on March 2, 2021, which can be found in **Appendix C**. The cross drains consist of two 36-inch and one 24-inch galvanized steel pipes and flow east.

**Figure 11** in **Appendix A** and the location map in **Appendix C** shows the location of C-40-1, C-40-2 and C-40-3 including the surrounding topography. **Plate 7** shows the condition of this cross drain.



**PLATE 7. CROSS DRAINS C-40-1, C-40-2 AND C-40-3**

#### 4.2.7 C-41

Cross drain C-41 is a submerged 36-inch galvanized steel pipe connecting weir PC-18 to Canal 32B from the west. The cross drain is connected to PC-18 which has regulated flow in both directions between the wetland and the canal.



**PLATE 8. WEIR PC-18 AT THE INLET OF C-41**

**Figure 12** in **Appendix A** and the location map in **Appendix C** shows the location of C-41 including the surrounding topography. **Plate 8** shows the connecting weir structure PC-18 at the inlet of C-41.

#### 4.2.8 P NED 15-1

P NED 15-1 is a 36-inch mitered end reinforced concrete pipe (RCP) which outfalls from the drop structure at the Tavistock utility site retention pond. It flows into a grassed ditch that flows east towards Lake Myrtle.



**PLATE 9. OUTFALL OF POND AT TAVISTOCK UTILITY SITE**

Considering ongoing construction at this site, it is assumed that this structure will be upgraded to handle additional flow from future developments as it is within Phase I of the defined Tavistock development plans.

**Figure 14** in **Appendix A** and the location map in **Appendix C** shows the location of P NED 15-1 including the surrounding topography. **Plate 9** shows the condition of the cross drain.

#### 4.2.9 C-44-1 and C-44-2

Cross drains C-44-1 and C-44-2 are located in the receiving basin of the proposed cross drain CD-6. These cross drains are included within the field notes for the field review on March 2, 2021, which can be found in **Appendix C**. The cross drains are both 48-inch galvanized steel pipes that flow east towards Lake Myrtle.

**Figure 15** in **Appendix A** and the location map in **Appendix C** shows the location and surrounding topography of cross drain C-44-1. **Plate 10** shows the condition of this cross drain.



**PLATE 10. CROSS DRAIN C-44-1 AND CD-44-2**

#### 4.2.10 P NED 15-2

P NED 15-2 is a structure noted in the existing permit information from Sunbridge NED (ERP Application 200-622-3738) to be a buried 18-inch pipe which flows south and is located south of the Tavistock Utility Site. However, this structure was not found during the field study conducted on March 2, 2021; therefore, the pipe is assumed to be buried or removed. This location is relevant as the Tavistock site has been raised and graded to divert flow south towards the sink in Lake Myrtle.

Flow at this site has overtopped the existing service and farm roads flowing east at a 0.5 feet depth towards Lake Myrtle across the proposed alignment.

**Figure 13** in **Appendix A** and the location map in **Appendix C** shows the location and surrounding topography at the site of P NED 15-2 where the Geographic Watershed Information System (GWIS) survey indicated its position. **Plate 11** shows the condition at this location.



**PLATE 11. OVERTOPPING FLOW AT MISSING P NED 15-2**

## 5 Proposed Conditions

Potential floodplain impacts as a result of the Northeast Connector Expressway were reviewed along the contributing basin for each cross drain. Any floodplain impacts associated with the proposed bridge over Canal 32C near Lake Joel will be handled during the design phase through a bridge hydraulics analysis.

Floodplain impacts are not expected to occur within the contributing areas for cross drains CD-1 and CD-6. There is some encroachment of the alternative footprint on the existing 100-year FEMA floodplain at cross drain CD-2, CD-4 and CD-5 which will be mitigated by routing the floodplain impacted volume to the proposed stormwater management facility or floodplain compensation pond, as stated in the Pond Siting Report prepared under a separate cover.

This document serves to identify the proposed offsite conveyance required to maintain existing drainage patterns through the proposed alternatives. Please see **Appendix D** for proposed calculations, assumptions, and HY-8 results.

Two alternative alignments were evaluated during the PD&E Study: Nova Road Connection – Option 1 and Nova Road Connection – Option 2. For the purpose of this report, the preferred alignment is Nova Road Connection-Option 2. The Nova Road Connection-Option 2 begins at the intersection of the alignment with Nova Road at station 948+93. From this intersection, the alignment runs along Nova for 1,614 feet east and 1,586 feet west. The proposed alignment continues on a northerly alignment from the junction at station 948+93 until the end of the project extents at station 735+00. An interchange is proposed at station 807+70 at the extension of Jack Brack Road. See **Figure 1** in **Appendix A**. The alignment intersects with both Flood Zones AE and X. **Table 4** provides alternatives for proposed cross drains.

**TABLE 4. PROPOSED CROSS DRAINS**

<b>Cross Drain</b>	<b>Culvert Size</b>	<b>Flow Direction</b>
C-19	DBL 30" RCP	North
CD-1	DBL 48" RCP	East
CD-2	DBL 48" RCP	East
CD-4	DBL 10' x 9' Box Culvert	East
CD-5	QUAD 6'x3' Box Culvert	South
CD-6	TRIP 60" RCP	East

\*DBL- Double

\*TRIP-Triple

\*QUAD - Quadruple

## 5.1 C-19

C-19 is the proposed extension of the existing double barrel 30" pipes (C-19-1 and C-19-2) spanning under Nova Road, about 940 feet east of where the proposed alignment begins, and convey flow north. Existing cross drains are assumed to be lengthened to span under the additional travel lanes added but remain at their current size. Both C-19-1 and C-19-2 require a proposed extension of 60 feet, bringing them from 80 feet to 140 feet in length.

The cross drains are not located within any of the FEMA Flood Zones.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of C-19-1 and C-19-2 and surrounding topography. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

## 5.2 Cross Drain 1

CD-1 is located along the alignment at station 910+19 across the entire mainline and conveys flow east to the wetlands connected to Lake Joel. The rational method was performed at this location, which estimated a peak design storm flow of 72.1 cubic feet per second (cfs) from a contributing area of 33.0 acres. To provide approximately 3 feet per second (fps) velocity through the cross drain during the design storm, the proposed cross drain was sized to be two 48-inch pipes.

The cross-drain crosses between a FEMA Flood Zone X to a Flood Zone AE, with a base flood elevation of 63.55 feet-NAVD per HY-8 calculation. The location is undeveloped hence there are no existing cross drains. Floodplain impacts are not expected to occur within the contributing area for CD-1.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of CD-1 and surrounding topography. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

### 5.3 Cross Drain 2

CD-2 is located along the alignment at station 880+34 across the entire mainline and conveys flow east to the wetlands connected to Lake Joel. Upstream flows were added to flows from the contributing basin, as calculated using the rational method. The total estimated peak design storm flow was 57.60 cfs from a contributing area of 20.6 acres. To provide approximately 3 (fps) velocity through the cross drain during the design storm, the proposed cross drain was sized to be two 42-inch pipes.

The cross drain is located within FEMA Flood Zone AE, with a base flood elevation of 63.06 feet-NAVD per HY-8 calculation. The location is undeveloped hence there are no existing cross drains. Floodplain impacts are expected to occur within the contributing area for CD-2.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of CD-2 and the surrounding topography. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

### 5.4 Cross Drain 4

CD-4 is located along the alignment at station 819+18 across the entire mainline and conveys flow east to the wetlands connected to Lake Myrtle. The peak flow utilized for this cross drain was obtained from the existing permitted flow of 496.1 cfs. To provide approximately 3 fps velocity through the cross drain during the design storm, the proposed cross drain was sized to be two 10-foot x 9-foot box culverts across the mainline.

The cross drain is located within FEMA Flood Zone AE, with a base flood elevation of 63.37 feet-NAVD per HY-8 calculation. The location is undeveloped hence there are no existing cross drains. Floodplain impacts are expected to occur within the contributing area for CD-4.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of CD-4 and the surrounding topology. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

### 5.5 Cross Drain 5

CD-5 runs north to south across the proposed extension of Jack Brack Road. It is located at the intersection between Jack Brack Road and the mainline. Upstream flows were added to flows from the contributing basin, as calculated using the rational method. The total estimated peak design storm flow was 141.4 cfs from a contributing basin of 42.3 acres. The proposed cross drain was sized to match the proposed upstream cross drain along Rummell Road, NED15-1 PBU, which is proposed as a four 6-foot x 3-foot box culverts under ERP Application 200622-3738, which meets the sizing estimate from an assumed 3 fps velocity.

The cross drain is located within FEMA Flood Zone AE, with a base flood elevation of 64.26 feet-NAVD per HY-8 calculation. The location is undeveloped hence there are no existing cross drains. Floodplain impacts are expected to occur within the contributing area for CD-5.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of CD-5 and the surrounding topology. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

## 5.6 Cross Drain 6

CD-6 is located along the alignment at station 765+85 across the entire mainline and conveys flow east to the wetlands connected to Lake Myrtle. Upstream flows were added to flows from the contributing basin, as calculated using the rational method. The total estimated peak design storm flow was 139.10 cfs from a contributing area of 1.4 acres and permitted upstream flows. To provide approximately 3 fps velocity through the cross drain during the design storm, the proposed cross drain was sized to be three 60-inch pipes.

The cross drain is located just upstream of a FEMA Flood Zone AE, with a base flood elevation of 64.02 feet-NAVD per HY-8 calculation. The location is undeveloped hence there are no existing cross drains. Floodplain impacts are not expected to occur within the contributing area for CD-6.

See **Figure 6** in **Appendix A** for a GIS exhibit showing the location of CD-6 and the surrounding topology. Refer to **Appendix D** for the full cross drain calculations and HY-8 input and output.

## 6 Conclusion

In summary, the hydraulic structures proposed along the new alignment will be designed to cause no adverse increase in flood stages and flood limits. The purpose of this report is to determine the existing condition and location of the cross drains along the project area of the Northeast Connector Expressway Phase I improvements and the associated impacts of these improvements. These changes will not result in any adverse impacts in the natural and beneficial floodplain values or any changes in flood risk or damage.

Additional right-of-way is anticipated for offsite floodplain compensation sites to mitigate for impacts to the floodplain on a cup-for-cup basis. Compensation sites have been preliminarily selected. Refer to the Pond Siting Report under a separate cover for additional information.

The proposed roadway improvements are expected to have no adverse impact on the existing cross drains that will be in series with the proposed cross drains. The proposed cross drains were analyzed to cause no increase in flood staging and flood limits. In addition, the proposed roadway is expected to route some of the roadway runoff to proposed ponds, thereby reducing the amount of flow through each cross drain. There are no significant impacts from the proposed roadway on the headwater stages for the modeled cross drains.

In final design, the HY-8 models from the PD&E Study should be updated to include surveyed cross drain information to demonstrate the hydraulic improvement and prove there will be no adverse impacts. It is expected that cross drain flows will decrease if a methodology that accounts for upstream storage within the surrounding wetlands is utilized. There shall be no adverse impacts due to the incorporation of proposed cross drains along the Northeast Connector Expressway.

*This is a project on a new alignment with encroachments into the floodplain. Proposed cross drains and bridges will perform hydraulically in a manner equal to or greater than the existing condition, and backwater surface elevations are not expected to increase. Floodplain encroachments will be mitigated on a cup-for-cup basis in floodplain*

*compensation sites and treatment/attenuation pond sites, which should result in no increase to the floodplain elevations. These changes will not result in any adverse impacts on the natural and beneficial floodplain values or any changes in flood risk or damage. There will not be a change in the potential for interruption or termination of emergency service or emergency evacuation routes. Therefore, it has been determined that the encroachment type for this study is classified as “minimal”.*

*It has been determined, through consultation with local, state, and federal water resources and floodplain management agencies that there is no regulatory floodway involvement on the project and that the project will not support base floodplain development that is incompatible with existing floodplain management programs.*

TABLE 5. FLOOD DATA BOX

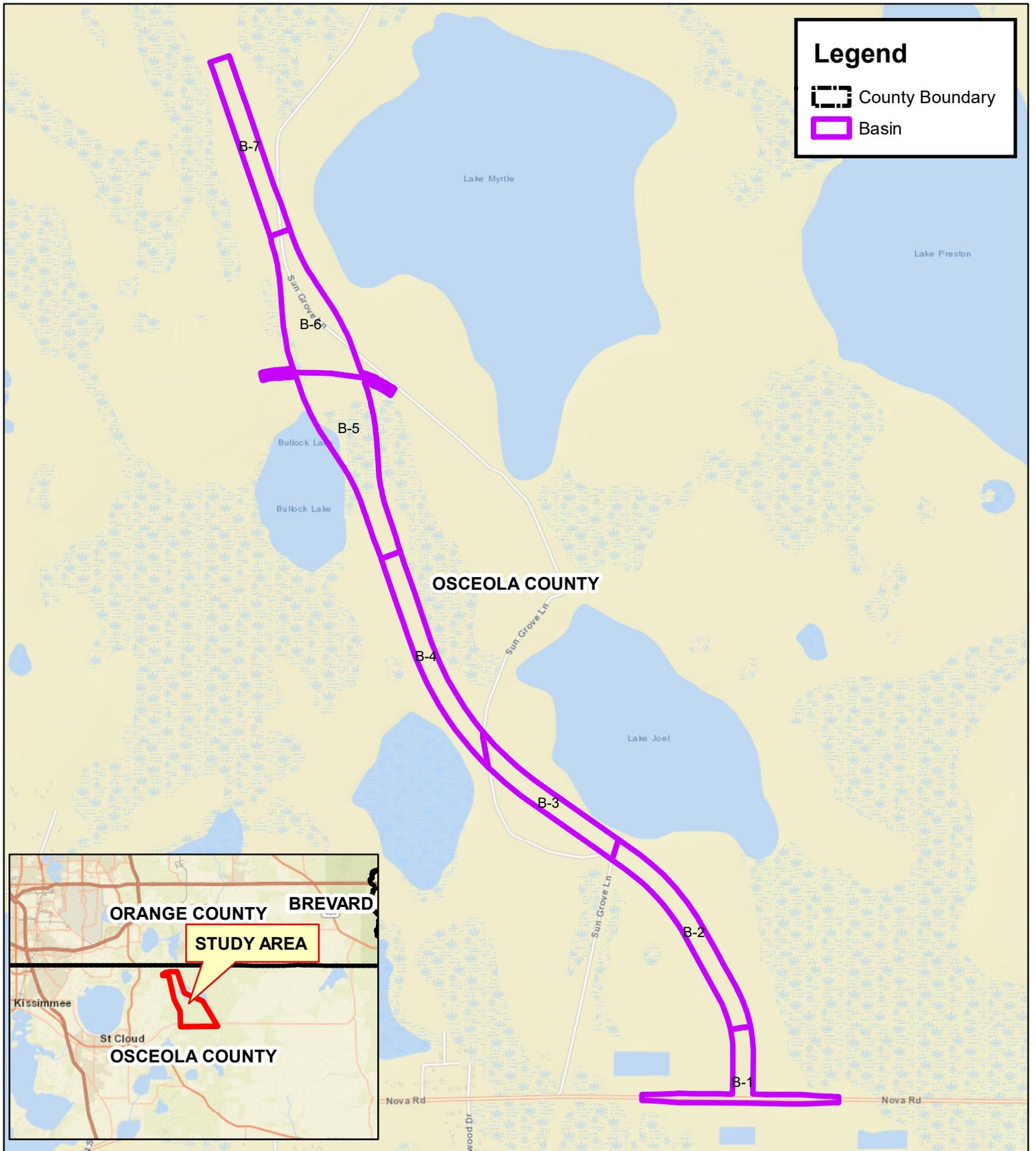
Structure No.	Cross Drain Size	Design Flood		Base Flood		Overtopping Flood				Greatest Flood	
		2% Prob. Discharge	50-Yr. Freq. Stage	1% Prob. Discharge	100-Yr. Freq. Stage	Discharge	Stage	% Prob.	Freq. Yr.	0.2% Prob. Discharge	500-Yr. Freq. Stage
CD-19_1	30" RCP	11.92	68.43	13.84	68.48	--	--	--	--	18.30	68.61
CD-19_2	30" RCP	13.18	69.95	15.12	70.04	--	--	--	--	19.63	70.30
CD-1	2 - 48" RCP	72.10	63.47	79.20	63.55	--	--	--	--	96.00	63.76
CD-2	2 - 42" RCP	57.60	63.01	60.90	63.06	--	--	--	--	68.70	63.18
CD-4	2 - 10' x 9' CBC	496.10	63.20	622.18	63.37	--	--	--	--	914.96	63.92
CD-5	4 - 6' x 3' CBC	141.40	64.22	162.70	64.26	--	--	--	--	212.10	64.38
CD-6	3 - 60" RCP	139.10	64.02	139.33	64.02	--	--	--	--	139.87	64.03

## 7 References

- Florida Department of Transportation. (2021). Drainage Design Guide.
- Florida Department of Transportation. (2021). Drainage Manual.
- CFX Design Guidelines. (2021).
- Osceola County Land Development Code. (2020).
- The Balmoral Group. (2021). Pond Siting Report; Northeast Connector Expressway – Phase I, From Cyrils Drive to Nova Road.
- Federal Emergency Management Agency (FEMA), Panel Nos. I2097C0110G and I2097C0120G (effective date 6/18/2013) with LOMR 16-04-2860P (effective date 1/20/2017), for Osceola County, Florida.

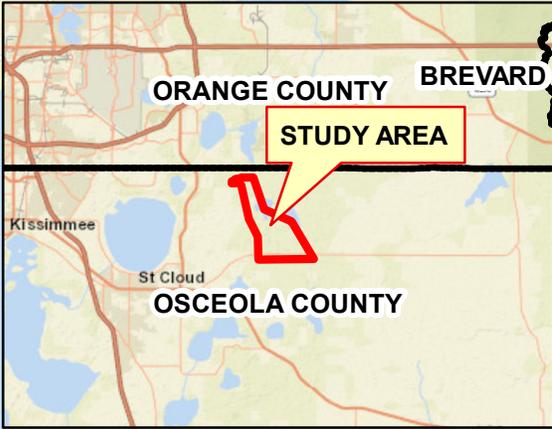
## Appendix A

### GIS Figures



**Legend**

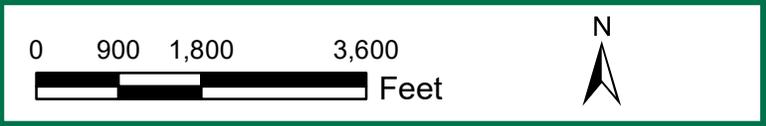
-  County Boundary
-  Basin

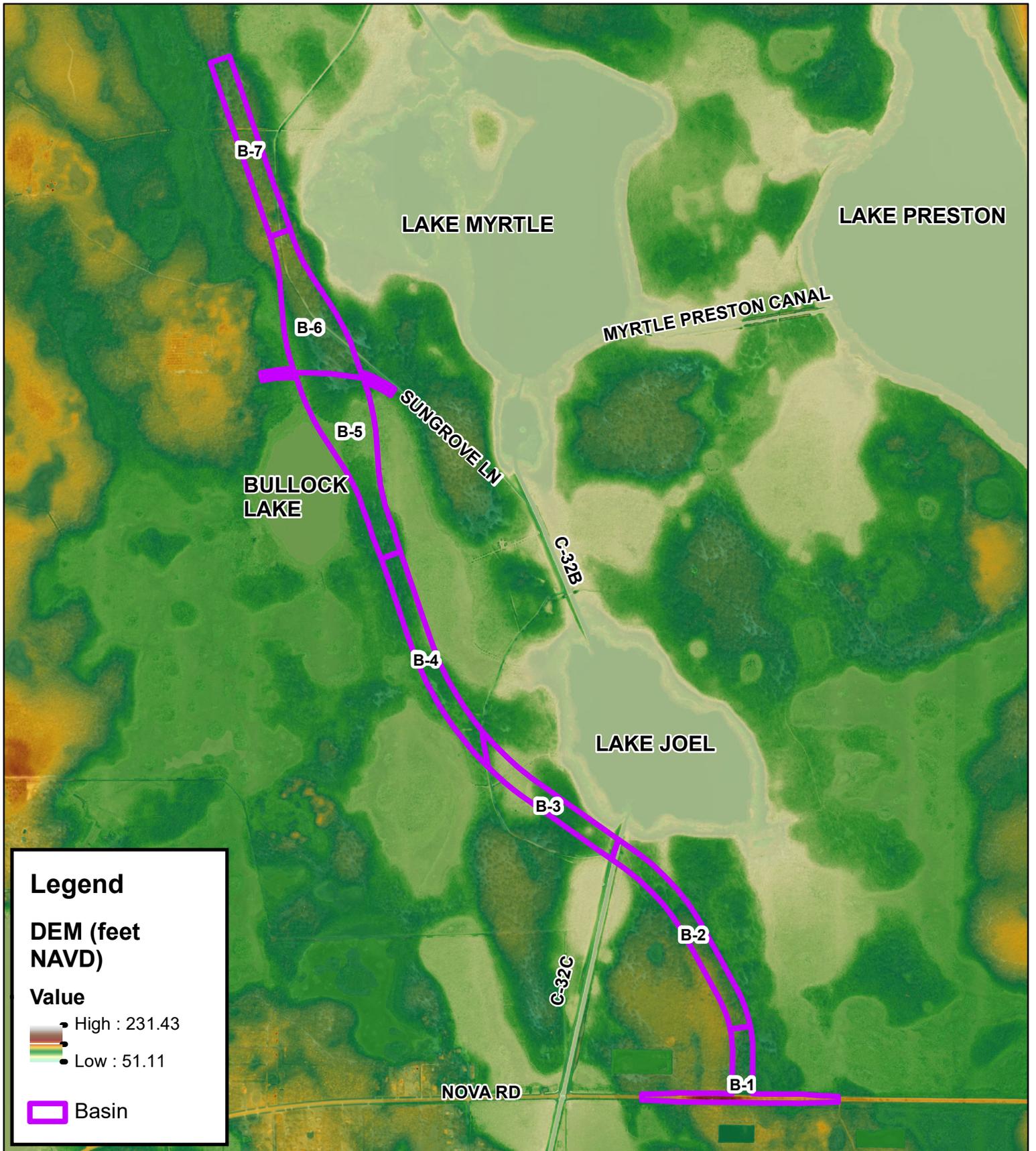


**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

**PREPARED BY:**  
 The Balmoral Group  
 165 Lincoln Avenue  
 Winter Park, Florida 32789

**FIGURE 1**  
**LOCATION MAP**





**Legend**

**DEM (feet NAVD)**

**Value**

- High : 231.43
- Low : 51.11

**Basin**

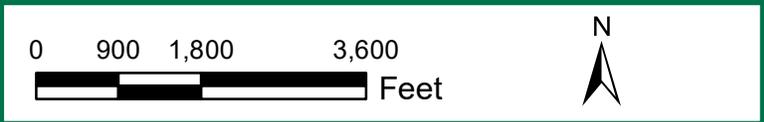
**NORTHEAST CONNECTOR**

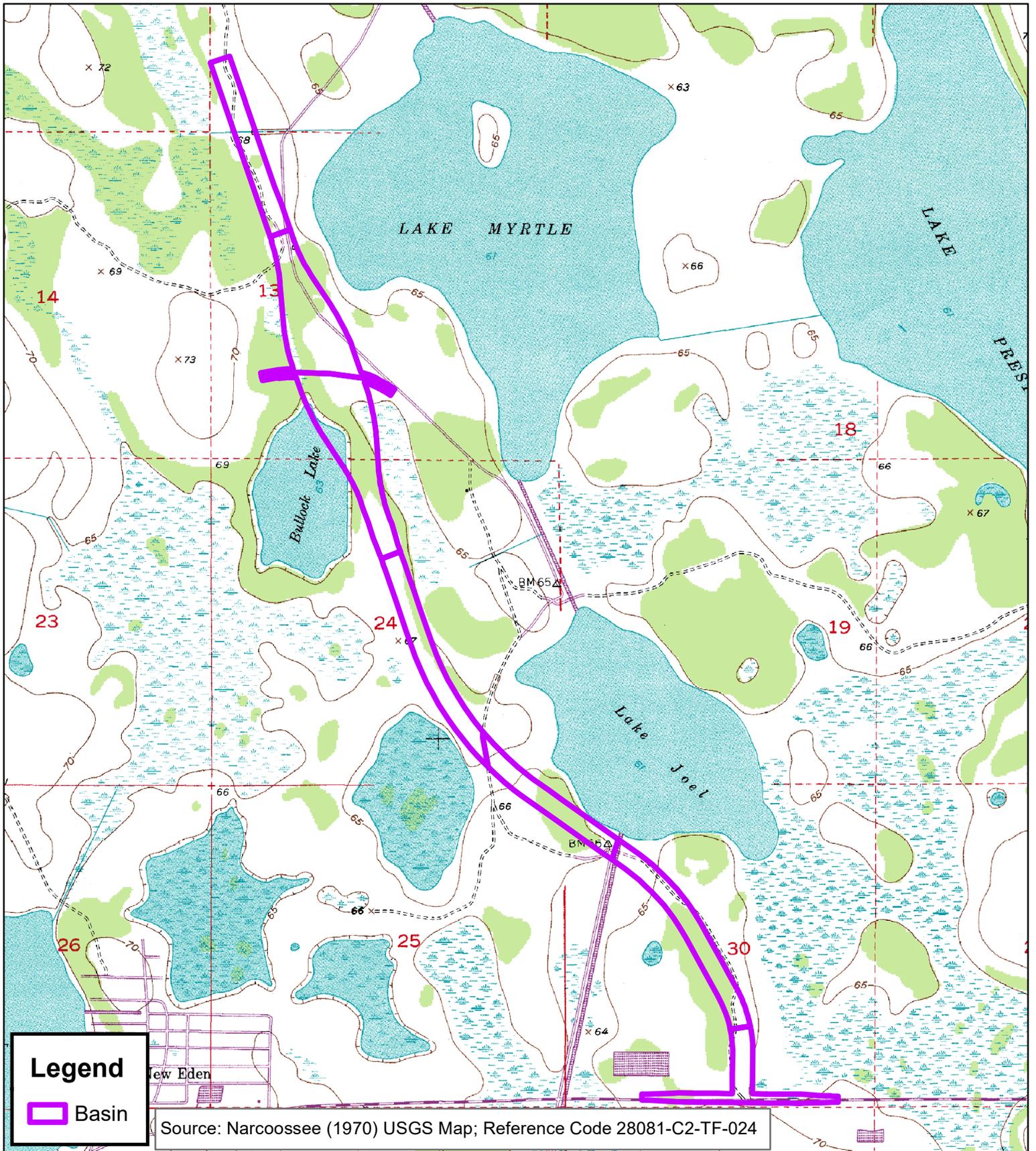
FROM CYRILS DRIVE TO NOVA ROAD (CR 532)

OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
 The Balmoral Group  
 165 Lincoln Avenue  
 Winter Park, Florida 32789

**FIGURE 2**  
**DEM MAP**



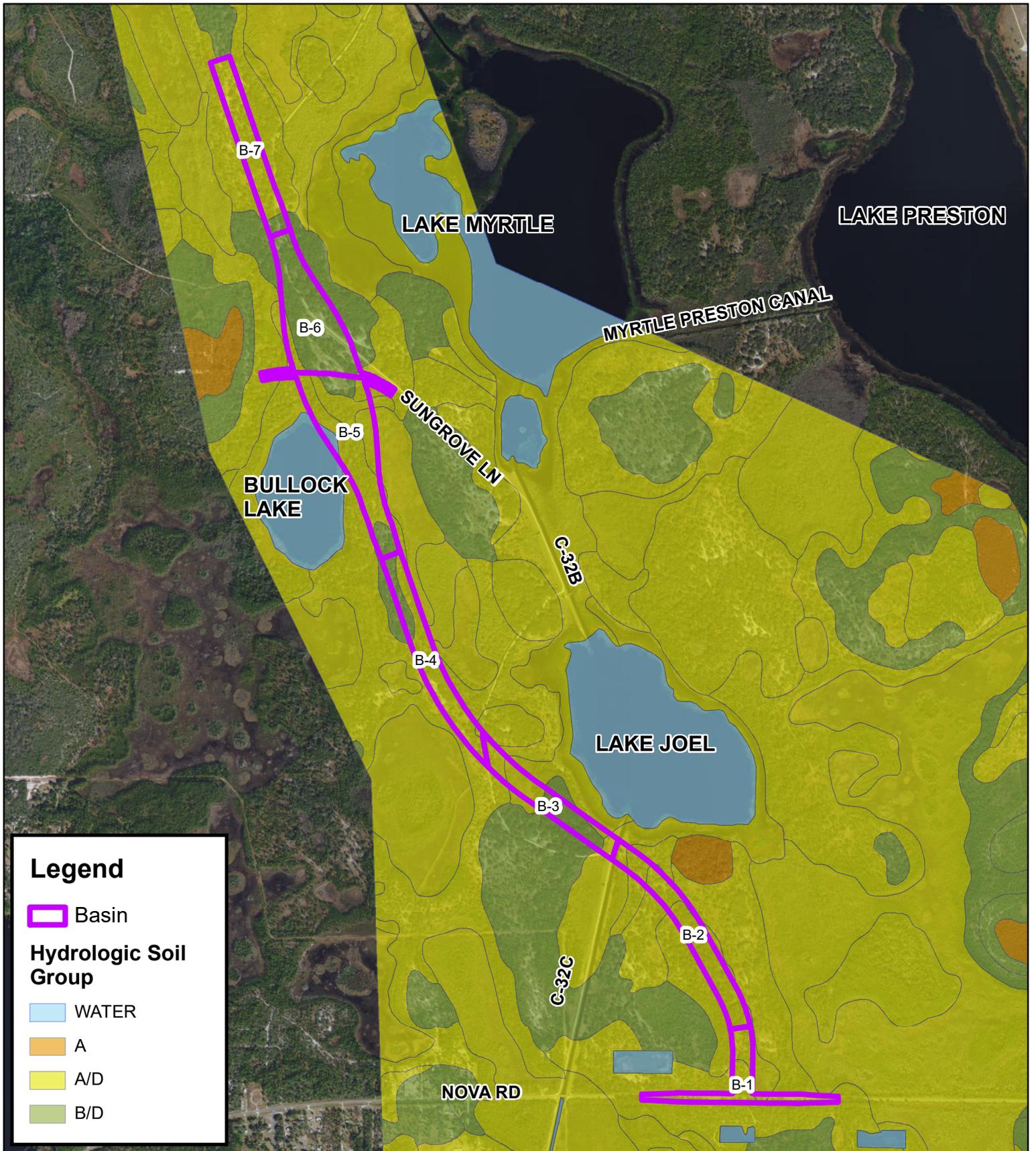


**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

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 Winter Park, Florida 32789

**FIGURE 3**  
**USGS MAP**





## NORTHEAST CONNECTOR

FROM CYRILS DRIVE TO NOVA ROAD (CR 532)

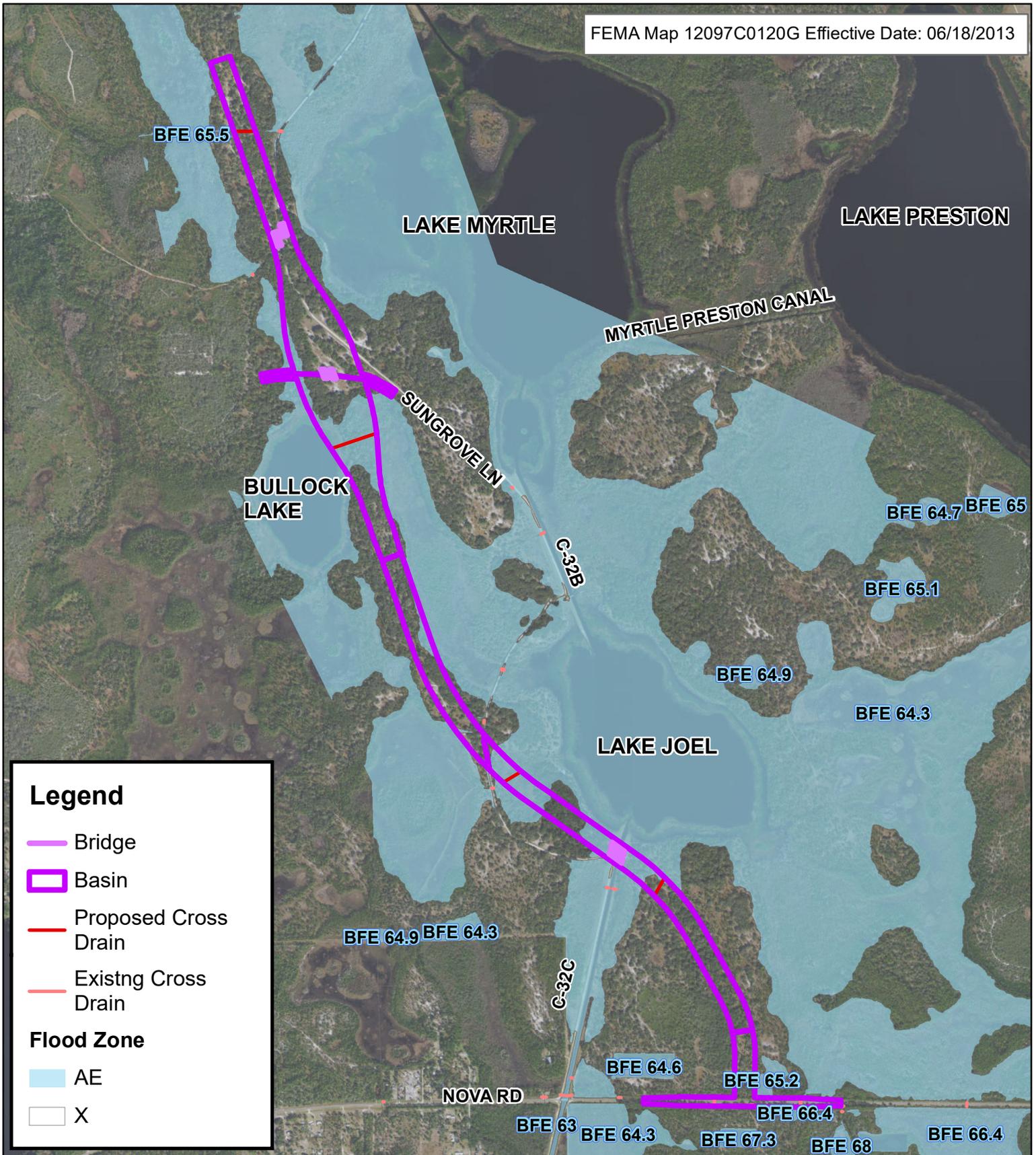
OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
The Balmoral Group  
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Winter Park, Florida 32789

## FIGURE 4 NRCS SOILS MAP

0 900 1,800 3,600  
Feet





**Legend**

- Bridge
- Basin
- Proposed Cross Drain
- Existing Cross Drain

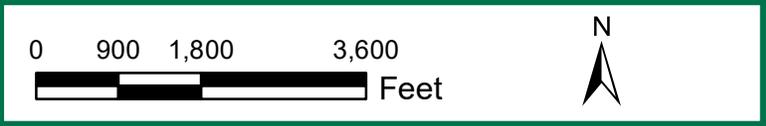
**Flood Zone**

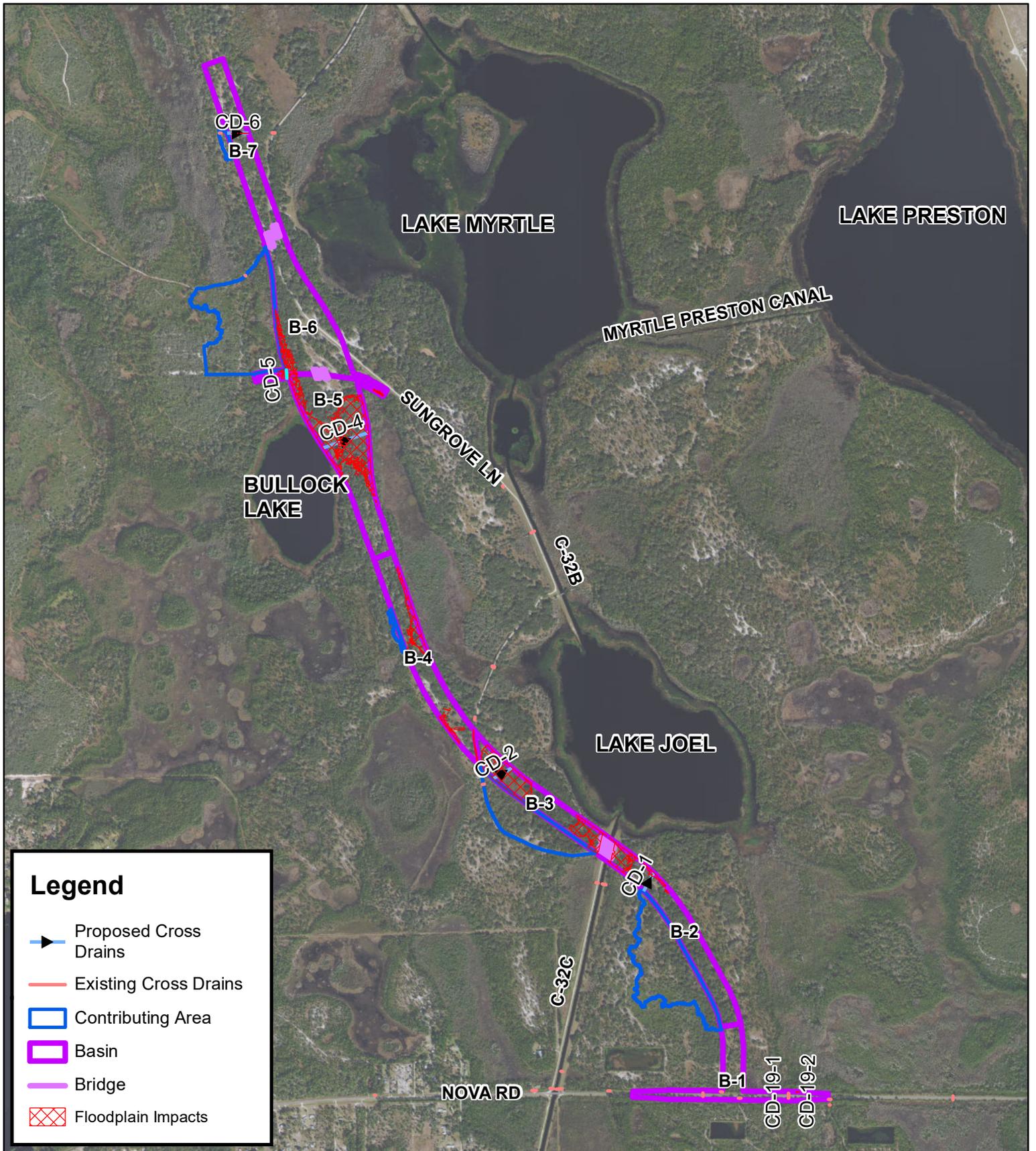
- AE
- X

**NORTHEAST CONNECTOR**  
FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
OSCEOLA COUNTY, FLORIDA

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**FIGURE 5  
FEMA MAP**





**Legend**

-  Proposed Cross Drains
-  Existing Cross Drains
-  Contributing Area
-  Basin
-  Bridge
-  Floodplain Impacts

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)

OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
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 Winter Park, Florida 32789

**FIGURE 6**  
**CROSS DRAIN**  
**LOCATION MAP**





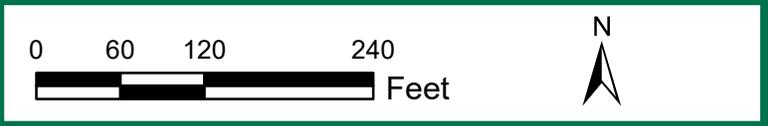
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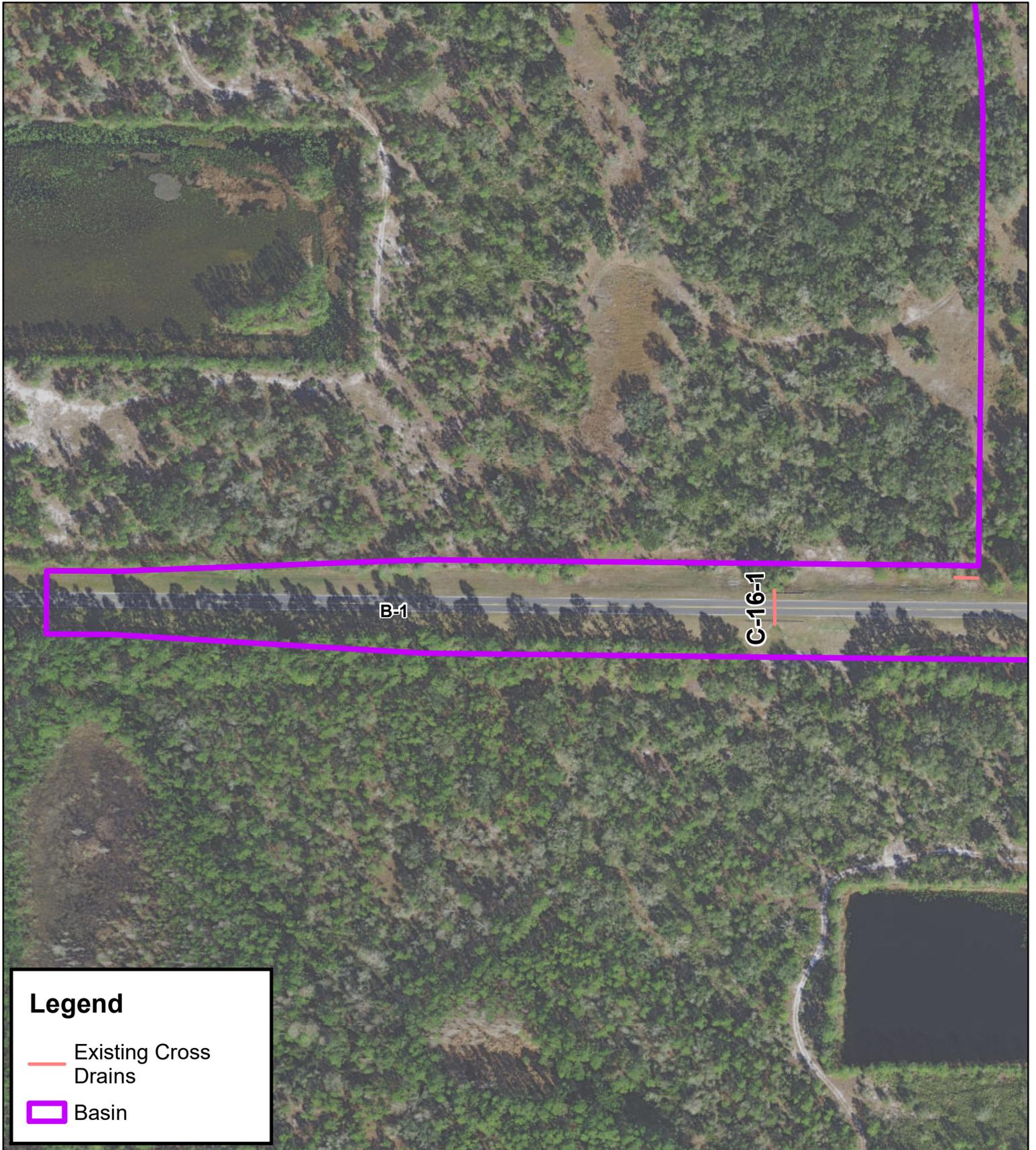
-  Existing Cross Drains
-  Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

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**FIGURE 7**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





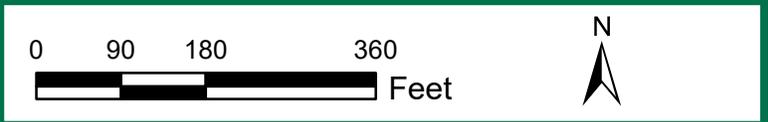
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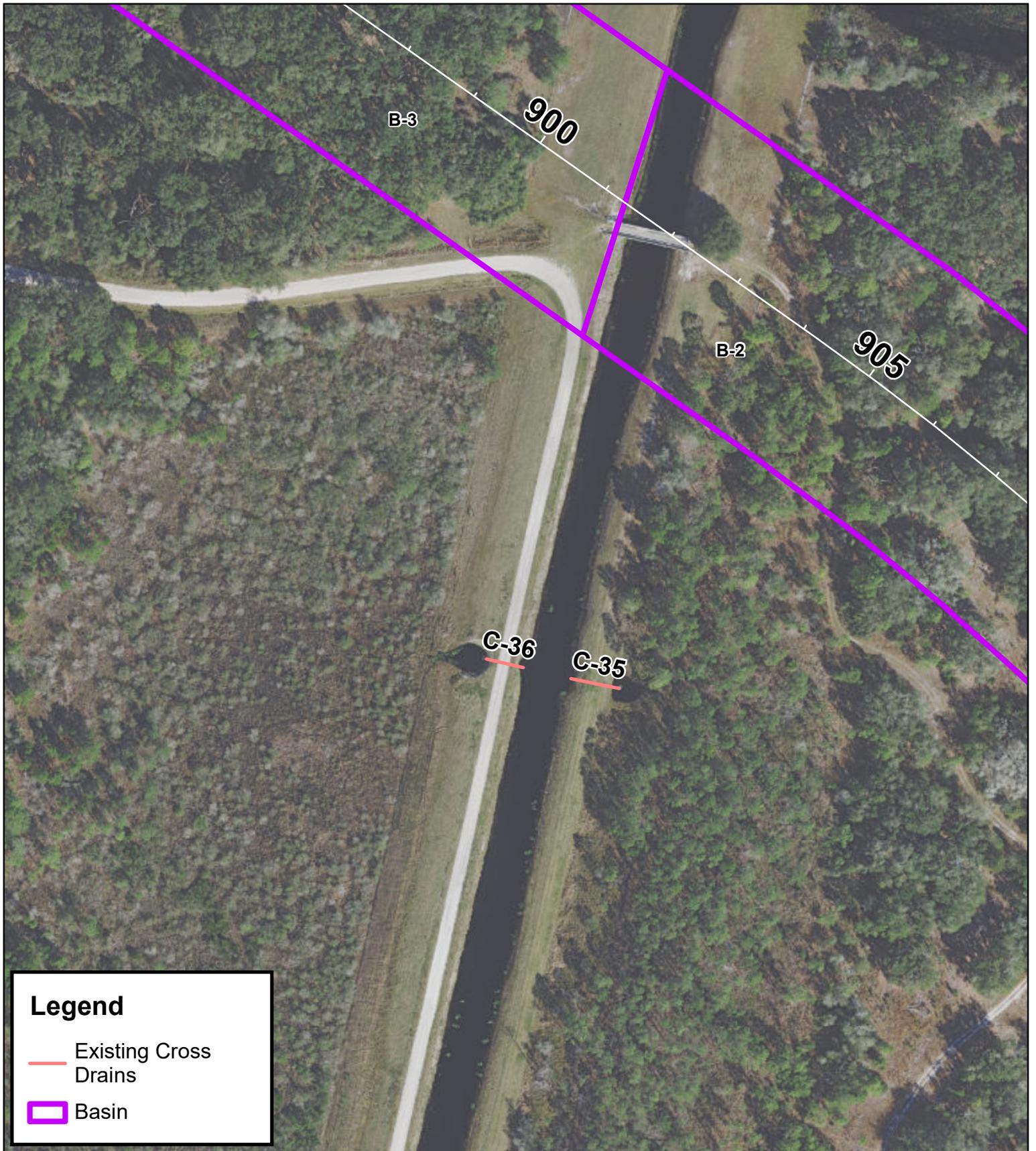
- Existing Cross Drains
- Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
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 Winter Park, Florida 32789

**FIGURE 8**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





**Legend**

- Existing Cross Drains
- Basin

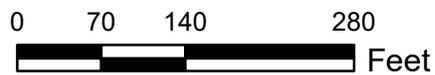
**NORTHEAST CONNECTOR**

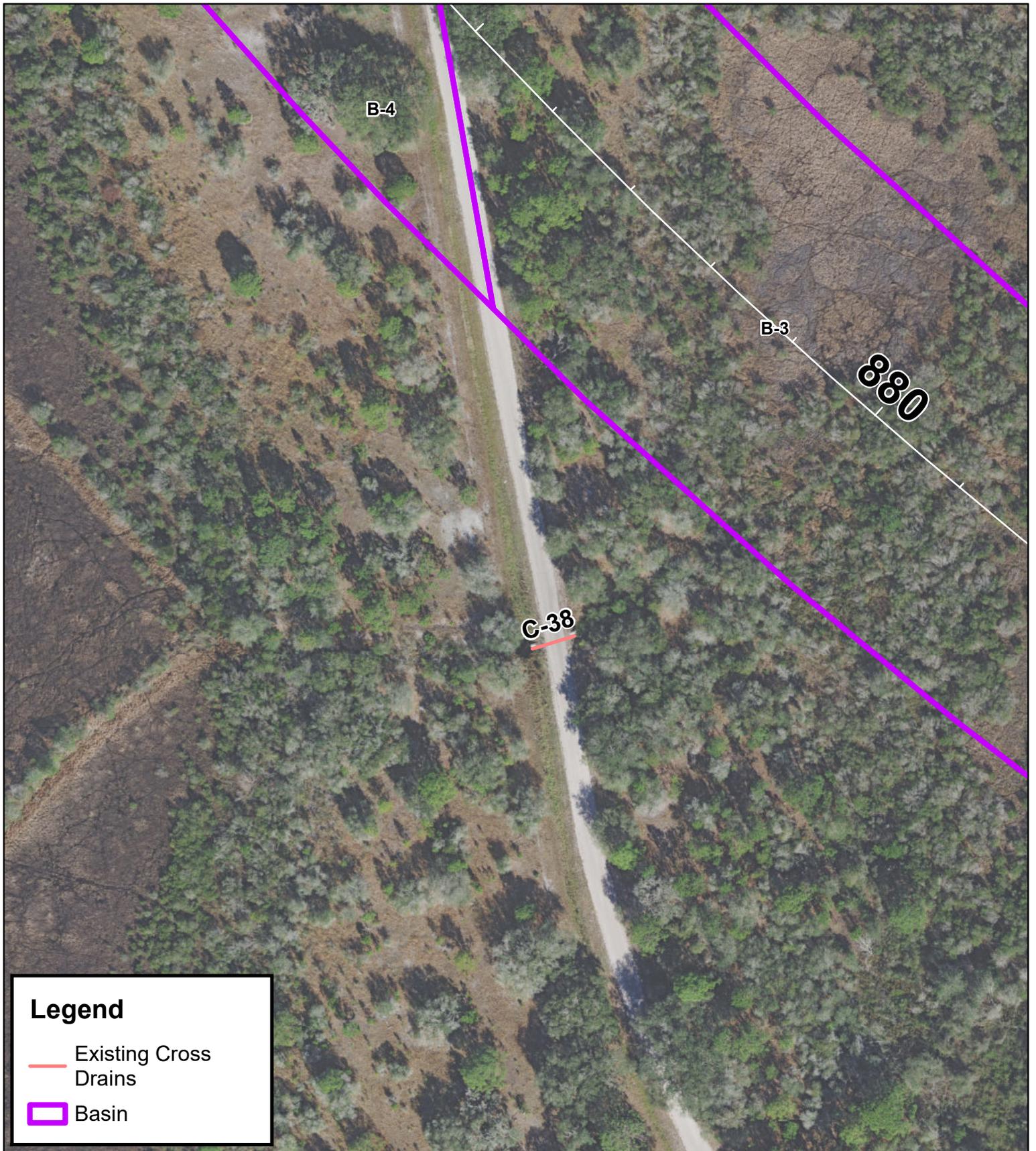
FROM CYRILS DRIVE TO NOVA ROAD (CR 532)

OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
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 Winter Park, Florida 32789

**FIGURE 9  
 EXISTING  
 CROSS DRAIN  
 MAP**





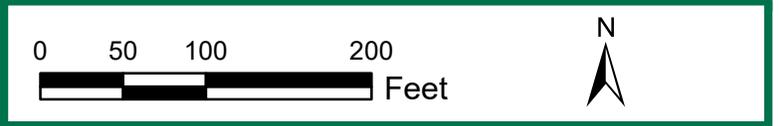
**Legend**

-  Existing Cross Drains
-  Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

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**FIGURE 10**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





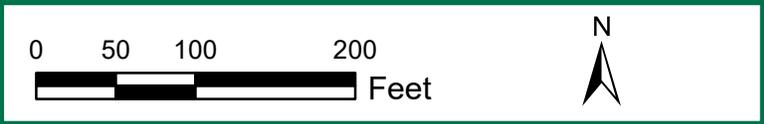
**Legend**

- Existing Cross Drains
- Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

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 Winter Park, Florida 32789

**FIGURE 11**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





**Legend**

— Existing Cross Drain

**NORTHEAST CONNECTOR**  
FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
OSCEOLA COUNTY, FLORIDA

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165 Lincoln Avenue  
Winter Park, Florida 32789

**FIGURE 12**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





**Legend**

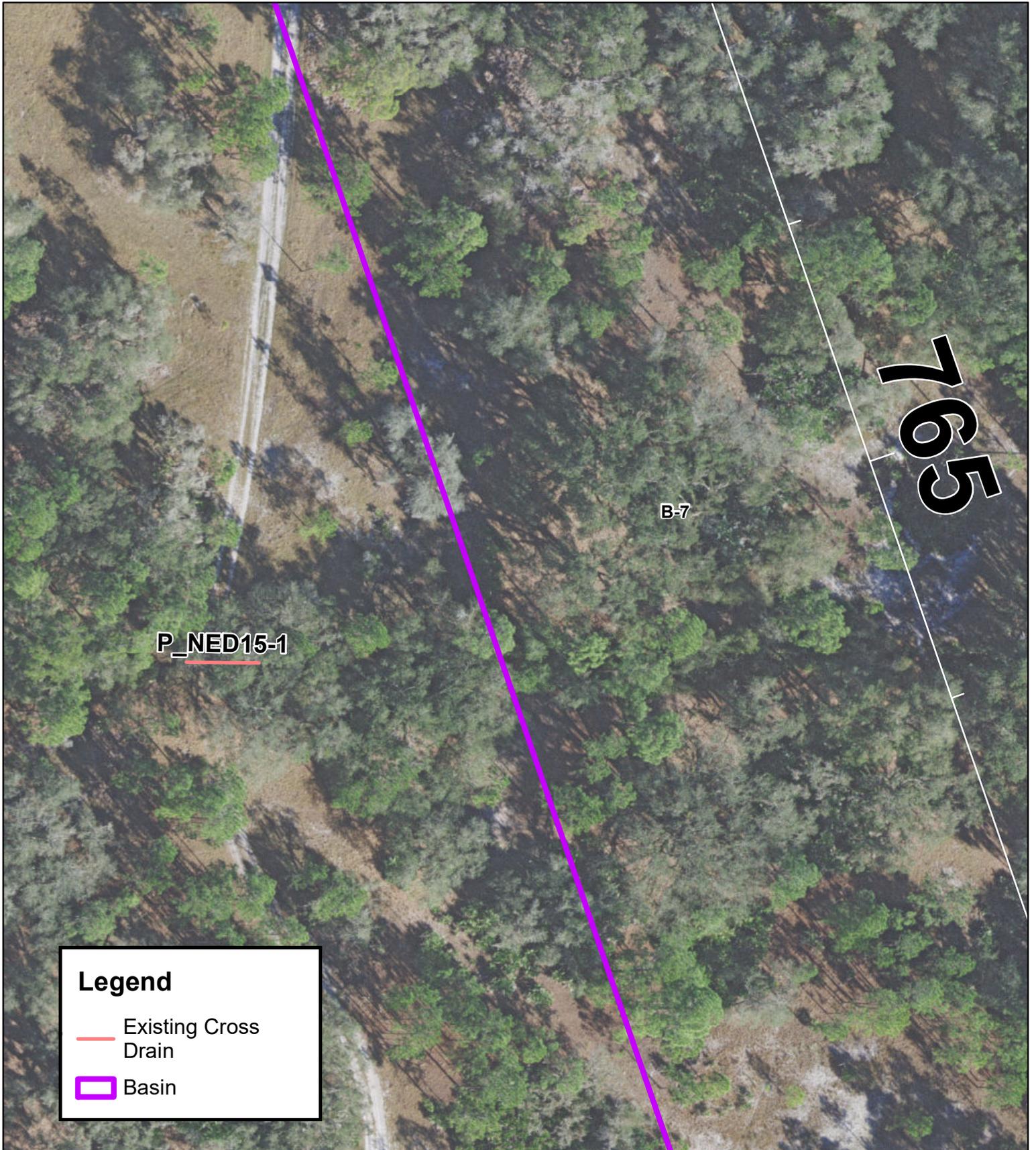
— Existing Cross Drain

**NORTHEAST CONNECTOR**  
FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
OSCEOLA COUNTY, FLORIDA

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Winter Park, Florida 32789

**FIGURE 13**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





P\_NED15-1

B-7

765

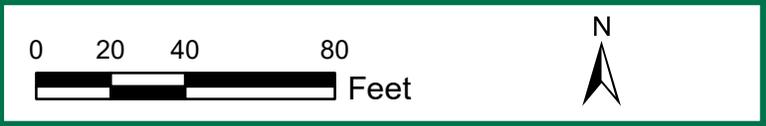
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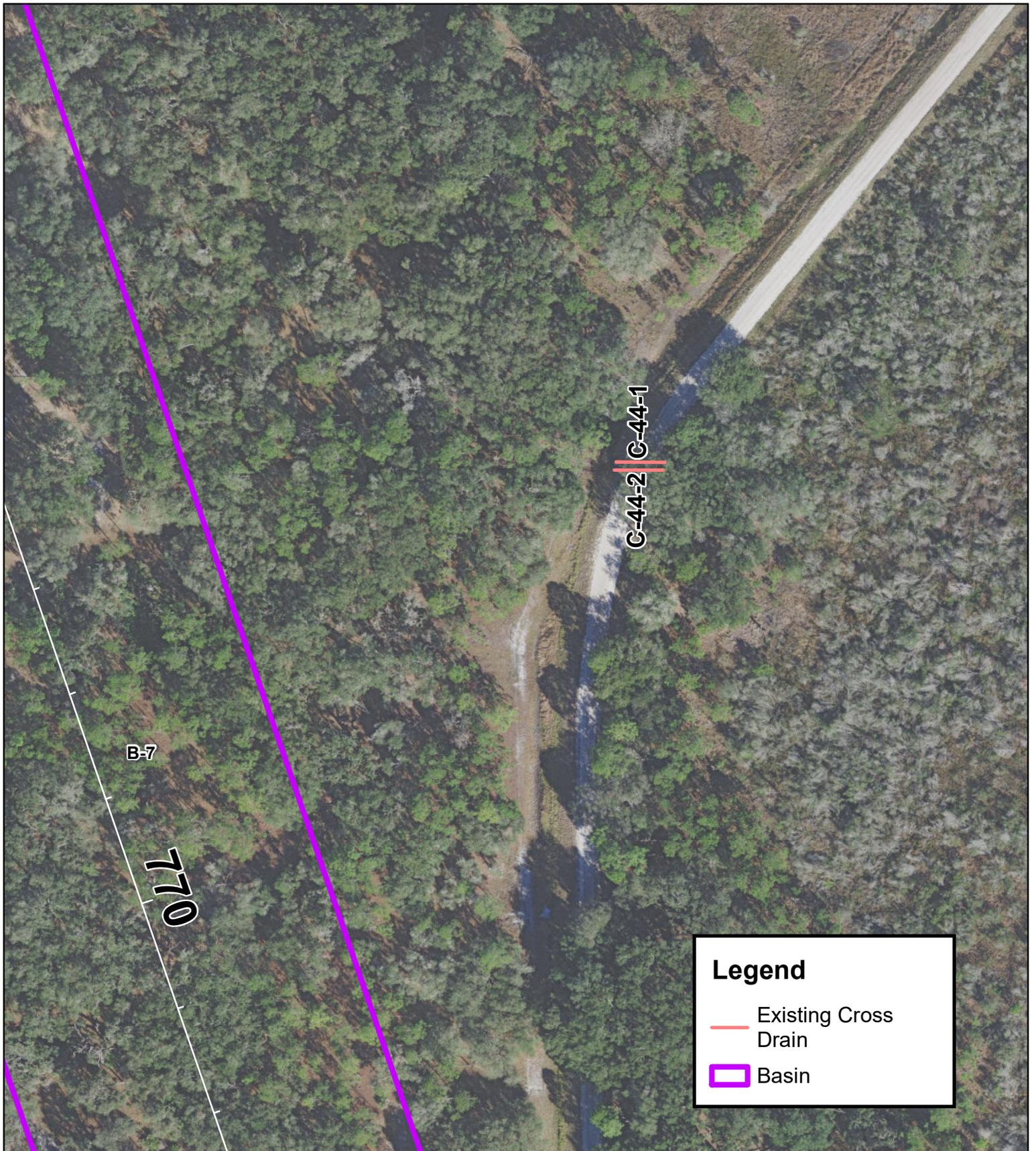
- Existing Cross Drain
- Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

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**FIGURE 14**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**





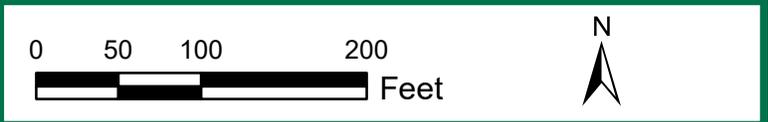
**Legend**

-  Existing Cross Drain
-  Basin

**NORTHEAST CONNECTOR**  
 FROM CYRILS DRIVE TO NOVA ROAD (CR 532)  
 OSCEOLA COUNTY, FLORIDA

PREPARED BY:  
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 165 Lincoln Avenue  
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**FIGURE 15**  
**EXISTING**  
**CROSS DRAIN**  
**MAP**



## Appendix B

### Existing Permitted Documents

SUNBRIDGE NORTHEAST DISTRICT (NED) MASTER DRAINAGE REPORT  
CONCEPTUAL PERMIT APPLICATION  
Phase 1 Post-Development Conditions  
ERP Application No. 200622-3738  
(June 2020)

**SUMMARY TABLE 1A  
SUNBRIDGE PHASE 1**

**PRE VS. POST-DEVELOPMENT FLOOD STAGES**

<b>Node I.D.</b>	<b>NED Pre-Development Model 100 yr/24 hr Peak Stages (ft)</b>	<b>NED Post-Development Model 100 yr/24 hr Peak Stages (ft)</b>
Lake Myrtle	64.2	64.2
Lake Bullock	64.3	64.3
Lake Preston	64.2	64.2
Lake Joel	64.2	64.2
Bay	72.1	72.1
Center	65.4	65.4
Conlin	70.4	70.4
Coon	65.4	65.4
Lizzie	65.4	65.4

**SUMMARY TABLE 11  
SUNBRIDGE PHASE 1**

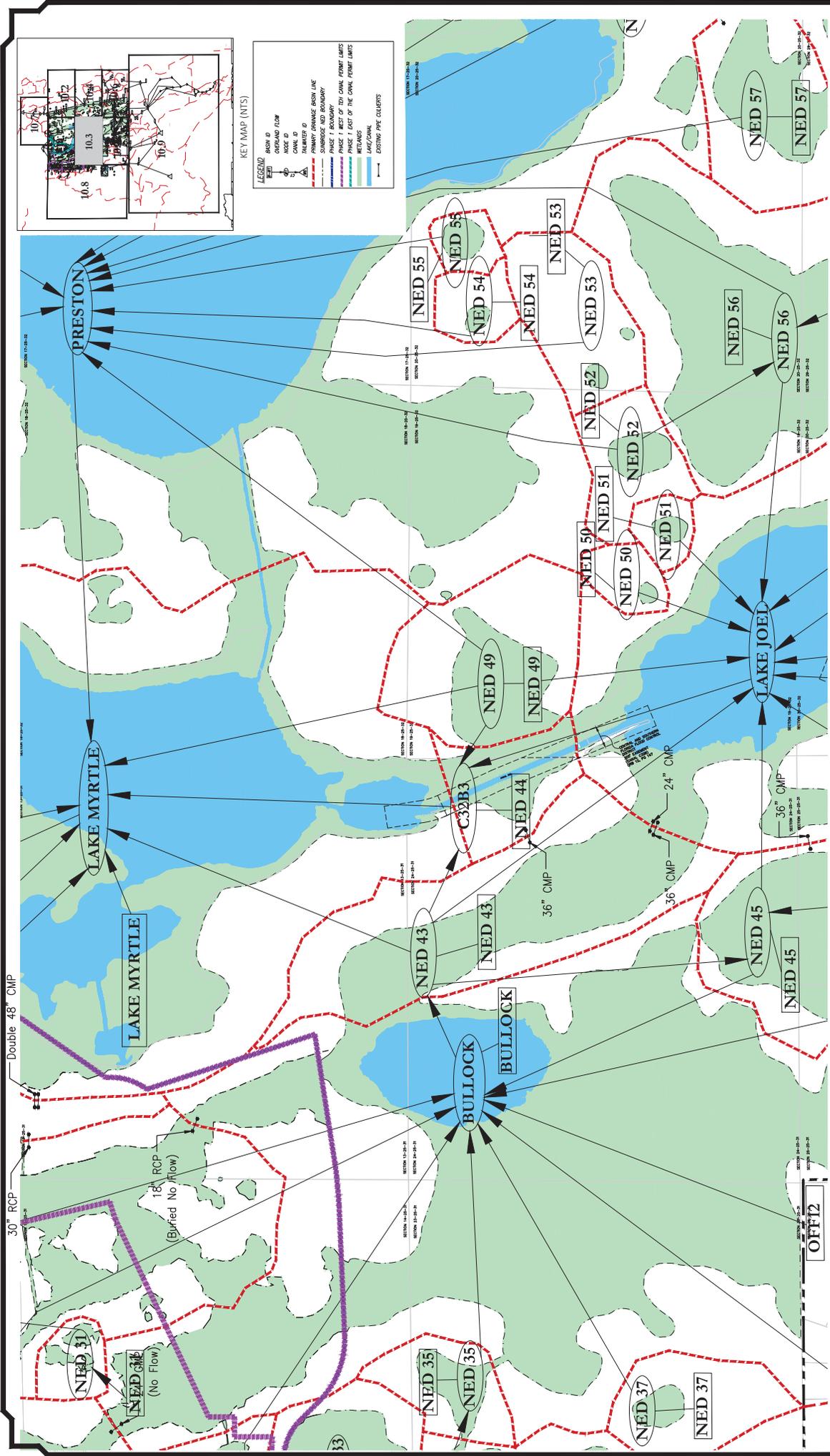
**CULVERT INFORMATION**

Node Link	Upstream Node	Downstream Node	Existing	Proposed	Existing
			100yr/24hr Stage (ft.)	100yr/24hr Stage (ft.)	50yr/24hr Stage (ft.)
NED10 C	NED10	NED14	71.3	70.9	71.2
NED01 C	NED01	NED02	67.2	67.6	67.2
NED02-1	NED15	NED02	65.5	66.1	65.5
NED15-2 P					
NED15-2 PBU					
NED15 DBI-1					
BULLOCK-2 C	NED14	BULLOCK	68.4	68.5	68.4
	NED30		69.3	69.3	69.3
NED16-1 C	NED16	MYRTLE	64.2	64.2	63.9
NED22-2C	NED22	NED25	69.2	69.3	69.1
NED22-3C					

The proposed stages in Nodes NED01 and NED15 are slightly increased by 0.4 feet, 0.6 feet for the 100 yr-24 hr storm event, respectively. However, they are still at or within the culvert cross-sections and are completely contained within the on-site property boundary. Node NED16 also has a slight increase of 0.1 feet in the 100 yr-24 hr storm event designed to provide additional retention of water within the wholly contained on-site wetland.

Node Link	Proposed 50yr/24hr Disch. (cfs)	Culvert Size (units as noted)	Culvert Cross-Sectional Area (ft <sup>2</sup> )	Proposed 50yr/24hr Outlet Velocity (ft./sec)
NED10-C	46.5	Two - 36" RCP	14.1	3.3
NED01-C	197.1	Three - 5' X 3' Box Culvert	45.0	4.4
NED02-1 C	301.2	Six - 6' X 3' Box Culvert	108.0	2.8
NED15-2 C	295.8	Six - 6' X 3' Box Culvert	108.0	2.7
NED15-2 PBU	50.8	Four - 6' X 3' Box Culvert	72.0	0.7
NED16-1 C	51.1	One - 60" RCP	7.1	7.2
BULLOCK-2 C	29.5	One - 36" RCP	19.6	1.5
NED22-2 C	0.0	One - 24" RCP	3.1	0.0
NED22-3 C	23.8	Two - 36" RCPs	14.1	1.7

Outlet velocities for the 50 year storm event are less than 4ft/sec, except for Node Links NED01C and NED16-1C, which is higher and will require erosion control protection at the culverts outlet points. Please refer to ICPR outputs for the existing and proposed conditions under Appendix C.



Pre-Development Nodal Map

Sunbridge NED

2012 E. Livingston St.  
 Ocala, Florida 32803-4177/2594  
 www.poulosbennett.com  
 Certificate of Authorization No. 28567

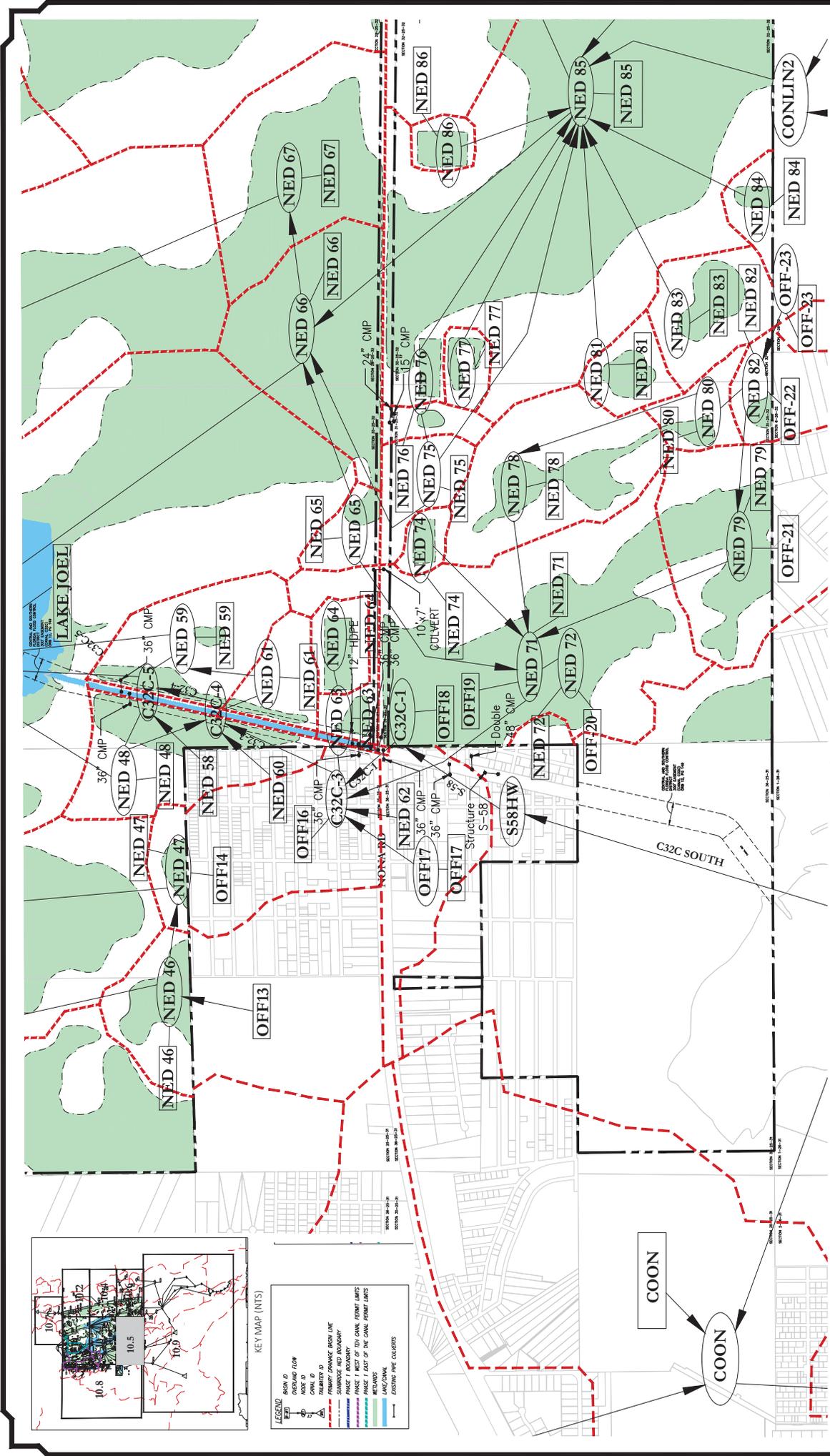
May 7, 2018  
 P & H Job No.: 17-042

EXHIBIT 10.3 - SUNBRIDGE WATER TREATMENT PLANT # 153/1042 PRE-DEVELOPMENT NODAL MAP

SCALE IN FEET  
 0 600 1200

Exhibit 10.3

APPENDIX PAGE 44 OF 85



Pre-Development Nodal Map

# Sunbridge NED

**POULOS & BENNETT**

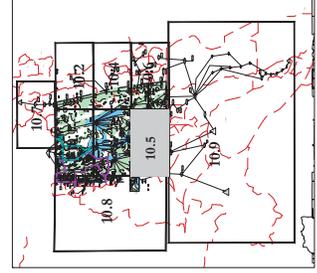
www.poulosandbenett.com  
 Certificate of Authorization No. 26567

2602 E. Livingston St.  
 Ocala, Florida 32803-4074/87-2594

May 7, 2018  
 P & H Job No.: 17-042  
 E:\0171-042\INSTRUC - SUNBRIDGE NODAL PRE-DEVELOPMENT NODAL MAP



SCALE IN FEET  
 Exhibit 10.5



**LEGEND**

FEED	SHOW ID	FROM
---	MODE ID	
---	CANAL ID	
---	DRAINAGE ID	
---	PRIMARY DRAINAGE BOUNDARY	
---	PHASE 1 BOUNDARY	
---	PHASE 1 WEST OF THE CANAL PERMIT LIMITS	
---	PHASE 1 EAST OF THE CANAL PERMIT LIMITS	
---	PERMANENT CANAL	
---	EXISTING PIPE COVERTS	

## Link Min/Max Conditions [Icpr3]

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
36 CAT-TROUT	10024	7.96	0.00	-0.03	2.66	4.55	3.60
BAY-LIZZIE	10024	0.00	0.00	0.00	0.00	0.00	0.00
BAY-TROUT	10024	0.00	0.00	0.00	0.00	0.00	0.00
BULL-CENTER P - Pipe	10024	42.84	-65.26	-1.85	0.00	0.00	0.00
BULL-CENTER P - Weir: 1	10024	42.84	-65.26	-3.70	-0.86	-0.86	-0.86
BULLOCK-2 C	10024	31.94	0.00	-0.09	4.52	7.08	5.80
C-13 - Pipe	10024	20.00	-0.02	0.02	0.00	0.00	0.00
C-13 - Weir: 1	10024	20.00	-0.02	0.03	1.60	1.60	1.60
C-13 - Weir: 2	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-13A - Pipe	10024	35.87	-0.80	0.02	0.00	0.00	0.00
C-13A - Weir: 1	10024	35.87	-0.80	0.02	3.52	3.52	3.52
C-13A - Weir: 2	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-14 - Pipe	10024	31.46	-0.04	0.05	0.00	0.00	0.00
C-14 - Weir: 1	10024	31.46	-0.04	0.10	1.64	1.64	1.64
C-14 - Weir: 2	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-14A - Pipe	10024	16.37	-0.08	1.92	0.00	0.00	0.00
C-14A - Weir: 1	10024	15.31	-0.08	4.04	2.14	2.14	2.14
C-14A - Weir: 2	10024	1.44	-0.01	-0.20	1.27	1.27	1.27
C-16	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-19-1	10024	13.84	0.00	0.03	3.51	5.75	4.63
C-19-2	10024	15.12	0.00	-0.04	3.71	5.96	4.84
C-20	10024	0.07	-0.01	0.00	0.33	1.40	0.87
C-21 - Pipe	10024	141.06	0.00	0.18	0.00	0.00	0.00
C-21 - Weir: 1	10024	141.06	0.00	0.21	0.86	0.86	0.86
C-25 - Pipe	10024	28.12	0.00	0.11	0.00	0.00	0.00
C-25 - Weir: 1	10024	28.12	0.00	0.15	0.33	0.33	0.33
C-26 - Pipe	10024	151.46	0.00	0.22	0.00	0.00	0.00
C-26 - Weir: 1	10024	151.46	0.00	0.29	0.95	0.95	0.95
C-27 - Pipe	10024	19.27	0.00	0.13	0.00	0.00	0.00
C-27 - Weir: 1	10024	19.27	0.00	0.18	0.41	0.41	0.41
C-28	10024	0.00	0.00	0.00	0.00	0.00	0.00

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
C-32C SOUTH	10024	3.55	-0.22	-0.07	0.01	0.01	0.01
C-32D	10024	48.91	-54.96	2.23	-0.12	-0.12	-0.12
C-32F	10024	433.78	-65.86	2.33	1.29	1.29	1.29
C-32G	10024	269.39	-319.72	2.23	1.60	1.62	1.61
C-34 - Pipe	10024	20.47	-0.07	2.21	0.00	0.00	0.00
C-34 - Weir: 1	10024	20.47	-0.06	4.53	1.67	1.67	1.67
C-34 - Weir: 2	10024	0.41	0.00	-0.11	0.82	0.82	0.82
C-34A-1 - Pipe	10024	30.48	-0.02	2.32	0.00	0.00	0.00
C-34A-1 - Weir: 1	10024	30.48	-0.02	4.65	3.38	3.38	3.38
C-34A-1 - Weir: 2	10024	0.37	0.00	-0.01	0.47	0.47	0.47
C-34A-2 - Pipe	10024	31.88	-0.02	2.19	0.00	0.00	0.00
C-34A-2 - Weir: 1	10024	31.88	-0.02	4.39	3.39	3.39	3.39
C-34A-2 - Weir: 2	10024	0.30	0.00	0.00	0.41	0.41	0.41
C-35 - Pipe	10024	19.59	0.00	-0.01	0.00	0.00	0.00
C-35 - Weir: 1	10024	19.59	0.00	-0.02	2.24	2.24	2.24
C-35 - Weir: 2	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-36 - Pipe	10024	11.82	-1.51	0.01	0.00	0.00	0.00
C-36 - Weir: 1	10024	11.82	-1.51	0.03	1.50	1.50	1.50
C-36 - Weir: 2	10024	0.00	0.00	0.00	0.00	0.00	0.00
C-38 - Pipe	10024	13.46	0.00	0.12	0.00	0.00	0.00
C-38 - Weir: 1	10024	13.46	0.00	0.13	0.22	0.22	0.22
C-40-1 - Pipe	10024	8.98	0.00	0.09	0.00	0.00	0.00
C-40-1 - Weir: 1	10024	8.98	0.00	0.14	0.00	0.00	0.00
C-40-2	10024	13.65	0.00	0.03	4.34	6.00	5.03
C-41 - Pipe	10024	39.57	0.00	1.37	0.00	0.00	0.00
C-41 - Weir: 1	10024	39.57	0.00	3.32	2.19	2.19	2.19
C-41 - Weir: 2	10024	3.51	0.00	-0.57	1.71	1.71	1.71
C-45 - Pipe	10024	31.98	-13.21	-2.10	0.00	0.00	0.00
C-45 - Weir: 1	10024	31.98	-13.14	-4.79	2.04	2.04	2.04
C-45 - Weir:	10024	0.05	-0.64	0.58	-0.56	-0.56	-0.56

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
NED15-1	10024	333.67	0.00	0.43	1.19	1.19	1.19
NED15-1 P - Pipe	10024	39.97	0.00	-0.06	0.00	0.00	0.00
NED15-1 P - Weir: 1	10024	39.97	0.00	0.08	0.73	0.73	0.73
NED15-16	10024	46.81	-136.05	8.56	-6.93	-9.31	-7.74
NED15-2	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED15-2 C	10024	328.96	-0.68	-0.85	4.03	4.75	4.39
NED15-2 PBU	10024	65.17	0.00	0.34	2.84	4.51	3.68
NED15-3	10024	0.00	-111.83	2.28	-1.25	-1.25	-1.25
NED16-1 C - Pipe	10024	54.52	-0.25	7.45	0.00	0.00	0.00
NED16-1 C - Weir: 1	10024	54.52	-0.25	-0.07	4.36	4.36	4.36
NED18-1	10024	11.96	-0.09	-0.02	0.08	0.08	0.08
NED18-2	10024	5.05	-15.53	5.14	-0.57	-0.57	-0.57
NED20 - Pipe	10024	43.89	-0.36	43.89	0.00	0.00	0.00
NED20 - Weir: 1	10024	43.89	-0.54	-44.99	2.66	2.66	2.66
NED20 - Weir: 2	10024	0.00	-0.02	0.01	-0.01	-0.01	-0.01
NED20-1	10024	14.76	-76.24	16.06	-1.14	-1.14	-1.14
NED20-2	10024	2.64	-5.59	4.48	0.38	0.38	0.38
NED22-1W	10024	34.42	-8.54	-0.04	0.62	0.62	0.62
NED22-2 C	10024	0.18	0.00	0.00	1.13	1.44	1.28
NED22-3 C	10024	27.28	0.00	0.01	3.33	4.94	4.13
NED23	10024	6.78	0.00	0.01	0.00	0.00	0.00
NED24	10024	14.40	0.00	0.03	0.71	0.71	0.71
NED25-2	10024	106.29	0.00	0.07	1.15	1.15	1.15
NED26	10024	471.85	0.00	-0.14	0.28	2.03	1.16
NED28	10024	48.23	0.00	0.03	1.17	1.17	1.17
NED29	10024	87.05	0.00	0.03	1.55	1.55	1.55
NED29 P - Pipe	10024	4.64	0.00	2.97	0.00	0.00	0.00
NED29 P - Weir: 1	10024	7.60	0.00	6.00	0.05	0.05	0.05
NED30	10024	27.80	0.00	0.02	1.46	1.46	1.46
NED31-1	10024	14.51	0.00	0.01	1.26	1.26	1.26
NED33	10024	24.88	-2.61	0.00	1.68	1.68	1.68
NED34-1	10024	50.47	0.00	0.01	2.91	2.91	2.91
NED34-2	10024	6.38	-8.21	0.00	-1.86	-1.86	-1.86
NED35	10024	69.22	0.00	0.01	3.06	3.06	3.06
NED37	10024	30.39	0.00	0.05	0.72	0.72	0.72
NED43	10024	622.18	0.00	0.06	2.22	2.22	2.22
NED43-1	10024	355.33	0.00	0.07	2.27	2.27	2.27
NED43-2	10024	126.35	0.00	-1.03	1.01	1.01	1.01
NED43-3	10024	145.87	0.00	0.03	1.11	1.11	1.11

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
NED43-4	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED45	10024	39.32	-58.14	0.04	-1.24	-1.24	-1.24
NED45-1	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED46-2	10024	40.94	0.00	-1.87	0.05	0.05	0.05
NED46-3	10024	116.52	0.00	-7.25	0.04	0.04	0.04
NED47	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED48-1	10024	0.13	-0.29	0.00	-0.14	-0.14	-0.14
NED48-2	10024	1.95	-18.22	0.62	-0.60	-0.60	-0.60
NED48-3	10024	0.00	-0.17	0.00	-0.01	-0.01	-0.01
NED48-4	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED49	10024	48.70	-55.72	-4.16	0.54	0.54	0.54
NED49-1	10024	0.98	0.00	0.00	0.05	0.05	0.05
NED49-2	10024	5.82	-9.77	-0.01	0.40	0.40	0.40
NED49-3	10024	0.00	-1.63	0.00	-0.04	-0.04	-0.04
NED50	10024	14.27	-0.34	0.02	0.80	0.80	0.80
NED51	10024	15.23	0.00	0.01	1.01	1.01	1.01
NED52-1	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED52-2	10024	37.43	-1.64	0.02	0.87	0.87	0.87
NED53	10024	53.08	0.00	0.06	0.84	0.84	0.84
NED54	10024	19.38	0.00	0.01	1.17	1.17	1.17
NED55	10024	11.22	0.00	0.02	0.56	0.56	0.56
NED56	10024	538.95	-57.21	0.50	1.52	1.52	1.52
NED56-1	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED57	10024	0.00	0.00	0.00	0.00	0.00	0.00
NED57-1	10024	252.23	0.00	0.06	1.34	1.34	1.34
NED57-2	10024	172.82	0.00	0.05	1.53	1.53	1.53
NED59-1	10024	45.56	-1.36	-0.16	1.12	1.12	1.12
NED59-2	10024	3.33	-1.71	0.00	0.51	0.51	0.51
NED61-1	10024	7.63	-0.87	0.02	0.83	0.83	0.83
NED61-3	10024	17.41	-0.36	0.05	0.65	0.65	0.65
NED63	10024	0.06	-0.16	0.00	-0.20	-1.52	-0.81
NED63-1	10024	0.07	-0.10	0.00	-0.11	-0.11	-0.11
NED64	10024	10.04	-0.11	0.00	1.28	1.28	1.28
NED65	10024	17.19	0.00	0.01	0.87	0.87	0.87
NED66	10024	265.28	0.00	1.41	0.39	0.39	0.39
NED67-1	10024	133.48	0.00	0.45	0.53	0.53	0.53
NED67-2	10024	8.42	-16.14	0.02	-0.44	-0.44	-0.44
NED68	10024	44.11	0.00	25.11	0.20	0.20	0.20
NED68 C	10024	464.40	0.00	-269.45	3.01	2.91	2.96
NED68 D1	10024	490.99	0.00	-3.94	1.59	1.59	1.59
NED68 P	10024	0.26	0.00	-0.16	0.26	0.29	0.28
NED69	10024	63.26	0.00	0.03	1.00	1.00	1.00
NED69 P - Pipe	10024	3.45	0.00	2.21	0.00	0.00	0.00
NED69 P - Weir: 1	10024	5.66	0.00	4.52	0.02	0.02	0.02
NED70	10024	10.27	0.00	0.19	0.09	0.09	0.09

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
36 CAT-TROUT	5024	7.08	0.00	-0.03	2.59	4.39	3.49
BAY-LIZZIE	5024	0.00	0.00	0.00	0.00	0.00	0.00
BAY-TROUT	5024	0.00	0.00	0.00	0.00	0.00	0.00
BULL-CENTER P - Pipe	5024	37.42	-62.93	-2.29	0.00	0.00	0.00
BULL-CENTER P - Weir: 1	5024	37.42	-62.93	4.59	-0.85	-0.85	-0.85
BULLOCK-2 C	5024	29.49	0.00	0.08	4.27	6.83	5.55
C-13 - Pipe	5024	19.11	-0.10	0.01	0.00	0.00	0.00
C-13 - Weir: 1	5024	19.11	-0.10	0.02	1.56	1.56	1.56
C-13 - Weir: 2	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-13A - Pipe	5024	35.71	-0.89	0.02	0.00	0.00	0.00
C-13A - Weir: 1	5024	35.71	-0.89	-0.02	3.52	3.52	3.52
C-13A - Weir: 2	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-14 - Pipe	5024	31.38	-0.04	0.02	0.00	0.00	0.00
C-14 - Weir: 1	5024	31.38	-0.05	-0.04	1.65	1.65	1.65
C-14 - Weir: 2	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-14A - Pipe	5024	13.34	-0.02	2.00	0.00	0.00	0.00
C-14A - Weir: 1	5024	13.34	-0.02	4.09	2.10	2.10	2.10
C-14A - Weir: 2	5024	0.52	0.00	-0.09	0.91	0.91	0.91
C-16	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-19-1	5024	11.92	0.00	0.03	3.28	5.47	4.38
C-19-2	5024	13.18	0.00	0.04	3.47	5.70	4.58
C-20	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-21 - Pipe	5024	132.16	0.00	0.18	0.00	0.00	0.00
C-21 - Weir: 1	5024	132.17	0.00	0.27	0.86	0.86	0.86
C-25 - Pipe	5024	23.09	0.00	-0.13	0.00	0.00	0.00
C-25 - Weir: 1	5024	23.09	0.00	0.15	0.33	0.33	0.33
C-26 - Pipe	5024	140.83	0.00	0.28	0.00	0.00	0.00
C-26 - Weir: 1	5024	140.83	0.00	0.42	0.95	0.95	0.95
C-27 - Pipe	5024	18.20	0.00	0.13	0.00	0.00	0.00
C-27 - Weir: 1	5024	18.20	0.00	-0.20	0.41	0.41	0.41
C-28	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-32C SOUTH	5024	3.16	-0.18	-0.10	0.01	0.01	0.01

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
C-32D	5024	41.79	-37.68	2.41	-0.09	-0.09	-0.09
C-32F	5024	412.49	-66.10	2.08	1.26	1.26	1.26
C-32G	5024	213.30	-183.19	3.14	1.34	1.35	1.35
C-34 - Pipe	5024	19.56	-0.32	2.05	0.00	0.00	0.00
C-34 - Weir: 1	5024	19.56	-0.31	4.17	1.62	1.62	1.62
C-34 - Weir: 2	5024	0.21	-0.02	-0.06	0.43	0.43	0.43
C-34A-1 - Pipe	5024	29.77	-0.06	1.73	0.00	0.00	0.00
C-34A-1 - Weir: 1	5024	29.77	-0.05	3.47	3.38	3.38	3.38
C-34A-1 - Weir: 2	5024	0.13	0.00	0.00	0.28	0.28	0.28
C-34A-2 - Pipe	5024	31.19	-0.06	1.54	0.00	0.00	0.00
C-34A-2 - Weir: 1	5024	31.19	-0.06	3.09	3.38	3.38	3.38
C-34A-2 - Weir: 2	5024	0.08	0.00	0.00	0.19	0.19	0.19
C-35 - Pipe	5024	19.43	0.00	0.01	0.00	0.00	0.00
C-35 - Weir: 1	5024	19.43	0.00	-0.02	2.24	2.24	2.24
C-35 - Weir: 2	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-36 - Pipe	5024	11.68	-3.77	0.01	0.00	0.00	0.00
C-36 - Weir: 1	5024	11.68	-3.77	0.02	1.50	1.50	1.50
C-36 - Weir: 2	5024	0.00	0.00	0.00	0.00	0.00	0.00
C-38 - Pipe	5024	13.46	0.00	-0.14	0.00	0.00	0.00
C-38 - Weir: 1	5024	13.46	0.00	-0.19	0.22	0.22	0.22
C-40-1 - Pipe	5024	8.81	0.00	-0.09	0.00	0.00	0.00
C-40-1 - Weir: 1	5024	8.81	0.00	-0.19	0.00	0.00	0.00
C-40-2	5024	13.41	0.00	0.03	4.27	5.96	4.98
C-41 - Pipe	5024	39.94	0.00	1.39	0.00	0.00	0.00
C-41 - Weir: 1	5024	39.94	0.00	3.32	2.19	2.19	2.19
C-41 - Weir: 2	5024	3.36	0.00	-0.54	1.68	1.68	1.68
C-45 - Pipe	5024	30.73	-10.53	-2.04	0.00	0.00	0.00
C-45 - Weir: 1	5024	30.73	-10.51	-4.45	2.02	2.02	2.02
C-45 - Weir: 2	5024	0.03	-0.40	0.37	-0.42	-0.42	-0.42

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
NED15-1 P - Pipe	5024	39.97	0.00	-0.07	0.00	0.00	0.00
NED15-1 P - Weir: 1	5024	39.97	0.00	-0.09	0.73	0.73	0.73
NED15-16	5024	46.81	-136.05	8.56	-6.93	-9.31	-7.74
NED15-2	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED15-2 C	5024	295.76	-0.71	-0.91	3.89	4.55	4.22
NED15-2 PBU	5024	50.79	0.00	0.34	2.64	4.12	3.38
NED15-3	5024	0.00	-111.83	2.28	-1.25	-1.25	-1.25
NED16-1 C - Pipe	5024	51.06	-0.38	7.45	0.00	0.00	0.00
NED16-1 C - Weir: 1	5024	51.06	-0.38	-0.08	4.27	4.27	4.27
NED18-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED18-2	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED20 - Pipe	5024	43.89	-0.42	43.89	0.00	0.00	0.00
NED20 - Weir: 1	5024	43.89	-0.62	-44.99	2.66	2.66	2.66
NED20 - Weir: 2	5024	0.00	-0.02	0.01	-0.01	-0.01	-0.01
NED20-1	5024	11.40	-63.39	14.59	-1.07	-1.07	-1.07
NED20-2	5024	3.31	-4.53	-3.67	0.33	0.33	0.33
NED22-1W	5024	30.46	-7.21	-0.04	0.61	0.61	0.61
NED22-2 C	5024	0.03	0.00	0.00	0.00	0.00	0.00
NED22-3 C	5024	23.82	0.00	0.01	3.20	4.78	3.99
NED23	5024	4.95	0.00	0.01	0.00	0.00	0.00
NED24	5024	11.97	0.00	0.02	0.67	0.67	0.67
NED25-2	5024	86.57	0.00	0.07	1.07	1.07	1.07
NED26	5024	395.83	0.00	-0.12	0.26	1.92	1.09
NED28	5024	38.19	0.00	0.03	1.08	1.08	1.08
NED29	5024	68.12	0.00	0.02	1.55	1.55	1.55
NED29 P - Pipe	5024	4.62	0.00	2.97	0.00	0.00	0.00
NED29 P - Weir: 1	5024	7.58	0.00	6.02	0.05	0.05	0.05
NED30	5024	23.74	0.00	0.02	1.39	1.39	1.39
NED31-1	5024	12.33	0.00	0.00	1.21	1.21	1.21
NED33	5024	21.27	-1.74	0.00	1.72	1.72	1.72
NED34-1	5024	43.77	0.00	0.01	2.81	2.81	2.81
NED34-2	5024	4.24	-4.49	0.00	-1.64	-1.64	-1.64
NED35	5024	60.24	0.00	0.01	2.97	2.97	2.97
NED37	5024	24.79	0.00	0.04	0.67	0.67	0.67
NED43	5024	496.10	0.00	-0.12	2.19	2.19	2.19
NED43-1	5024	314.30	0.00	0.06	2.27	2.27	2.27
NED43-2	5024	75.45	0.00	0.01	0.87	0.87	0.87
NED43-3	5024	95.99	0.00	0.02	0.97	0.97	0.97
NED43-4	5024	0.00	0.00	0.00	0.00	0.00	0.00

Link Name	Sim Name	Max Flow [cfs]	Min Flow [cfs]	Min/Max Delta Flow [cfs]	Max Us Velocity [fps]	Max Ds Velocity [fps]	Max Avg Velocity [fps]
NED45	5024	27.55	-45.08	0.04	-1.15	-1.15	-1.15
NED45-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED46-2	5024	36.33	0.00	1.84	0.04	0.04	0.04
NED46-3	5024	103.63	0.00	7.14	0.04	0.04	0.04
NED47	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED48-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED48-2	5024	1.52	-25.45	-0.44	-0.91	-0.91	-0.91
NED48-3	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED48-4	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED49	5024	59.84	-43.49	-3.90	0.65	0.65	0.65
NED49-1	5024	0.46	-0.01	0.00	0.06	0.06	0.06
NED49-2	5024	0.21	-8.04	0.00	-0.04	-0.04	-0.04
NED49-3	5024	0.00	-0.12	0.00	-0.05	-0.05	-0.05
NED50	5024	12.33	0.00	0.02	0.80	0.80	0.80
NED51	5024	12.42	0.00	0.01	0.97	0.97	0.97
NED52-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED52-2	5024	33.03	0.00	0.02	0.83	0.83	0.83
NED53	5024	46.15	0.00	0.05	0.81	0.81	0.81
NED54	5024	16.76	0.00	0.01	1.13	1.13	1.13
NED55	5024	8.10	0.00	0.01	0.00	0.00	0.00
NED56	5024	483.26	-37.40	0.50	1.39	1.39	1.39
NED56-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED57	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED57-1	5024	224.54	0.00	0.06	1.30	1.30	1.30
NED57-2	5024	154.37	0.00	0.04	1.49	1.49	1.49
NED59-1	5024	36.38	-1.00	-0.38	1.07	1.07	1.07
NED59-2	5024	1.50	-1.27	0.00	0.37	0.37	0.37
NED61-1	5024	6.94	0.00	0.01	0.81	0.81	0.81
NED61-3	5024	14.84	0.00	0.04	0.62	0.62	0.62
NED63	5024	0.01	-0.04	0.00	-0.05	-0.50	-0.27
NED63-1	5024	0.00	0.00	0.00	0.00	0.00	0.00
NED64	5024	8.51	0.00	0.00	1.24	1.24	1.24
NED65	5024	15.17	0.00	0.01	0.84	0.84	0.84
NED66	5024	243.39	0.00	1.41	0.36	0.36	0.36
NED67-1	5024	120.85	0.00	0.38	0.48	0.48	0.48
NED67-2	5024	6.19	-8.27	0.01	-0.40	-0.40	-0.40
NED68	5024	44.10	0.00	-23.62	0.20	0.20	0.20
NED68 C	5024	472.51	0.00	-277.18	3.08	2.97	3.03
NED68 D1	5024	445.15	0.00	4.08	1.54	1.54	1.54
NED68 P	5024	0.27	0.00	-0.17	0.27	0.30	0.29
NED69	5024	55.33	0.00	0.03	0.96	0.96	0.96
NED69 P - Pipe	5024	3.46	0.00	2.21	0.00	0.00	0.00
NED69 P - Weir: 1	5024	5.67	0.00	4.52	0.02	0.02	0.02
NED70	5024	9.17	0.00	0.19	0.08	0.08	0.08
NED71	5024	350.10	-8.53	1.06	2.73	2.73	2.73

aka PC-22

Pipe Link: C-16	Upstream	Downstream
Scenario: Icp3	Invert: 69.02 ft	Invert: 68.96 ft
From Node: NED71	Manning's N: 0.0120	Manning's N: 0.0120
To Node: NED65	Geometry: Rectangular	Geometry: Rectangular
Link Count: 1	Max Depth: 7.00 ft	Max Depth: 7.00 ft
Flow Direction: Both	Max Width: 10.00 ft	Max Width: 10.00 ft
Damping: 0.0000 ft	Fillet: 0.00 ft	Fillet: 0.00 ft
Length: 54.00 ft	Bottom Clip	
FHWA Code: 14	Default: 0.00 ft	Default: 0.00 ft
Entr Loss Coef: 0.50	Op Table:	Op Table:
Exit Loss Coef: 0.50	Ref Node:	Ref Node:
Bend Loss Coef: 0.00	Manning's N: 0.0120	Manning's N: 0.0120
Bend Location: 0.00 ft	Top Clip	
Energy Switch: Energy	Default: 0.00 ft	Default: 0.00 ft
	Op Table:	Op Table:
	Ref Node:	Ref Node:
	Manning's N: 0.0120	Manning's N: 0.0120

Comment: DWMA Survey-Cattle/Wildlife crossing under Nova Rd

Pipe Link: C-19-1	Upstream	Downstream
Scenario: Icp3	Invert: 64.36 ft	Invert: 64.27 ft
From Node: NED75	Manning's N: 0.0120	Manning's N: 0.0120
To Node: NED66	Geometry: Circular	Geometry: Circular
Link Count: 1	Max Depth: 2.33 ft	Max Depth: 2.33 ft
Flow Direction: Both	Bottom Clip	
Damping: 0.0000 ft	Default: 0.00 ft	Default: 0.00 ft
Length: 80.00 ft	Op Table:	Op Table:
FHWA Code: 1	Ref Node:	Ref Node:
Entr Loss Coef: 0.50	Manning's N: 0.0120	Manning's N: 0.0120
Exit Loss Coef: 0.50	Top Clip	
Bend Loss Coef: 0.00	Default: 0.00 ft	Default: 0.00 ft
Bend Location: 0.00 ft	Op Table:	Op Table:
Energy Switch: Energy	Ref Node:	Ref Node:
	Manning's N: 0.0120	Manning's N: 0.0120

Comment: DWMA Survey-Box culvert under Nova Rd

Pipe Link: C-19-2	Upstream	Downstream
Scenario: Icp3	Invert: 64.27 ft	Invert: 64.15 ft
From Node: NED75	Manning's N: 0.0120	Manning's N: 0.0120
To Node: NED66	Geometry: Circular	Geometry: Circular

Pre-Development Conditions

Link Count:	1	Max Depth:	2.33 ft	Max Depth:	2.33 ft
Flow Direction:	Both	Bottom Clip			
Damping:	0.0000 ft	Default:	0.00 ft	Default:	0.00 ft
Length:	80.00 ft	Op Table:		Op Table:	
FHWA Code:	1	Ref Node:		Ref Node:	
Entr Loss Coef:	0.50	Manning's N:	0.0120	Manning's N:	0.0120
Exit Loss Coef:	0.50	Top Clip			
Bend Loss Coef:	0.00	Default:	0.00 ft	Default:	0.00 ft
Bend Location:	0.00 ft	Op Table:		Op Table:	
Energy Switch:	Energy	Ref Node:		Ref Node:	
		Manning's N:	0.0120	Manning's N:	0.0120

Comment: DWMA Survey-Box culvert under Nova Rd

Pipe Link: C-20	Upstream	Downstream	
Scenario:	Icpr3	Invert: 66.14 ft	Invert: 66.22 ft
From Node:	NED75	Manning's N: 0.0240	Manning's N: 0.0240
To Node:	NED85	Geometry: Circular	Geometry: Circular
Link Count:	1	Max Depth: 2.00 ft	Max Depth: 2.00 ft
Flow Direction:	Both	Bottom Clip	
Damping:	0.0000 ft	Default:	0.00 ft
Length:	41.00 ft	Op Table:	
FHWA Code:	6	Ref Node:	
Entr Loss Coef:	0.90	Manning's N: 0.0240	Manning's N: 0.0240
Exit Loss Coef:	0.50	Top Clip	
Bend Loss Coef:	0.00	Default:	0.00 ft
Bend Location:	0.00 ft	Op Table:	
Energy Switch:	Energy	Ref Node:	
		Manning's N: 0.0240	Manning's N: 0.0240

Comment: DWMA Survey

Drop Structure Link: C-21	Upstream Pipe	Downstream Pipe	
Scenario:	Icpr3	Invert: 63.47 ft	Invert: 63.28 ft
From Node:	NED85	Manning's N: 0.0120	Manning's N: 0.0120
To Node:	NED66	Geometry: Rectangular	Geometry: Rectangular
Link Count:	1	Max Depth: 4.00 ft	Max Depth: 4.00 ft
Flow Direction:	Both	Max Width: 8.00 ft	Max Width: 8.00 ft
Solution:	Combine	Fillet: 0.00 ft	Fillet: 0.00 ft
Increments:	10	Bottom Clip	
Pipe Count:	1	Default:	0.00 ft
Damping:	0.0000 ft	Op Table:	
Length:	63.00 ft	Ref Node:	
FHWA Code:	14	Manning's N: 0.0120	Manning's N: 0.0120
Entr Loss Coef:	0.50	Top Clip	
Exit Loss Coef:	0.50	Default:	0.00 ft
Bend Loss Coef:	0.00	Op Table:	

Control Elevation: 64.43 ft  
 Max Depth: 1.50 ft

Ref Node:  
 Discharge Coefficients  
 Weir Default: 3.000  
 Weir Table:  
 Orifice Default: 0.600  
 Orifice Table:

Weir Comment:

Drop Structure Comment: DWMA Survey-Connection to Canal 32C north of S-58 and Nova Rd  
 aka PC-25

Drop Structure Link: C-38	Upstream Pipe	Downstream Pipe
Scenario: Icp3	Invert: 60.97 ft	Invert: 61.14 ft
From Node: NED45	Manning's N: 0.0240	Manning's N: 0.0240
To Node: JOEL	Geometry: Circular	Geometry: Circular
Link Count: 1	Max Depth: 3.00 ft	Max Depth: 3.00 ft
Flow Direction: Both	Bottom Clip	
Solution: Combine	Default: 0.00 ft	Default: 0.00 ft
Increments: 10	Op Table:	Op Table:
Pipe Count: 1	Ref Node:	Ref Node:
Damping: 0.0000 ft	Manning's N: 0.0240	Manning's N: 0.0240
Length: 40.00 ft	Top Clip	
FHWA Code: 4	Default: 0.00 ft	Default: 0.00 ft
Entr Loss Coef: 0.90	Op Table:	Op Table:
Exit Loss Coef: 0.50	Ref Node:	Ref Node:
Bend Loss Coef: 0.00	Manning's N: 0.0240	Manning's N: 0.0240
Bend Location: 0.00 dec		
Energy Switch: Energy		

Pipe Comment:

Weir Component	
Weir: 1	Bottom Clip
Weir Count: 1	Default: 0.00 ft
Weir Flow Direction: Both	Op Table:
Damping: 0.0000 ft	Ref Node:
Weir Type: Broad Crested Vertical	Top Clip
Geometry Type: Rectangular	Default: 0.00 ft
Invert: 62.90 ft	Op Table:
Control Elevation: 62.90 ft	Ref Node:
Max Depth: 833.25 ft	Discharge Coefficients
Max Width: 833.25 ft	Weir Default: 3.200
Fillet: 0.00 ft	Weir Table:
	Orifice Default: 0.600
	Orifice Table:

Weir Comment:

Energy Switch: Energy

Pipe Comment:

Weir Component	
Weir: 1	Bottom Clip
Weir Count: 1	Default: 0.00 ft
Weir Flow Direction: Both	Op Table:
Damping: 0.0000 ft	Ref Node:
Weir Type: Broad Crested Vertical	Top Clip
Geometry Type: Rectangular	Default: 0.00 ft
Invert: 65.40 ft	Op Table:
Control Elevation: 65.40 ft	Ref Node:
Max Depth: 833.25 ft	Discharge Coefficients
Max Width: 833.25 ft	Weir Default: 3.200
Fillet: 0.00 ft	Weir Table:
	Orifice Default: 0.600
	Orifice Table:

Weir Comment:

Drop Structure Comment: DWMA Survey-Under dirt drive west of Lake Myrtle  
Artificial weir added to maintain upstream initial stage elevation.

Pipe Link: NED15-16	Upstream	Downstream
Scenario: Icpr3	Invert: 54.50 ft	Invert: 54.00 ft
From Node: NED15 MH-1	Manning's N: 0.0120	Manning's N: 0.0120
To Node: NED16	Geometry: Circular	Geometry: Circular
Link Count: 1	Max Depth: 5.00 ft	Max Depth: 5.00 ft
Flow Direction: Both	Bottom Clip	
Damping: 0.0000 ft	Default: 0.00 ft	Default: 0.00 ft
Length: 490.00 ft	Op Table:	Op Table:
FHWA Code: 1	Ref Node:	Ref Node:
Entr Loss Coef: 1.50	Manning's N: 0.0120	Manning's N: 0.0120
Exit Loss Coef: 1.50	Top Clip	
Bend Loss Coef: 0.00	Default: 0.00 ft	Default: 0.00 ft
Bend Location: 0.00 dec	Op Table:	Op Table:
Energy Switch: Energy	Ref Node:	Ref Node:
	Manning's N: 0.0120	Manning's N: 0.0120

Comment:

Weir Link: NED15-2	
Scenario: Icpr3	Bottom Clip
From Node: NED15-2	Default: 0.00 ft
To Node: DITCH 15-1	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip

Damping: 0.0000 ft  
 Weir Type: Broad Crested Vertical  
 Geometry Type: Irregular  
 Invert: 67.60 ft  
 Control Elevation: 67.60 ft  
 Cross Section: NED15-2W

Default: 0.00 ft  
 Op Table:  
 Ref Node:  
 Discharge Coefficients  
 Weir Default: 2.800  
 Weir Table:  
 Orifice Default: 0.600  
 Orifice Table:

Comment:

Pipe Link: NED15-2 C	Upstream	Downstream
Scenario: Icp3	Invert: 63.79 ft	Invert: 63.65 ft
From Node: NED15	Manning's N: 0.0120	Manning's N: 0.0120
To Node: NED15-1	Geometry: Rectangular	Geometry: Rectangular
Link Count: 6	Max Depth: 3.00 ft	Max Depth: 3.00 ft
Flow Direction: Both	Max Width: 6.00 ft	Max Width: 6.00 ft
Damping: 0.0000 ft	Fillet: 0.00 ft	Fillet: 0.00 ft
Length: 143.00 ft	Bottom Clip	
FHWA Code: 9	Default: 0.00 ft	Default: 0.00 ft
Entr Loss Coef: 0.30	Op Table:	Op Table:
Exit Loss Coef: 0.50	Ref Node:	Ref Node:
Bend Loss Coef: 0.00	Manning's N: 0.0120	Manning's N: 0.0120
Bend Location: 0.00 dec	Top Clip	
Energy Switch: Energy	Default: 0.00 ft	Default: 0.00 ft
	Op Table:	Op Table:
	Ref Node:	Ref Node:
	Manning's N: 0.0120	Manning's N: 0.0120

Comment:

Pipe Link: NED15-2 PBU	Upstream	Downstream
Scenario: Icp3	Invert: 65.10 ft	Invert: 64.50 ft
From Node: NED15	Manning's N: 0.0120	Manning's N: 0.0120
To Node: BULLOCK	Geometry: Rectangular	Geometry: Rectangular
Link Count: 4	Max Depth: 3.00 ft	Max Depth: 3.00 ft
Flow Direction: Both	Max Width: 6.00 ft	Max Width: 6.00 ft
Damping: 0.0000 ft	Fillet: 0.00 ft	Fillet: 0.00 ft
Length: 180.00 ft	Bottom Clip	
FHWA Code: 6	Default: 0.00 ft	Default: 0.00 ft
Entr Loss Coef: 0.00	Op Table:	Op Table:
Exit Loss Coef: 1.00	Ref Node:	Ref Node:
Bend Loss Coef: 0.00	Manning's N: 0.0120	Manning's N: 0.0120
Bend Location: 0.00 dec	Top Clip	
Energy Switch: Energy	Default: 0.00 ft	Default: 0.00 ft
	Op Table:	Op Table:

Weir Link: NED35	
Scenario: Icp3	Bottom Clip
From Node: NED35	Default: 0.00 ft
To Node: BULLOCK	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 66.00 ft	Discharge Coefficients
Control Elevation: 66.00 ft	Weir Default: 2.600
Cross Section: NED35-W	Weir Table:
	Orifice Default: 0.600
	Orifice Table:
Comment:	

Weir Link: NED37	
Scenario: Icp3	Bottom Clip
From Node: NED37	Default: 0.00 ft
To Node: BULLOCK	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 68.00 ft	Discharge Coefficients
Control Elevation: 68.00 ft	Weir Default: 2.600
Cross Section: NED37-W	Weir Table:
	Orifice Default: 0.600
	Orifice Table:
Comment:	

Weir Link: NED43	
Scenario: Icp3	Bottom Clip
From Node: BULLOCK	Default: 0.00 ft
To Node: NED43	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 63.00 ft	Discharge Coefficients
Control Elevation: 63.50 ft	Weir Default: 2.600
Cross Section: NED43-W	Weir Table:
	Orifice Default: 0.600

Weir Link: NED45-1	
Scenario: Icp3	Bottom Clip
From Node: NED45	Default: 0.00 ft
To Node: JOEL	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 65.00 ft	Discharge Coefficients
Control Elevation: 65.00 ft	Weir Default: 2.600
Cross Section: NED45-1-W	Weir Table:
	Orifice Default: 0.600
	Orifice Table:
Comment:	

Weir Link: NED46-2	
Scenario: Icp3	Bottom Clip
From Node: NED46	Default: 0.00 ft
To Node: BULLOCK	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 64.00 ft	Discharge Coefficients
Control Elevation: 64.90 ft	Weir Default: 2.600
Cross Section: NED46-2-W	Weir Table:
	Orifice Default: 0.600
	Orifice Table:
Comment:	

Weir Link: NED46-3	
Scenario: Icp3	Bottom Clip
From Node: NED46	Default: 0.00 ft
To Node: NED47	Op Table:
Link Count: 1	Ref Node:
Flow Direction: Both	Top Clip
Damping: 0.0000 ft	Default: 0.00 ft
Weir Type: Broad Crested Vertical	Op Table:
Geometry Type: Irregular	Ref Node:
Invert: 63.60 ft	Discharge Coefficients
Control Elevation: 64.90 ft	Weir Default: 2.600
Cross Section: NED46-3-W	Weir Table:
	Orifice Default: 0.600
	Orifice Table:
Comment:	

Damping:	0.0000 ft	
Weir Type:	Broad Crested Vertical	Default: 0.00 ft
Geometry Type:	Irregular	Op Table:
Invert:	62.00 ft	Ref Node:
Control Elevation:	62.00 ft	Discharge Coefficients
Cross Section:	NED59-1-W	Weir Default: 2.600
		Weir Table:
		Orifice Default: 0.600
		Orifice Table:

Comment:

**Weir Link: NED59-2**

Scenario:	Icpr3	Bottom Clip
From Node:	NED59	Default: 0.00 ft
To Node:	JOEL	Op Table:
Link Count:	1	Ref Node:
Flow Direction:	Both	Top Clip
Damping:	0.0000 ft	Default: 0.00 ft
Weir Type:	Broad Crested Vertical	Op Table:
Geometry Type:	Irregular	Ref Node:
Invert:	63.00 ft	Discharge Coefficients
Control Elevation:	63.00 ft	Weir Default: 2.600
Cross Section:	NED59-2-W	Weir Table:
		Orifice Default: 0.600
		Orifice Table:

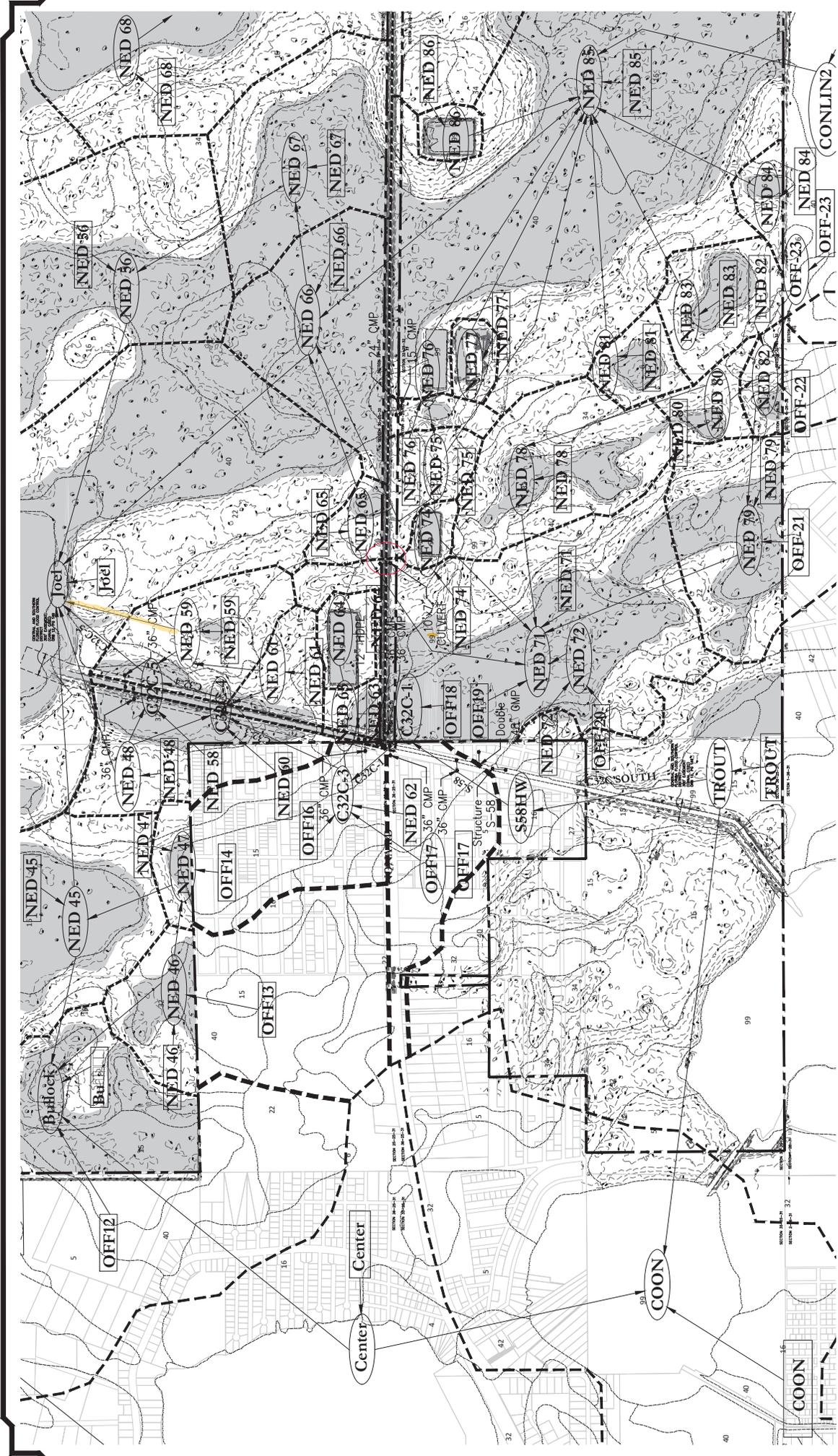
Comment:

**Weir Link: NED61-1**

Scenario:	Icpr3	Bottom Clip
From Node:	NED61	Default: 0.00 ft
To Node:	NED59	Op Table:
Link Count:	1	Ref Node:
Flow Direction:	Both	Top Clip
Damping:	0.0000 ft	Default: 0.00 ft
Weir Type:	Broad Crested Vertical	Op Table:
Geometry Type:	Irregular	Ref Node:
Invert:	64.00 ft	Discharge Coefficients
Control Elevation:	64.00 ft	Weir Default: 2.600
Cross Section:	NED61-1-W	Weir Table:
		Orifice Default: 0.600
		Orifice Table:

Comment:

SUNBRIDGE NORTHEAST DISTRICT (NED) MASTER DRAINAGE REPORT  
CONCEPTUAL PERMIT APPLICATION  
Phase 1 Post-Development Conditions  
ERP Application No. 171106-4  
(May 2018)



Pre-Development Basin Map

# Sunbridge NED

POULOS & BENNETT

2002 E. Livingston St.  
 Ocala, Florida 32803-4174/87.2594

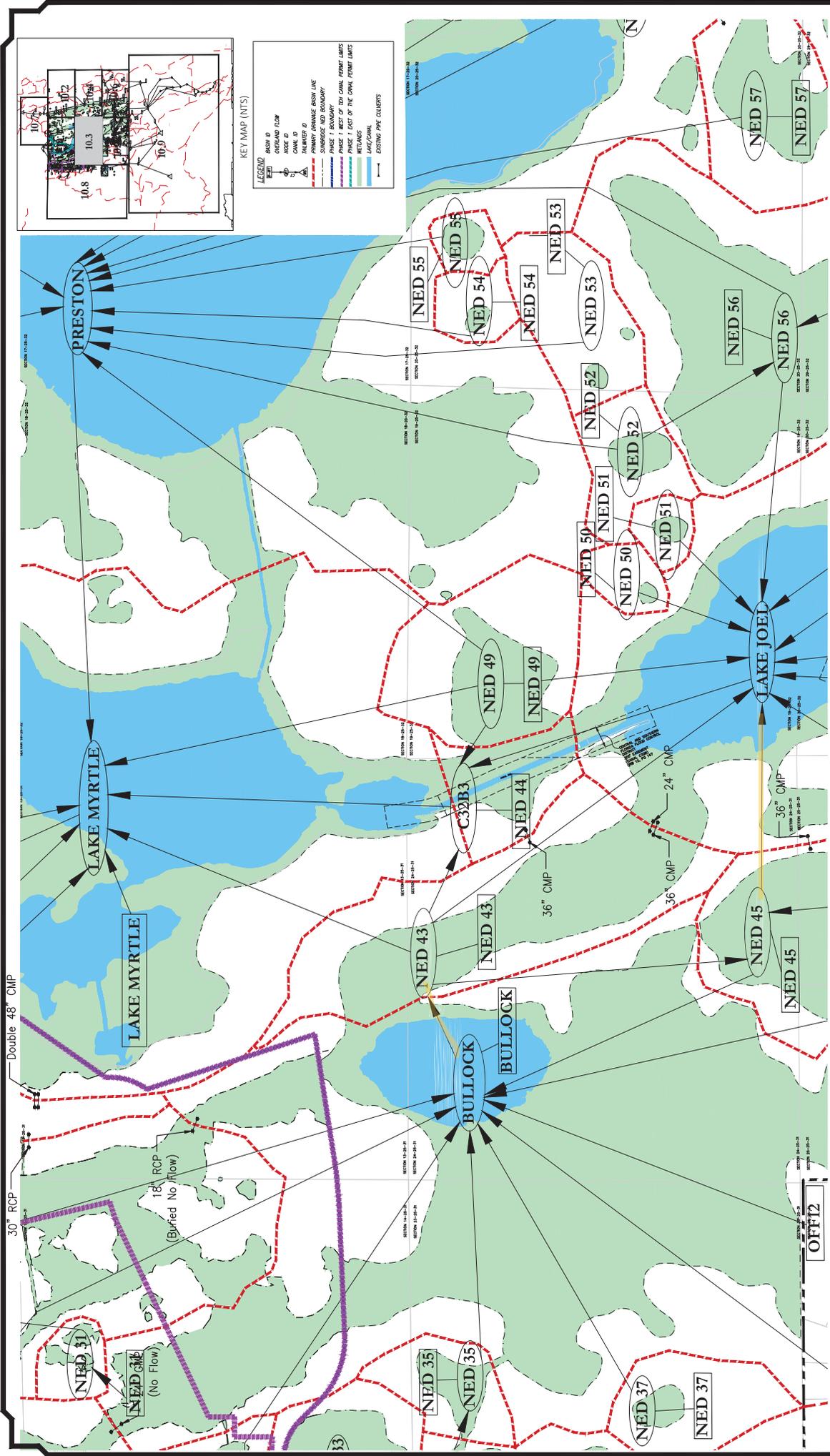
www.poulosbennett.com  
 Certificate of Authorization No. 26567



SCALE IN FEET  
 Exhibit 9.5

October 11, 2017  
 P & E Job No.: 17.042

EXHIBIT 9.5 - SUNBRIDGE NED - PRE-DEVELOPMENT BASIN MAP - NED SITE



Pre-Development Nodal Map

Sunbridge NED

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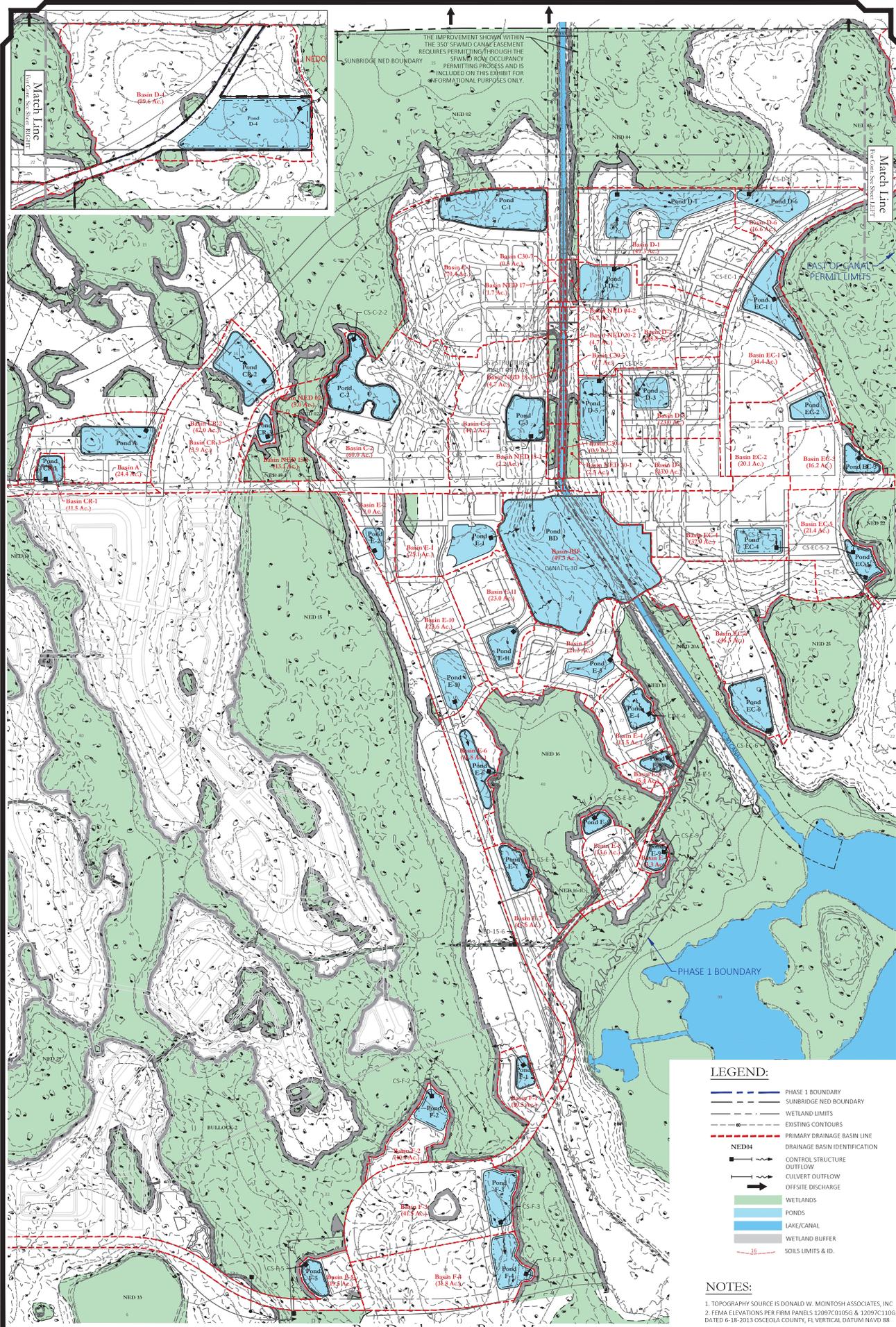
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May 7, 2018  
P & H Job No.: 17-042

FL000101-042 - Bullock - Sunbridge Water System/Collection & Riser/1042 - Pre-Development Nodal Map

Exhibit 10.3



THE IMPROVEMENT SHOWN WITHIN THE 50' SWAMP CANAL EASEMENT REQUIRES PERMITTING THROUGH THE SWAMP ROW OCCUPANCY PERMITTING PROCESS AND IS INCLUDED ON THIS EXHIBIT FOR INFORMATIONAL PURPOSES ONLY.

Match Line  
To: 17-042 (WEST SIDE)

Match Line  
From: 17-042 (EAST SIDE)

- LEGEND:**
- PHASE 1 BOUNDARY
  - SUNBRIDGE NED BOUNDARY
  - - - WETLAND LIMITS
  - - - EXISTING CONTOURS
  - - - PRIMARY DRAINAGE BASIN LINE
  - - - DRAINAGE BASIN IDENTIFICATION
  - NED#4
  - CONTROL STRUCTURE
  - OUTFLOW
  - CULVERT OUTFLOW
  - OFFSITE DISCHARGE
  - WETLANDS
  - PONDS
  - LAKE/CANAL
  - WETLAND BUFFER
  - SOILS LIMITS & ID.

**NOTES:**

1. TOPOGRAPHY SOURCE IS DONALD W. MCINTOSH ASSOCIATES, INC.
2. FEMA ELEVATIONS PER FIRM PANELS 12097C0105G & 12097C110G DATED 6-18-2013 OSCEOLA COUNTY, FL VERTICAL DATUM NAVD 88



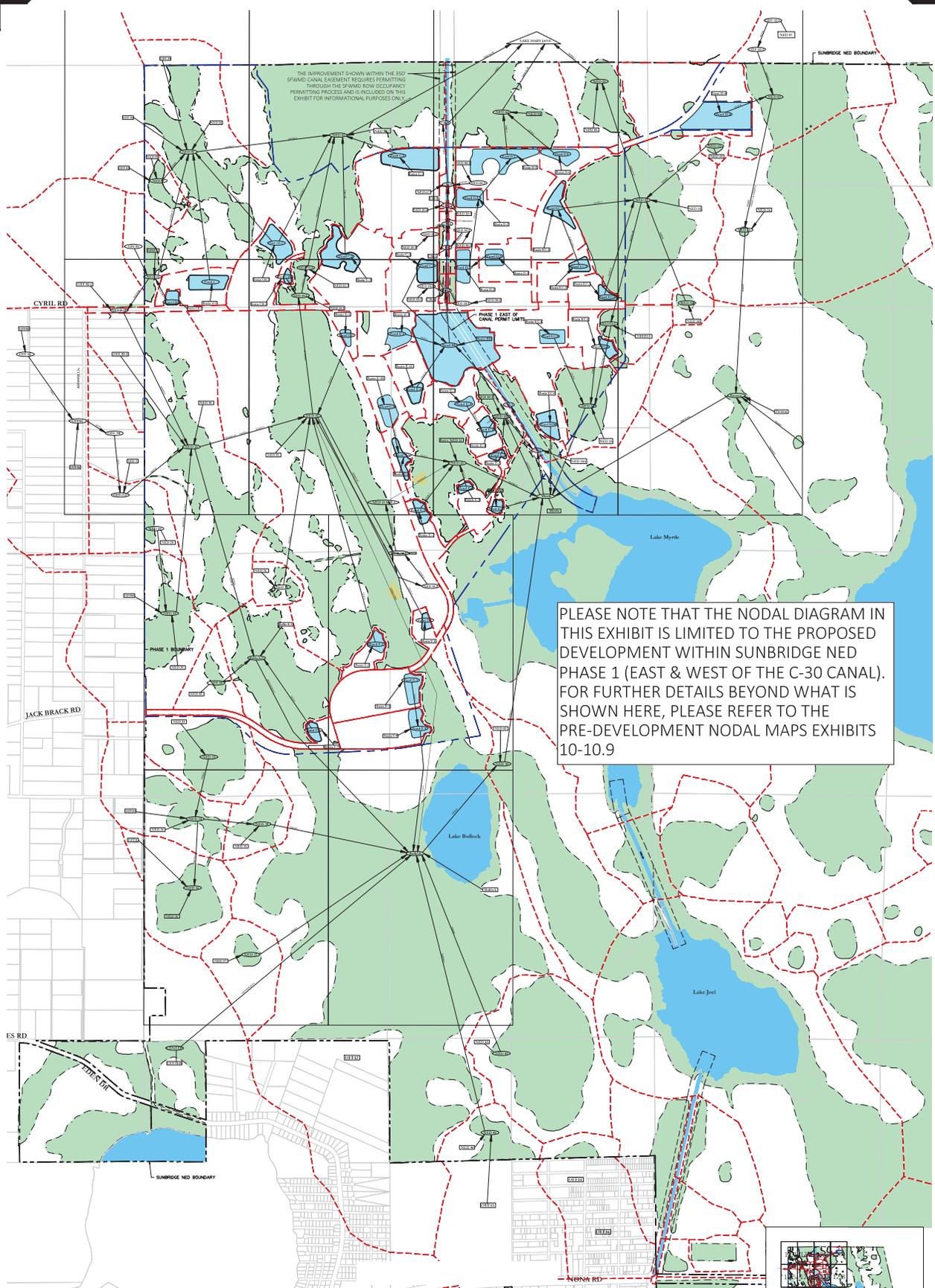
Post-Development Basins Map  
**Sunbridge NED**

**POULOS & BENNETT**  
www.poulosandbennett.com  
Certificate of Authorization No. 28567

May 18, 2020  
P & B Job No.: 17-042

2002 E. Livingston St.  
Orlando, Florida 32803-4074872594

Scale in Feet  
Appendix B, Page 25 of 28  
**Exhibit 11.1**



PLEASE NOTE THAT THE NODAL DIAGRAM IN THIS EXHIBIT IS LIMITED TO THE PROPOSED DEVELOPMENT WITHIN SUNBRIDGE NED PHASE 1 (EAST & WEST OF THE C-30 CANAL). FOR FURTHER DETAILS BEYOND WHAT IS SHOWN HERE, PLEASE REFER TO THE PRE-DEVELOPMENT NODAL MAPS EXHIBITS 10-10.9

**LEGEND**  
 [B-W1] BASIN ID  
 [---] OVERLAND FLOW  
 [W1] NODE ID  
 [---] CANAL ID/NODE DISCHARGE LINK  
 [W/G] TAILWATER ID

[---] PRIMARY DRAINAGE BASIN LINE  
 [---] SUNBRIDGE NED BOUNDARY  
 [---] PHASE 1 BOUNDARY  
 [---] WETLANDS  
 [---] PONDS  
 [---] LAKE/CANAL

Post-Development Nodal Diagram Phase 1

**Sunbridge NED**

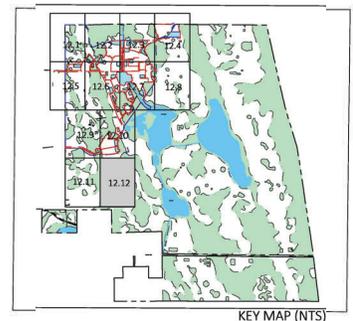
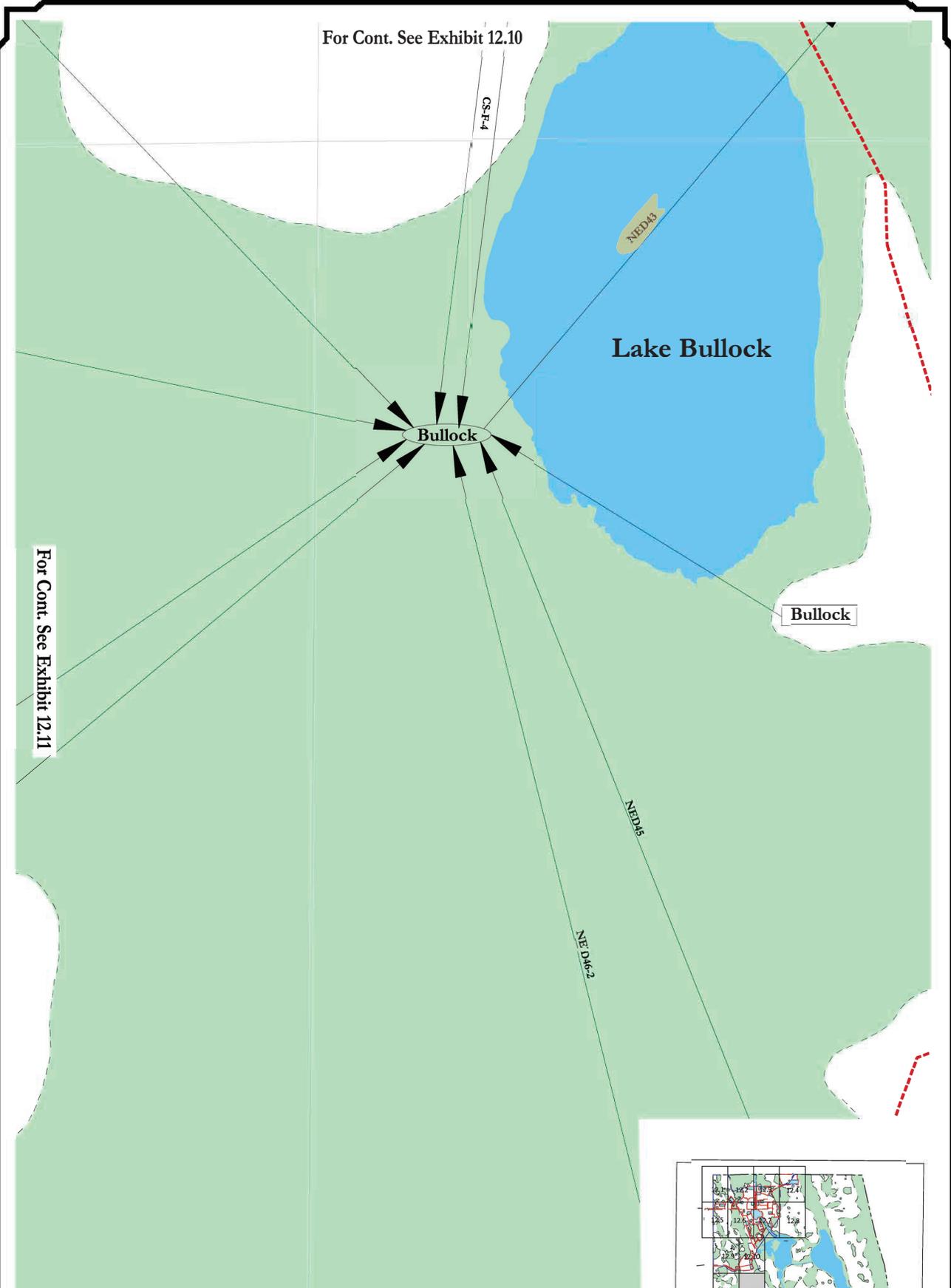
**POULOS & BENNETT**



Z:\2017\17-042 TAUSTOCK - SUNBRIDGE MASTER STORMWATER\CAD\EXH & FIGS\17042 POST DEVELOPMENT NODAL MAP (E&M)

For Cont. See Exhibit 12.10

For Cont. See Exhibit 12.11



**LEGEND**

- B-w1 BASIN ID
- OVERLAND FLOW
- W1 NODE ID
- CANAL ID/NODE DISCHARGE LINK
- W6 TAILWATER ID

- PRIMARY DRAINAGE BASIN LINE
- SUNBRIDGE NED BOUNDARY
- PHASE 1 BOUNDARY

- WETLANDS
- PONDS
- LAKE/CANAL

Post-Development Nodal Diagram Phase 1

# Sunbridge NED

**POULOS & BENNETT**



Sunbridge NED Overall  
Pre-Development Conditions

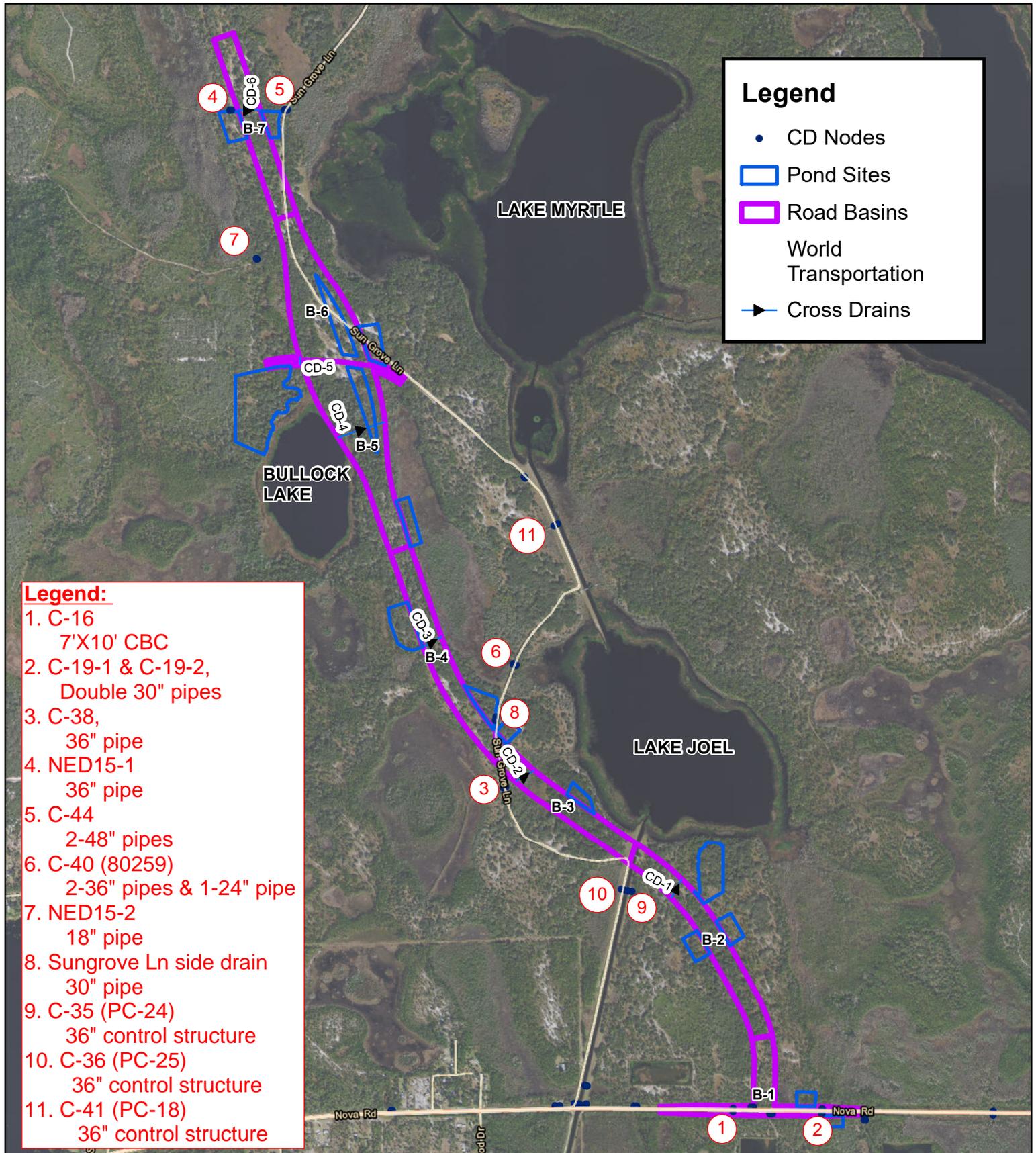
Node Name	Sim Name	Warning Stage [ft]	Max Stage [ft]	Min/Max Delta Stage [ft]	Max Total Inflow [cfs]	Max Total Outflow [cfs]	Max Surface Area [ft <sup>2</sup> ]
NED26	10024	75.00	65.59	0.0002	468.25	437.24	5526650
NED28	10024	77.00	71.26	0.0005	67.29	48.23	687340
NED29	10024	76.00	70.10	0.0003	121.08	235.98	2141153
NED30	10024	73.00	69.30	0.0006	26.83	22.92	243083
NED31	10024	75.00	69.33	0.0002	15.64	14.51	229257
NED33	10024	74.00	68.77	0.0003	98.35	26.08	1685503
NED34	10024	76.00	68.68	0.0004	84.80	60.01	1177514
NED35	10024	72.00	67.84	0.0005	74.06	71.43	482220
NED36	10024	74.00	68.74	0.0003	101.01	8.60	1688686
NED37	10024	74.00	68.08	0.0004	32.02	30.39	374898
NED43	10024	69.00	64.19	0.0005	670.90	667.30	6315416
NED45	10024	70.00	64.29	0.0002	189.40	46.99	5062369
NED46	10024	71.00	64.90	0.0000	157.46	157.45	4781925
NED47	10024	70.00	64.17	0.0005	249.28	142.96	2698130
NED48	10024	68.00	64.17	0.0004	72.34	11.91	1632083
NED49	10024	68.00	64.16	0.0002	123.25	52.03	3157024
NED50	10024	67.00	64.16	0.0005	14.52	14.28	139997
NED51	10024	67.00	64.94	0.0004	20.59	15.23	231506
NED52	10024	67.00	64.17	0.0001	37.63	37.43	527726
NED53	10024	71.00	65.13	0.0004	53.89	53.08	648350
NED54	10024	71.00	64.62	0.0003	20.44	19.38	236328
NED55	10024	71.00	65.05	0.0004	20.75	11.22	301472
NED56	10024	72.00	64.17	0.0001	545.74	538.96	9459954
NED57	10024	69.00	64.31	0.0001	253.33	252.24	1674887
NED59	10024	69.00	64.17	0.0006	64.10	60.29	637364
NED61	10024	70.00	64.17	0.0005	25.25	25.03	224742
NED63	10024	78.00	64.17	0.0005	24.20	16.32	307942
NED64	10024	70.00	64.51	0.0001	13.29	10.04	395171
NED65	10024	78.00	65.13	0.0001	17.29	17.19	208956
NED66	10024	73.00	64.17	0.0000	265.32	265.28	3306559
NED67	10024	73.00	64.17	0.0000	141.38	141.10	1886536
NED68	10024	80.00	64.48	0.0002	702.36	708.32	9057588
NED68 D1	10024	80.00	64.47	0.0010	555.98	491.00	55151

Z:\2017\17-042 Tavistock - Sunbridge\MASTER STORMWATER\ENG\STORMWATER\NED\PRICPR4 NED PRE\

5/2/2018 17:30

# Appendix C

## Field Review Notes



**Legend:**

- 1. C-16  
7'X10' CBC
- 2. C-19-1 & C-19-2,  
Double 30" pipes
- 3. C-38,  
36" pipe
- 4. NED15-1  
36" pipe
- 5. C-44  
2-48" pipes
- 6. C-40 (80259)  
2-36" pipes & 1-24" pipe
- 7. NED15-2  
18" pipe
- 8. Sungrove Ln side drain  
30" pipe
- 9. C-35 (PC-24)  
36" control structure
- 10. C-36 (PC-25)  
36" control structure
- 11. C-41 (PC-18)  
36" control structure

**Legend**

- CD Nodes
- Pond Sites
- ▭ Road Basins
- World Transportation
- ➔ Cross Drains

<h2 style="margin: 0;">NORTHEAST CONNECTOR</h2> <p style="margin: 0;">FROM CYRILS DRIVE TO NOVA ROAD (CR 532)</p> <p style="margin: 0;">OSCEOLA COUNTY, FLORIDA</p>	<p style="margin: 0;">PREPARED BY: The Balmoral Group 165 Lincoln Avenue Winter Park, Florida 32789</p>	<h2 style="margin: 0;">LOCATION MAP</h2>
<p style="margin: 0;">0    900    1,800    3,600</p> <p style="margin: 0;">Feet</p>		
<p style="margin: 0;">Appendix C, Page 1 of 26</p>		



**1. C-16**



2. C-19



**3. C-38**



**4. NED15-1**



5. C-44



**6. C-40-1, C-40-2, and C-40-3**



**7. NED15-2**



**8. Sungrove Lane Side Drain**



9. PC-24



10. PC-25



**11. PC-18**

### Structure Evaluation Form

Project Name: NEC Date: 03/02/2021  
 Evaluator(s): NBW Roadway: NEC/Nova.  
 Structure-ID: 1  
 General Hydraulic Feature Type: Box culvert  
 Location Description: Box culvert across Nova Rd.

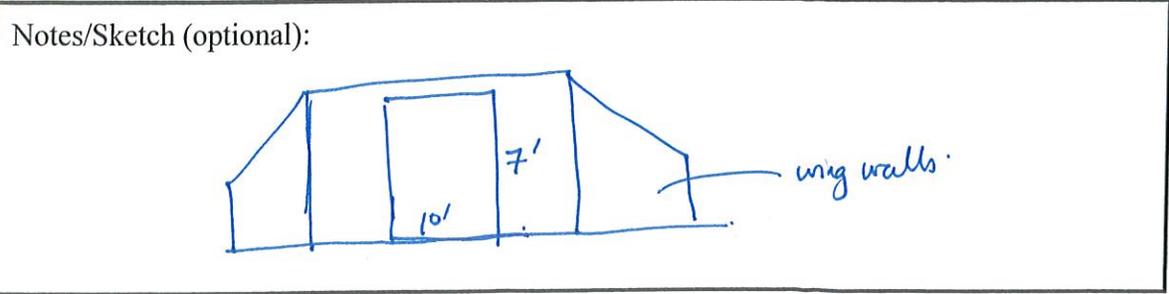
**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Good  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) NA in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: \_\_\_\_\_ in  
 Width: 10 in<sup>ft</sup> Height: 7 in<sup>ft</sup>  
 Silted: (Y/N) 2 in Debris  
 Condition: Good  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) NA in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)

Comments: Appears to be an animal (wildlife or cattle) crossing. It is full of debris.



### Structure Evaluation Form

Project Name: NCE Date: 03/02/2021  
 Evaluator(s): NBN Roadway: NEC/Nova  
 Structure-ID: 2A  
 General Hydraulic Feature Type: Cross Drain  
 Location Description: Double 30' CS across Nova. End wall on the S side of Nova.

**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Moderate  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) 6 in  
 Condition: Good  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) 10 in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Notes/Sketch (optional):

stain lines @ 10" from pipe bottom.

### Structure Evaluation Form

Project Name: NCC Date: 09/02/2021  
 Evaluator(s): NBW Roadway: NCC/Nova  
 Structure-ID: 26  
 General Hydraulic Feature Type: Cross drain  
 Location Description: Double 30' CA across Nova. End wall on the N side of Nova

**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Moderate  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: 30 in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) \_\_\_\_\_ in  
 Condition: Good  
 Water Level: (Y/N) 6 in  
 Stain Lines: (Y/N) 13 in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)  
 Comments: Very heavily vegetated and needs to be cleaned

Notes/Sketch (optional):

stain lines @ 13" from pipe bottom.

### Structure Evaluation Form

Project Name: NCC Date: 08/02/2021  
 Evaluator(s): NBW Roadway: NCC  
 Structure-ID: 3A/B  
 General Hydraulic Feature Type: Cross Drain  
 Location Description: Cross Drain across service road

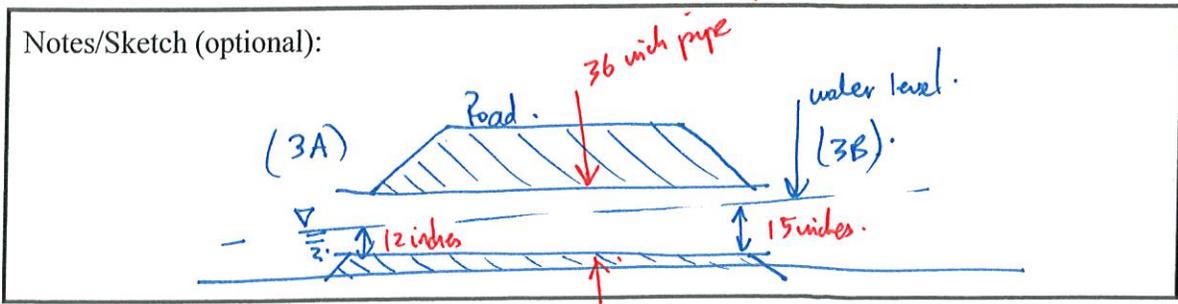
**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Moderate  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: 36 in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) \_\_\_\_\_ in  
 Condition: Good  
 Water Level: (Y/N) 12 in and @ 15 downstream.  
 Stain Lines: (Y/N) 16 in (see pic.)  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





### Structure Evaluation Form

Project Name: NEC Date: 03/02/2021  
 Evaluator(s): NBW Roadway: NEC  
 Structure-ID: 5A  
 General Hydraulic Feature Type: Cross Drain  
 Location Description: Double 48" CMP cross drain at station 5 at N end of project corridor

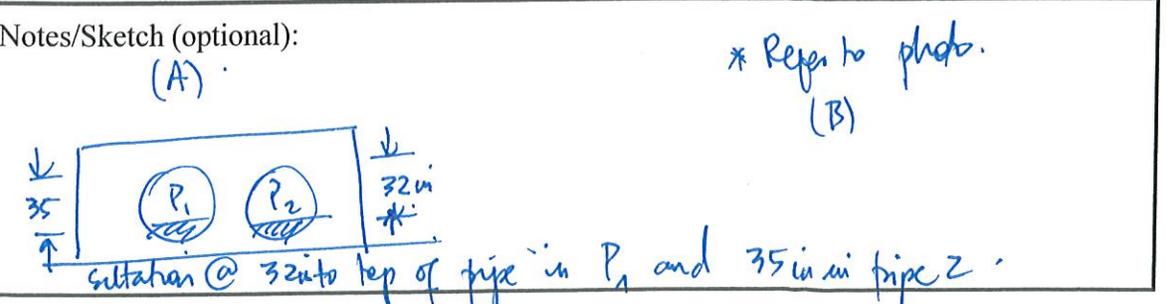
**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Good  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) 4 in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: 48 in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) 32 in  
 Condition: Poor  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (X/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (X/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)

Comments: Rusted at the bottom. Pipes degraded and in poor condition.



### Structure Evaluation Form

Project Name: NEC Date: \_\_\_\_\_  
 Evaluator(s): NEV Roadway: \_\_\_\_\_  
 Structure-ID: 6  
 General Hydraulic Feature Type: Cross drain  
 Location Description: 3 nozzle CD

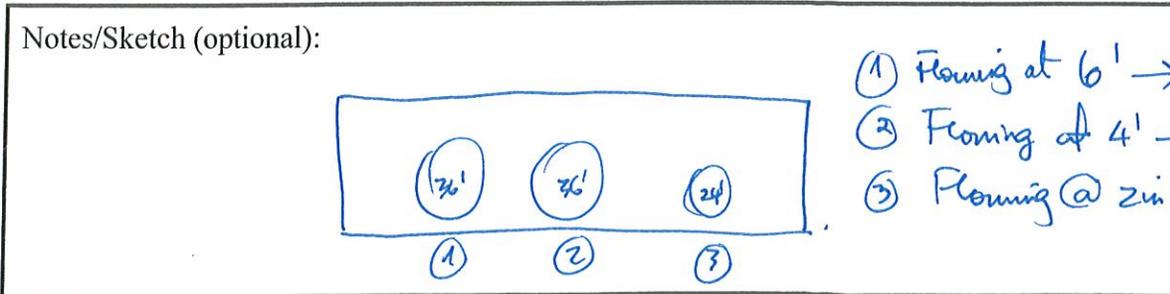
**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: Good  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) 4 in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: 2 pipes - 2, 36" and 1 24" in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) \_\_\_\_\_ in  
 Condition: Good  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
 Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
 Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
 Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N) \_\_\_\_\_  
 w/o rdwy (Y/N) \_\_\_\_\_  
 Facing away from End Treatment: (Y/N) \_\_\_\_\_  
 Inside of Pipe: (Y/N) \_\_\_\_\_  
 Measurement of Pipe Size: (Y/N) \_\_\_\_\_  
 Measurement of Stain Mark: (Y/N) \_\_\_\_\_  
 Station Ahead: (Y/N) \_\_\_\_\_  
 Station Back: (Y/N) \_\_\_\_\_

Comments: Fast flowing water through CD.







### Structure Evaluation Form

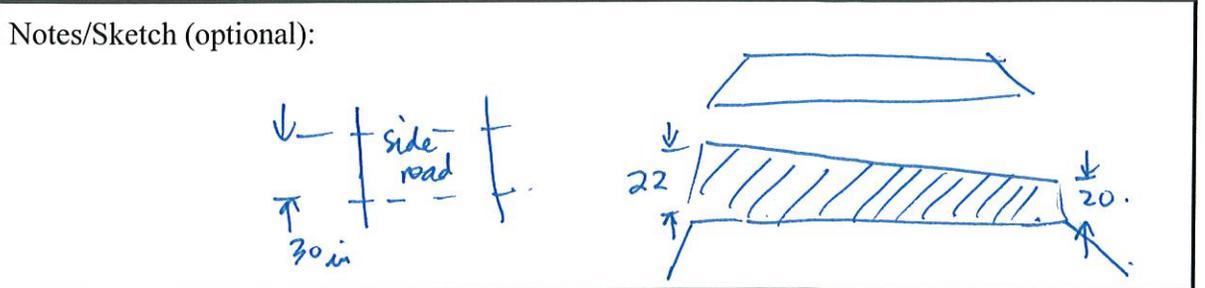
Project Name: NCC Date: 02/02/2021  
 Evaluator(s): NAN Roadway: NCC  
 Structure-ID: 8  
 General Hydraulic Feature Type: Cross Drain  
 Location Description: Side drain

**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: \_\_\_\_\_  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: 30 in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: (Y/N) 22 in and 20 in  
 Condition: \_\_\_\_\_  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Flow Direction Evident: (Y/N) [ N | S | W | E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)  
 Comments: Heavily sedimented



### Structure Evaluation Form

Project Name: NEC Date: 03/02/2021  
 Evaluator(s): NBW Roadway: NEC  
 Structure-ID: 12  
 General Hydraulic Feature Type: Side drain  
 Location Description: Small CMP buried in sediment

**End Treatment:**  
 Mitered  Endwall  Wingwall  
 Mitered with Safety Bars  Projecting  
 DBI: \_\_\_\_\_ in x \_\_\_\_\_ in  
 Other: \_\_\_\_\_  
 Condition: \_\_\_\_\_  
 Erosion: (Y/N) \_\_\_\_\_  
 Beveled: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Scour Hole: (Y/N) Length: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Depth: \_\_\_\_\_ in

**Culvert:**  
 Circular  Rectangular  Elliptical  
 Metal  Concrete  Other: \_\_\_\_\_  
 Approx. Size: Diameter: \_\_\_\_\_ in  
 Width: \_\_\_\_\_ in Height: \_\_\_\_\_ in  
 Silted: ( Y/N) \_\_\_\_\_ in unobscured  
 Condition: Poor  
 Water Level: (Y/N) \_\_\_\_\_ in  
 Stain Lines: (Y/N) \_\_\_\_\_ in  
 Flow Direction Evident: ( Y/N) [  N |  S |  W |  E ]

**Surroundings:**  
Channel:  Natural  Man-made  
 Channelized  Bottom Erosion  
 Sediments  Sloughing  Lined  
 No Vegetation  Grassed  
 Slightly Vegetated  Steep Banks  
 Medium Vegetated  Mild Banks  
 Heavily Vegetated  Trees  
Lake/Pond:  Dry  Wet  
 Littoral Zone  Sediment Build-up  
 Well Maintained  Heavily Vegetated  
Description:  Grass(short)  
 Grass(dense)  Brush(light)  
 Brush(dense)  Range

**Pictures:**  
 End Treatment: w/ rdwy (Y/N)  
 w/o rdwy (Y/N)  
 Facing away from End Treatment: (Y/N)  
 Inside of Pipe: (Y/N)  
 Measurement of Pipe Size: (Y/N)  
 Measurement of Stain Mark: (Y/N)  
 Station Ahead: (Y/N)  
 Station Back: (Y/N)

Comments: Completely buried

Notes/Sketch (optional):







## Appendix D

### Proposed Hydrologic and Hydraulic Calculations

Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
SUMMARY OF FLOOD DATA PROPOSED CONDITION

STRUCTURE NO.	Cross Drain Size	DESIGN FLOOD			BASE FLOOD			OVERTOPPING FLOOD				GREATEST FLOOD*				
		2% PROB	50 YR FREQ	1% PROB	100 YR FREQ	DISCHARGE	STAGE	FREQ YR	DISCHARGE	STAGE	PROB %	FREQ YR	DISCHARGE	STAGE	PROB %	FREQ YR
		DISCHARGE	STAGE	DISCHARGE	STAGE	DISCHARGE	STAGE	DISCHARGE	STAGE	PROB %	FREQ YR	DISCHARGE	STAGE	PROB %	FREQ YR	
CD-19-1	30" RCP	11.92	68.43	13.84	68.48	--	--	--	--	--	--	18.30	68.61	0.2%	500.0	
CD-19-2	30" RCP	13.18	69.95	15.12	70.04	--	--	--	--	--	--	19.63	70.30	0.2%	500.0	
CD-1	2 - 48" RCP	72.10	63.47	79.20	63.55	--	--	--	--	--	--	96.00	63.76	0.2%	500.0	
CD-2	2 - 42" RCP	57.60	63.01	60.90	63.06	--	--	--	--	--	--	68.70	63.18	0.2%	500.0	
CD-4	2 - 10' x 9' CBC	496.10	63.20	622.18	63.37	--	--	--	--	--	--	914.96	63.92	0.2%	500.0	
CD-5	4 - 6' x 3' CBC	141.40	64.22	162.70	64.26	--	--	--	--	--	--	212.10	64.38	0.2%	500.0	
CD-6	3 - 60" RCP	139.10	64.02	139.33	64.02	--	--	--	--	--	--	139.87	64.03	0.2%	500.0	

NOTE: THE HYDRAULIC DATA IS SHOWN FOR INFORMATIONAL PURPOSES ONLY, TO INDICATE THE FLOOD DISCHARGES AND WATER SURFACE ELEVATIONS WHICH MAY BE ANTICIPATED IN ANY GIVEN YEAR. THIS DATA WAS GENERATED USING HIGHLY VARIABLE FACTORS DETERMINED BY A STUDY OF THE WATERSHED. MANY JUDGEMENTS AND ASSUMPTIONS ARE REQUIRED TO ESTABLISH THESE FACTORS. THE RESULTANT HYDRAULIC DATA IS SENSITIVE TO CHANGES, PARTICULARLY OF ANTECEDENT CONDITIONS, URBANIZATION, CHANNELIZATION, AND LAND USE. USERS OF THIS DATA ARE CAUTIONED AGAINST THE ASSUMPTION OF PRECISION WHICH CAN NOT BE ATTAINED. DISCHARGES ARE IN CUBIC FEET PER SECOND (CFS) AND STAGES ARE IN FEET, NAVD 88.

\*In instances where the Overtopping Flood is due to a basin divide, the Greatest Flood (500-year) is also provided for informational purposes during design.

PROJECT: Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)

PREPARED: MJM DATE: 05/18/21

CHECKED: JAN DATE: 05/19/21

LOCATION: Osceola and Orange County, Florida

Table B.1 - Existing Offsite Conveyance

From Node	To Node	CD	Peak Flow			Upstream Invert (ft)	Downstream Invert (ft)
			50 y-24h (cfs)	100 y-24h (cfs)	500 y-24h (cfs)		
NED 75	NED 66	C-19-1	11.9	13.8	18.3	65.8	67.2
		C-19-2	13.2	15.1	19.6	66.1	66.6

50 y (cfs)	100 y (cfs)	500 y (cfs)
0.02	0.01	0.002

Solve for 500-year flow rate using log-log graph

C-19-1

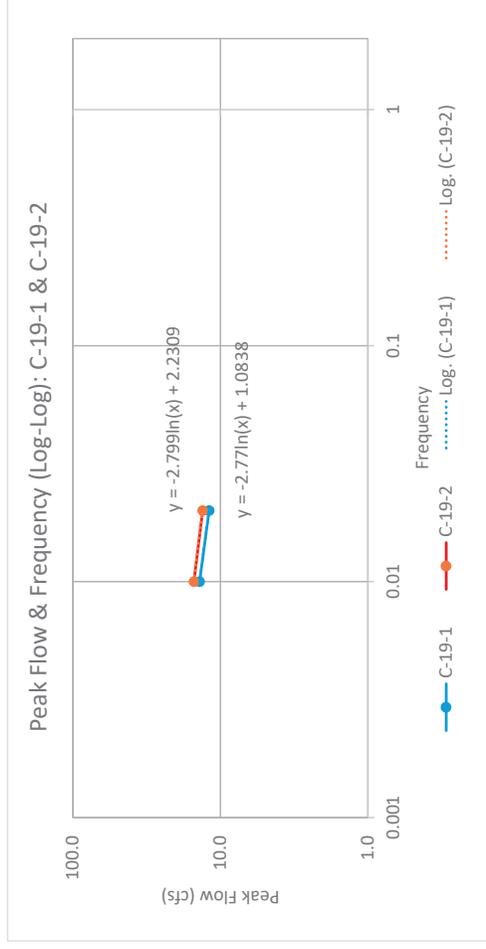
$$y = -A \ln(x) + B$$

A= 2.770  
 B= 1.084  
 y= **18.30 cfs**  
 x= 0.002

C-19-2

$$y = -A \ln(x) + B$$

A= 2.799  
 B= 2.231  
 y= **19.63 cfs**  
 x= 0.002



Notes:  
 Flow for the existing cross drains were not calculated but obtained from ERP conceptual permit application 200622-3738 with no rational flow.

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)

**PREPARED:** MJM

**DATE:** 05/18/21

**LOCATION:** Osceola and Orange County, Florida

**CHECKED:** JAN

**DATE:** 05/18/21

**Table B.2 - Proposed Offsite Conveyance Summary**

Cross Drain Name	Number of Barrels	Required Minimum Size & Material	Contributing Basin Area (ac)	Design (50yr) Storm			Method	NED Link
				Calculated Peak Flow (cfs)	NED Sunbridge Flow (cfs)	Total Peak Flow (cfs)		
CD-1	2	48 in RCP	33.0	70.6	1.5	72.1	Rational + NED Contribution	NED59-2
CD-2	2	42 in RCP	20.6	44.1	13.5	57.6	Rational + NED Contribution	C-38
CD-4	2	10' x 9' Box Culvert	--	--	496.1	496.1	NED Contribution	NED43
CD-5	4	6' x 3' Box Culvert	42.3	90.6	50.8	141.4	Rational + NED Contribution	NED15-2 PBU
CD-6	3	60 in RCP	1.4	3.1	136.1	139.1	Rational + NED Contribution	NED15-16

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
**LOCATION:** Osceola County, Florida

**PREPARED:** MJM  
**CHECKED:** JAN

**DATE:** 05/18/21  
**DATE:** 05/19/21

**Table B.3 - Proposed Offsite Conveyance Calculations for CD-1**

Cross Drain Name	CD-1
FDOT IDF Precipitation Zone	7
Pervious C-Value	0.2
Impervious C-value	0.95
Time of Concentration (min)	10.0

**Basin Runoff Calculations**

Total Contributing Area (acres)	33.0
Pervious Contributing Area (acres)	33.0
Impervious Contributing Area (acres)	0.0
Weighted Runoff Coefficient <sup>1</sup>	0.24

**Rational Method Peak Flow Rate Calculations**

Event <sup>2</sup>	Design 50-year	Base 100-year	Greatest 500-yr
Intensity (in/hr) <sup>3</sup>	8.9	9.6	N/A
Calculated Peak Flow (cfs)	70.6	75.9	N/A
NED Sunbridge Flow (cfs)	1.5	3.3	N/A
Total Peak Flow (cfs)	72.1	79.2	96.0
Frequency	0.020	0.010	0.002

IDF Curves from FDOT  
Q=CiA

50-year Intensity calculated using IDF curve coefficients, 100-year Intensity extracted straight from Zone 7 IDF curve  
 (Used 500-year Log-Log graph to obtain basin runoff flow rate)

**NED Sunbridge Contributing Flow**

Condition: Pre-Development  
 Link: NED59-2 Overland Weir

**Cross Drain Sizing Calculations**

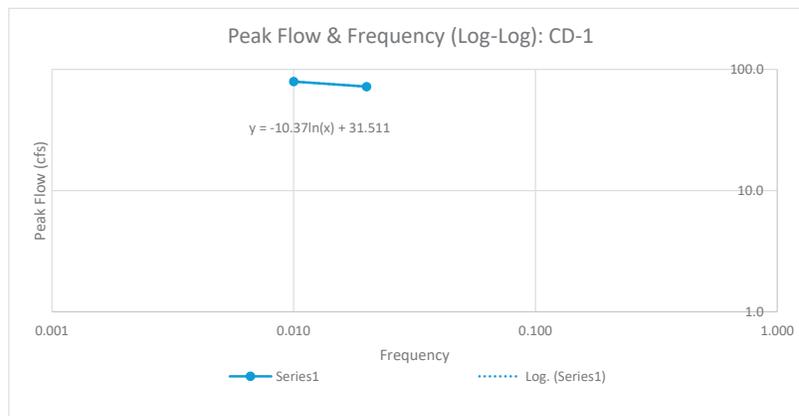
Tailwater Elevation/Source	63.1
Minimum Elevation at Edge of Travel Lane	68.1
Upstream Culvert Invert	59.1
Estimated Pipe Slope (%)	0.058%
Downstream Culvert Invert	58.9
Culvert length	342
Upstream Est. SHWL Elev (ft-NAVD88)	64.7
Upstream Est. Ground Elev (ft-NAVD88)	65.2
Assumed Velocity	3 ft/s
Culvert Conveyance Area for Assumed Velocity	24.0 sf
Recommended Culvert Conveyance Size	2 - 48 inch
Recommended Culvert Size's Conveyance Area	25.1 sf

Crown of Pipe  
Assumed 5-ft above crown

$$A = \frac{Q}{V} = \left( \frac{50\text{-yr Peak Flow}}{\text{Velocity}} \right)$$

**Solve for 500-year flow rate using log-log graph**

$y = -A \ln(x) + B$   
 A= 10.370  
 B= 31.51  
 y= **95.96 cfs**  
 x= 0.002



**Notes:**

- <sup>1</sup> Frequency Factor for Pervious Area Runoff Coefficients will be applied per Design Storm Event (Table B-5, FDOT Drainage Design Guide, January 2021).
- <sup>2</sup> Per FDOT Drainage Manual, 50-year considered design event for mainline interstates and 100-year used if culvert proposed within regulated floodway.
- <sup>3</sup> Design Intensity calculated from FDOT IDF Regression Equations for Tc < 180 minutes. If Tc > 180 minutes, intensity estimated directly from the IDF Curve.

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
**LOCATION:** Osceola County, Florida

**PREPARED:** MJM  
**CHECKED:** JAN

**DATE:** 05/18/21  
**DATE:** 05/19/21

**Table B.4 - Proposed Offsite Conveyance Calculations for CD-2**

Cross Drain Name	CD-2
FDOT IDF Precipitation Zone	7
Pervious C-Value	0.2
Impervious C-value	0.95
Time of Concentration (min)	10.0

**Basin Runoff Calculations**

Total Contributing Area (acres)	20.6
Pervious Contributing Area (acres)	20.6
Impervious Contributing Area (acres)	0.00
Weighted Runoff Coefficient <sup>1</sup>	0.24

**Rational Method Peak Flow Rate Calculations**

	Design	Base	Greatest
Event <sup>2</sup>	50-year	100-year	500-yr
Intensity (in/hr) <sup>3</sup>	8.9	9.6	N/A
Calculated Peak Flow (cfs)	44.1	47.5	N/A
NED Sunbridge Flow (cfs)	13.5	13.5	N/A
Total Peak Flow (cfs)	57.6	60.9	68.7
Frequency	0.020	0.010	0.002

IDF Curves from FDOT  
 $Q=CiA$   
 ICPR Link C-38 (ERP 20062;

50-year Intensity calculated using IDF curve coefficients, 100-year Intensity extracted straight from Zone 7 IDF curve  
 (Used 500-year Log-Log graph to obtain basin runoff flow rate)

**NED Sunbridge Contributing Flow**

Condition: Pre-Development  
 Link: NED45-1  
 Link: C-38

Overland Weir (only contributes in 500-year, ~ 5cfs, not included in calcs)  
 36" CMP

**Cross Drain Sizing Calculations**

Tailwater Elevation/Source	62.6
Minimum Elevation at Edge of Travel Lane	67.6
Upstream Culvert Invert	59.1
Estimated Pipe Slope (%)	0.058%
Downstream Culvert Invert	58.9
Culvert length	290
Upstream Est. SHWL Elev (ft-NAVD88)	62.0
Upstream Est. Ground Elev (ft-NAVD88)	62.6
Assumed Velocity	3 ft/s
Culvert Conveyance Area for Assumed Velocity	19.2 sf
Recommended Culvert Conveyance Size	2 - 42 inch
Recommended Culvert Size's Conveyance Area	19.2 sf

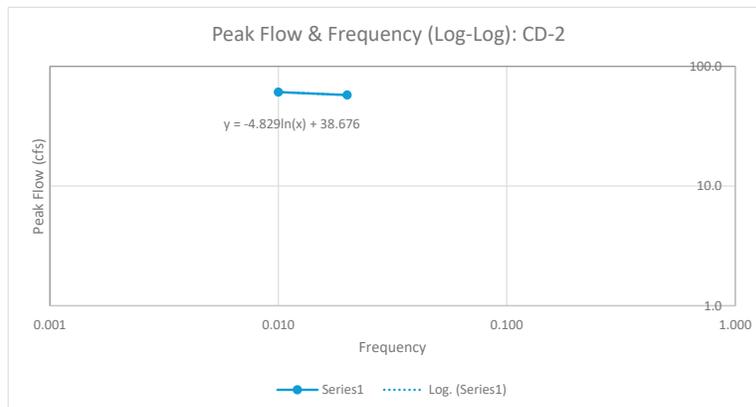
Crown of Pipe  
 Assumed 5-ft above crown

$$A = \frac{Q}{V} = \left( \frac{50\text{-yr Peak Flow}}{\text{Velocity}} \right)$$

**Solve for 500-year flow rate using log-log graph**

$y = -A \ln(x) + B$

A= 4.829  
 B= 38.68  
 y= **68.69 cfs**  
 x= 0.002



**Notes:**

- <sup>1</sup> Frequency Factor for Pervious Area Runoff Coefficients will be applied per Design Storm Event (Table B-5, FDOT Drainage Design Guide, January 2021).
- <sup>2</sup> Per FDOT Drainage Manual, 50-year considered design event for mainline interstates and 100-year used if culvert proposed within regulated floodway.
- <sup>3</sup> Design Intensity calculated from FDOT IDF Regression Equations for Tc < 180 minutes. If Tc > 180 minutes, intensity estimated directly from the IDF Curve.

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
**LOCATION:** Osceola County, Florida

**PREPARED:** MJM  
**CHECKED:** JAN

**DATE:** 05/18/21  
**DATE:** 05/19/21

**Table B.5 - Proposed Offsite Conveyance Calculations for CD-4**

**Rational Method Peak Flow Rate Calculations**

	Design	Base	Greatest
Event <sup>2</sup>	50-year	100-year	500-yr
NED Sunbridge Flow (cfs)	496.10	622.18	N/A
Total Peak Flow (cfs)	496.10	622.18	914.96
Frequency	0.02	0.01	0.002

**NED Sunbridge Contributing Flow**

Condition: Post-Development  
 Link: NED43

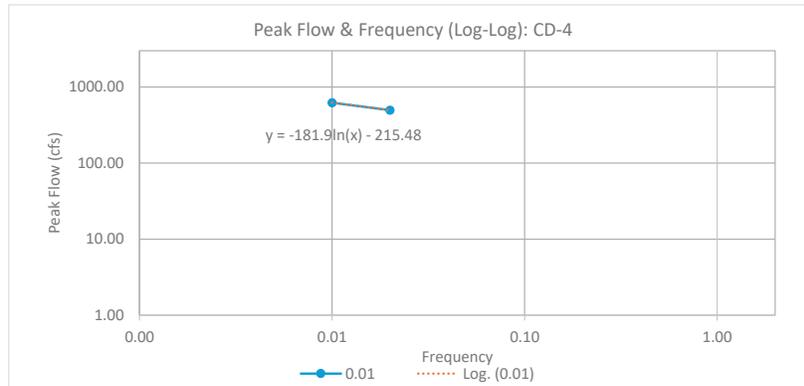
Overland Weir

**Cross Drain Sizing Calculations**

Cross Drain Name	CD-4	
Tailwater Elevation/Source	62.9	Crown of Pipe
Minimum Elevation at Edge of Travel Lane	67.9	Assumed 5-ft above crown
Upstream Culvert Invert	53.9	
Estimated Culvert Slope (%)	0.050%	
Downstream Culvert Invert	53.5	
Culvert length	779	
Upstream Est. SHWL Elev (ft-NAVD88)	63.0	
Upstream Est. Ground Elev (ft-NAVD88)	63.8	
Assumed Velocity	3 ft/s	
Culvert Conveyance Area for Assumed Velocity	165.4 sf	
Recommended Culvert Conveyance Size	2 - 10' x 9' Box Culverts	
Recommended Culvert Size's Conveyance Area	180.0 sf	

**Solve for 500-year flow rate using log-log graph**

$y = -A \ln(x) + B$   
 A= 181.90  
 B= -215.480  
 y= **914.96 cfs**  
 x= 0.002



**Notes:**

Flow for this CD was not calculated but obtained from ERP conceptual permit application 200622-3738 with no rational flow.

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
**LOCATION:** Osceola County, Florida

**PREPARED:** MJM  
**CHECKED:** JAN  
**DATE:** 05/18/21  
**DATE:** 05/19/21

**Table B.6 - Proposed Offsite Conveyance Calculations for CD-5**

Cross Drain Name	CD-5
FDOT IDF Precipitation Zone	7
Pervious C-Value	0.2
Impervious C-value	0.95
Time of Concentration (min)	10.0

**Basin Runoff Calculations**

Total Contributing Area (acres)	42.3
Pervious Contributing Area (acres)	42.3
Impervious Contributing Area (acres)	0.00
Weighted Runoff Coefficient <sup>1</sup>	0.24

**Rational Method Peak Flow Rate Calculations**

	Design	Base	Greatest
Event <sup>2</sup>	50-year	100-year	500-yr
Intensity (in/hr) <sup>3</sup>	8.9	9.6	N/A
Calculated Peak Flow (cfs)	90.6	97.5	N/A
NED Sunbridge Flow (cfs)	50.8	65.2	N/A
Total Peak Flow (cfs)	141.4	162.7	212.1
Frequency	0.020	0.010	0.002

IDF Curves from FDOT  
Q=CiA

50-year Intensity calculated using IDF curve coefficients, 100-year Intensity extracted straight from Zone 7 IDF curve  
 (Used 500-year Log-Log graph to obtain basin runoff flow rate)

**NED Sunbridge Contributing Flow**

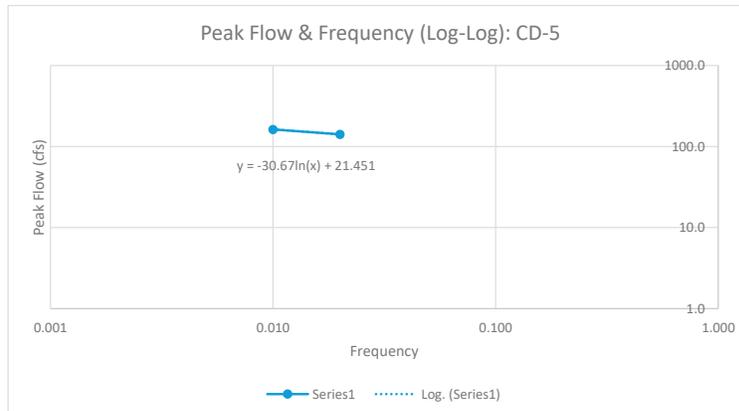
Condition: Post-Development  
 Link: NED15-2 PBU Overland Weir

**Cross Drain Sizing Calculations**

Tailwater Elevation/Source	64.1	Crown of Pipe
Minimum Elevation at Edge of Travel Lane	69.1	Assumed 5-ft above crown
Upstream Culvert Invert	61.1	
Estimated Pipe Slope (%)	0.058%	
Downstream Culvert Invert	61.0	
Culvert length	137	
Upstream Est. SHWL Elev (ft-NAVD88)	63.7	
Upstream Est. Ground Elev (ft-NAVD88)	64.2	
Assumed Velocity	3 ft/s	$A = \frac{Q}{V} = \left( \frac{50\text{-yr Peak Flow}}{\text{Velocity}} \right)$
Culvert Conveyance Area for Assumed Velocity	47.1 sf	
Recommended Culvert Conveyance Size	4 - 6' x 3'	Matches upstream cross drain NED15-2 PBU
Recommended Culvert Size's Conveyance Area	72.0 sf	

**Solve for 500-year flow rate using log-log graph**

$y = -A \ln(x) + B$   
 A= 30.67  
 B= 21.451  
 y= **212.05 cfs**  
 x= 0.002



**Notes:**

- <sup>1</sup> Frequency Factor for Pervious Area Runoff Coefficients will be applied per Design Storm Event (Table B-5, FDOT Drainage Design Guide, January 2021).
- <sup>2</sup> Per FDOT Drainage Manual, 50-year considered design event for mainline interstates and 100-year used if culvert proposed within regulated floodway.
- <sup>3</sup> Design Intensity calculated from FDOT IDF Regression Equations for Tc < 180 minutes. If Tc > 180 minutes, intensity estimated directly from the IDF Curve.

**PROJECT:** Northeast Connector Expressway from Cyrils Drive to Nova Road (CR 532)  
**LOCATION:** Osceola County, Florida

**PREPARED:** MJM  
**CHECKED:** JAN

**DATE:** 05/18/21  
**DATE:** 05/19/21

**Table B.7 - Proposed Offsite Conveyance Calculations for CD-6**

Cross Drain Name	CD-6
FDOT IDF Precipitation Zone	7
Pervious C-Value	0.2
Impervious C-value	0.95
Time of Concentration (min)	10.0

**Basin Runoff Calculations**

Total Contributing Area (acres)	1.42
Pervious Contributing Area (acres)	1.42
Impervious Contributing Area (acres)	0.00
Weighted Runoff Coefficient <sup>1</sup>	0.24

**Rational Method Peak Flow Rate Calculations**

	Design	Base	Greatest
Event <sup>2</sup>	50-year	100-year	500-yr
Intensity (in/hr) <sup>3</sup>	8.9	9.6	N/A
Calculated Peak Flow (cfs)	3.1	3.3	N/A
NED Sunbridge Flow (cfs)	136.05	136.05	N/A
Total Peak Flow (cfs)	139.10	139.33	139.87
Frequency	0.02	0.01	0.002

IDF Curves from FDOT  
 $Q=CiA$

50-year Intensity calculated using IDF curve coefficients, 100-year Intensity extracted straight from Zone 7 IDF curve  
 (Used 500-year Log-Log graph to obtain basin runoff flow rate)

**NED Sunbridge Contributing Flow**

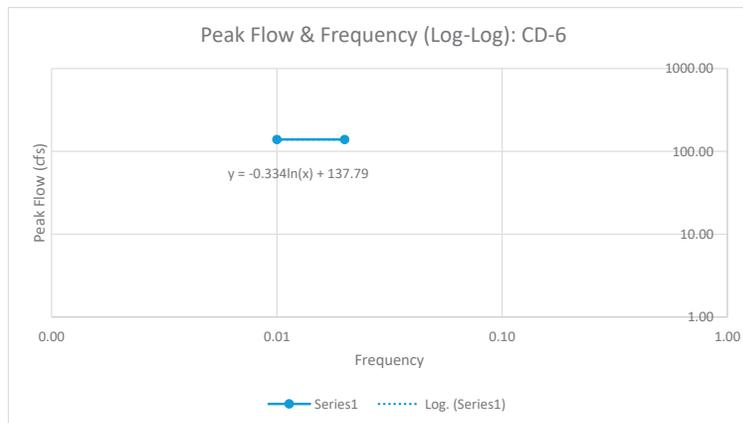
Condition: Post-Development  
 Link: NED15-16 60" Pipe - NED Model showed instability here; Max Flow was used

**Cross Drain Sizing Calculations**

Tailwater Elevation/Source	63.8	Crown of Pipe
Minimum Elevation at Edge of Travel Lane	68.8	Assumed 5-ft above crown
Upstream Culvert Invert	58.8	
Estimated Pipe Slope (%)	0.036%	
Downstream Culvert Invert	58.6	
Culvert length	346	
Upstream Est. SHWL Elev (ft-NAVD88)	64.3	
Upstream Est. Ground Elev (ft-NAVD88)	64.8	
Assumed Velocity	3 ft/s	
Culvert Conveyance Area for Assumed Velocity	46.4 sf	$A = \frac{Q}{v} = \frac{(50\text{-yr Peak Flow})}{\text{Velocity}}$
Recommended Culvert Conveyance Size	3 - 60 inch	Size matches upstream cross drain NED15-16
Recommended Culvert Size's Conveyance Area	58.9 sf	

**Solve for 500-year flow rate using log-log graph**

$y = -A \ln(x) + B$   
 A= 0.334  
 B= 137.790  
 y= **139.87 cfs**  
 x= 0.002



**Notes:**

- <sup>1</sup> Frequency Factor for Pervious Area Runoff Coefficients will be applied per Design Storm Event (Table B-5, FDOT Drainage Design Guide, January 2021).
- <sup>2</sup> Per FDOT Drainage Manual, 50-year considered design event for mainline interstates and 100-year used if culvert proposed within regulated roadway.
- <sup>3</sup> Design Intensity calculated from FDOT IDF Regression Equations for  $T_c < 180$  minutes. If  $T_c > 180$  minutes, intensity estimated directly from the IDF Curve.

# HY-8 Culvert Analysis Report

# C-19\_1 Culvert Crossing

## Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 1 - Summary of Culvert Flows at Crossing: C-19\_1**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
68.43	50-yr	11.92	11.92	0.00	1
68.48	100-yr	13.84	13.84	0.00	1
68.61	500-yr	18.30	18.30	0.00	1
71.11	Overtopping	47.07	47.07	0.00	Overtopping

**Table 2 - Culvert Summary Table: C-19\_1**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	11.92	11.92	68.43	1.700	2.637	7-A2f	-1.000	1.158	2.500	2.500	2.428	0.000
100-yr	13.84	13.84	68.48	1.861	2.685	7-A2f	-1.000	1.252	2.500	2.500	2.819	0.000
500-yr	18.30	18.30	68.61	2.209	2.824	7-A2f	-1.000	1.449	2.500	2.500	3.728	0.000

\*\*\*\*\*  
 Straight Culvert  
 Inlet Elevation (invert): 65.79 ft, Outlet Elevation (invert): 67.16 ft  
 Culvert Length: 140.00 ft, Culvert Slope: -0.0098  
 \*\*\*\*\*

### Site Data - C-19\_1

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 65.79 ft  
 Outlet Station: 140.00 ft  
 Outlet Elevation: 67.16 ft  
 Number of Barrels: 1

### Tailwater Channel Data - C-19\_1

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 69.66 ft

### Roadway Data for Crossing: C-19\_1

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 71.11 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 160.00 ft

### Culvert Data Summary - C-19\_1

Barrel Shape: Circular  
 Barrel Diameter: 2.50 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge with Headwall  
 Inlet Depression: None

**Table 3 - Downstream Channel Rating Curve (Crossing: C-19\_1)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
11.92	69.66	2.50
13.84	69.66	2.50
18.30	69.66	2.50

# C-19\_2 Culvert Crossing

## Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 4 - Summary of Culvert Flows at Crossing: C-19\_2**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
69.95	50-yr	13.18	13.18	0.00	1
70.04	100-yr	15.12	15.12	0.00	1
70.30	500-yr	19.63	19.63	0.00	1
71.11	Overtopping	29.44	29.44	0.00	Overtopping

**Table 5 - Culvert Summary Table: C-19\_2**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	13.18	13.18	69.95	1.798	3.830	4-FFf	-1.000	1.220	2.500	3.100	2.685	0.000
100-yr	15.12	15.12	70.04	1.955	3.922	4-FFf	-1.000	1.311	2.500	3.100	3.080	0.000
500-yr	19.63	19.63	70.30	2.302	4.184	4-FFf	-1.000	1.503	2.500	3.100	3.999	0.000

\*\*\*\*\*

Straight Culvert

Inlet Elevation (invert): 66.12 ft, Outlet Elevation (invert): 66.56 ft

Culvert Length: 140.00 ft, Culvert Slope: -0.0031

\*\*\*\*\*

### Site Data - C-19\_2

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 66.12 ft  
 Outlet Station: 140.00 ft  
 Outlet Elevation: 66.56 ft  
 Number of Barrels: 1

### Tailwater Channel Data - C-19\_2

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 69.66 ft

### Culvert Data Summary - C-19\_2

Barrel Shape: Circular  
 Barrel Diameter: 2.50 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge with Headwall  
 Inlet Depression: None

### Roadway Data for Crossing: C-19\_2

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 71.11 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 160.00 ft

**Table 6 - Downstream Channel Rating Curve (Crossing: C-19\_2)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
13.18	69.66	3.10
15.12	69.66	3.10
19.63	69.66	3.10

# CD-1 Culvert Crossing

## Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 7 - Summary of Culvert Flows at Crossing: CD-1**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-3 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
63.47	50-yr	72.10	72.10	0.00	1
63.55	100-yr	79.20	79.20	0.00	1
63.76	500-yr	96.00	96.00	0.00	1
68.10	Overtopping	263.57	263.57	0.00	Overtopping

**Table 8 - Culvert Summary Table: CD-1**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	72.10	72.10	63.47	2.588	4.374	4-FFf	3.132	1.787	4.000	4.200	2.869	0.000
100-yr	79.20	79.20	63.55	2.741	4.452	4-FFf	3.499	1.877	4.000	4.200	3.151	0.000
500-yr	96.00	96.00	63.76	3.083	4.663	4-FFf	4.000	2.076	4.000	4.200	3.820	0.000

\*\*\*\*\*  
 Straight Culvert  
 Inlet Elevation (invert): 59.10 ft, Outlet Elevation (invert): 58.90 ft  
 Culvert Length: 342.00 ft, Culvert Slope: 0.0006  
 \*\*\*\*\*

### Site Data - CD-1

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 59.10 ft  
 Outlet Station: 342.00 ft  
 Outlet Elevation: 58.90 ft  
 Number of Barrels: 2

### Tailwater Channel Data - CD-1

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 63.10 ft

### Culvert Data Summary - CD-1

Barrel Shape: Circular  
 Barrel Diameter: 4.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge with Headwall  
 Inlet Depression: None

### Roadway Data for Crossing: CD-1

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 68.10 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 178.00 ft

**Table 9 - Downstream Channel Rating Curve (Crossing: CD-1)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
72.10	63.10	4.20
79.20	63.10	4.20
96.00	63.10	4.20

## CD-2 Culvert Crossing

### Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 10 - Summary of Culvert Flows at Crossing: CD-2**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-4 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
63.01	50-yr	57.60	57.60	0.00	1
63.06	100-yr	60.90	60.90	0.00	1
63.18	500-yr	68.70	68.70	0.00	1
67.60	Overtopping	201.15	201.15	0.00	Overtopping

**Table 11 - Culvert Summary Table: CD-2**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	57.60	57.60	63.01	2.421	3.910	4-FFf	2.883	1.656	3.500	3.700	2.993	0.000
100-yr	60.90	60.90	63.06	2.505	3.958	4-FFf	3.125	1.705	3.500	3.700	3.165	0.000
500-yr	68.70	68.70	63.18	2.696	4.083	4-FFf	3.500	1.816	3.500	3.700	3.570	0.000

\*\*\*\*\*

#### Straight Culvert

Inlet Elevation (invert): 59.10 ft, Outlet Elevation (invert): 58.90 ft

Culvert Length: 290.00 ft, Culvert Slope: 0.0007

\*\*\*\*\*

#### Site Data - CD-2

Site Data Option: Culvert Invert Data  
 Inlet Elevation: 59.10 ft  
 Outlet Station: 290.00 ft  
 Outlet Elevation: 58.90 ft  
 Number of Barrels: 2

#### Tailwater Channel Data - CD-2

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 62.60 ft

#### Culvert Data Summary - CD-2

Barrel Shape: Circular  
 Barrel Diameter: 3.50 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge with Headwall  
 Inlet Depression: None

#### Roadway Data for Crossing: CD-2

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 67.60 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 178.00 ft

**Table 12 - Downstream Channel Rating Curve (Crossing: CD-2)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
57.60	62.60	3.70
60.90	62.60	3.70
68.70	62.60	3.70

# CD-4 Culvert Crossing

## Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 13 - Summary of Culvert Flows at Crossing: CD-4**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-5 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
63.20	50-yr	496.10	496.10	0.00	1
63.37	100-yr	622.18	622.18	0.00	1
63.92	500-yr	914.96	914.96	0.00	1
67.90	Overtopping	2030.70	2030.70	0.00	Overtopping

**Table 14 - Culvert Summary Table: CD-4**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	496.10	496.10	63.20	4.588	9.298	4-FFf	4.841	2.673	9.000	9.400	2.756	0.000
100-yr	622.18	622.18	63.37	5.306	9.469	4-FFf	5.744	3.109	9.000	9.400	3.457	0.000
500-yr	914.96	914.96	63.92	6.812	10.015	4-FFf	7.753	4.021	9.000	9.400	5.083	0.000

\*\*\*\*\*

Straight Culvert

Inlet Elevation (invert): 53.90 ft, Outlet Elevation (invert): 53.50 ft

Culvert Length: 779.00 ft, Culvert Slope: 0.0005

\*\*\*\*\*

### Site Data - CD-4

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 53.90 ft  
 Outlet Station: 779.00 ft  
 Outlet Elevation: 53.50 ft  
 Number of Barrels: 2

### Tailwater Channel Data - CD-4

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 62.90 ft

### Culvert Data Summary - CD-4

Barrel Shape: Concrete Box  
 Barrel Span: 10.00 ft  
 Barrel Rise: 9.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge  
 (90°) Headwall  
 Inlet Depression: None

### Roadway Data for Crossing: CD-4

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 67.90 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 100.00 ft

**Table 15 - Downstream Channel Rating Curve (Crossing: CD-4)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
496.10	62.90	9.40
622.18	62.90	9.40
914.96	62.90	9.40

# CD-5 Culvert Crossing

Crossing Discharge Data - Discharge Selection Method: Recurrence

**Table 16 - Summary of Culvert Flows at Crossing: CD-5**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-6 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
64.22	50-yr	141.40	141.40	0.00	1
64.26	100-yr	162.70	162.70	0.00	1
64.38	500-yr	212.10	212.10	0.00	1
69.10	Overtopping	851.35	851.35	0.00	Overtopping

**Table 17 - Culvert Summary Table: CD-5**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	141.40	141.40	64.22	1.750	3.124	4-FFf	1.675	1.025	3.000	3.100	1.964	0.000
100-yr	162.70	162.70	64.26	1.916	3.164	4-FFf	1.849	1.126	3.000	3.100	2.260	0.000
500-yr	212.10	212.10	64.38	2.276	3.279	4-FFf	2.235	1.344	3.000	3.100	2.946	0.000

\*\*\*\*\*  
 Straight Culvert  
 Inlet Elevation (invert): 61.10 ft, Outlet Elevation (invert): 61.00 ft  
 Culvert Length: 137.00 ft, Culvert Slope: 0.0007  
 \*\*\*\*\*

## Site Data - CD-5

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft  
 Inlet Elevation: 61.10 ft  
 Outlet Station: 137.00 ft  
 Outlet Elevation: 61.00 ft  
 Number of Barrels: 4

## Tailwater Channel Data - CD-5

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 64.10 ft

## Roadway Data for Crossing: CD-5

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 69.10 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 100.00 ft

## Culvert Data Summary - CD-5

Barrel Shape: Concrete Box  
 Barrel Span: 6.00 ft  
 Barrel Rise: 3.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge  
 (90°) Headwall  
 Inlet Depression: None

**Table 18 - Downstream Channel Rating Curve (Crossing: CD-5)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
141.40	64.10	3.10
162.70	64.10	3.10
212.10	64.10	3.10

# CD-6 Culvert Crossing

## Crossing Discharge Data

Discharge Selection Method: Recurrence

**Table 19 - Summary of Culvert Flows at Crossing: CD-6**

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	CD-7 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
64.02	50-yr	139.10	139.10	0.00	1
64.02	100-yr	139.33	139.33	0.00	1
64.03	500-yr	139.87	139.87	0.00	1
68.80	Overtopping	658.97	658.97	0.00	Overtopping

**Table 20 - Culvert Summary Table: CD-6**

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50-yr	139.10	139.10	64.02	2.670	5.223	4-FFf	3.030	1.905	5.000	5.200	2.361	0.000
100-yr	139.33	139.33	64.02	2.673	5.224	4-FFf	3.034	1.906	5.000	5.200	2.365	0.000
500-yr	139.87	139.87	64.03	2.680	5.225	4-FFf	3.041	1.910	5.000	5.200	2.375	0.000

\*\*\*\*\*  
 Straight Culvert  
 Inlet Elevation (invert): 58.80 ft, Outlet Elevation (invert): 58.60 ft  
 Culvert Length: 346.00 ft, Culvert Slope: 0.0006  
 \*\*\*\*\*

### Site Data - CD-6

Site Data Option: Culvert Invert Data  
 Inlet Station: 0.00 ft  
 Inlet Elevation: 58.80 ft  
 Outlet Station: 346.00 ft  
 Outlet Elevation: 58.60 ft  
 Number of Barrels: 3

### Tailwater Channel Data - CD-6

Tailwater Channel Option: Enter  
 Constant Tailwater Elevation  
 Constant Tailwater Elevation: 63.80 ft

### Culvert Data Summary - CD-6

Barrel Shape: Circular  
 Barrel Diameter: 5.00 ft  
 Barrel Material: Concrete  
 Embedment: 0.00 in  
 Barrel Manning's n: 0.0120  
 Culvert Type: Straight  
 Inlet Configuration: Square Edge with Headwall  
 Inlet Depression: None

### Roadway Data for Crossing: CD-6

Roadway Profile Shape: Constant  
 Roadway Elevation  
 Crest Length: 100.00 ft  
 Crest Elevation: 68.80 ft  
 Roadway Surface: Paved  
 Roadway Top Width: 100.00 ft

**Table 21 - Downstream Channel Rating Curve (Crossing: CD-6)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
139.10	63.80	5.20
139.33	63.80	5.20
139.87	63.80	5.20

## Appendix E

### Correspondence

**Acres of Ponds/Lakes:**

**Corridor A: 35.83 Ac**

**Corridor B: 37.02 Ac**



**Legend**

-  Ponds/Lakes
-  Corridor A
-  Corridor B
-  Study Area

The Balmoral Group  
165 Lincoln Avenue  
Winter Park, FL 32789  
Phone: (407) 629-2185  
[www.balmoralgroup.us](http://www.balmoralgroup.us)

**CENTRAL  
FLORIDA  
EXPRESSWAY  
AUTHORITY**

Northeast Connector PD&E Study  
from Cyrils Drive to Nova Road  
CFX Project No.599-228

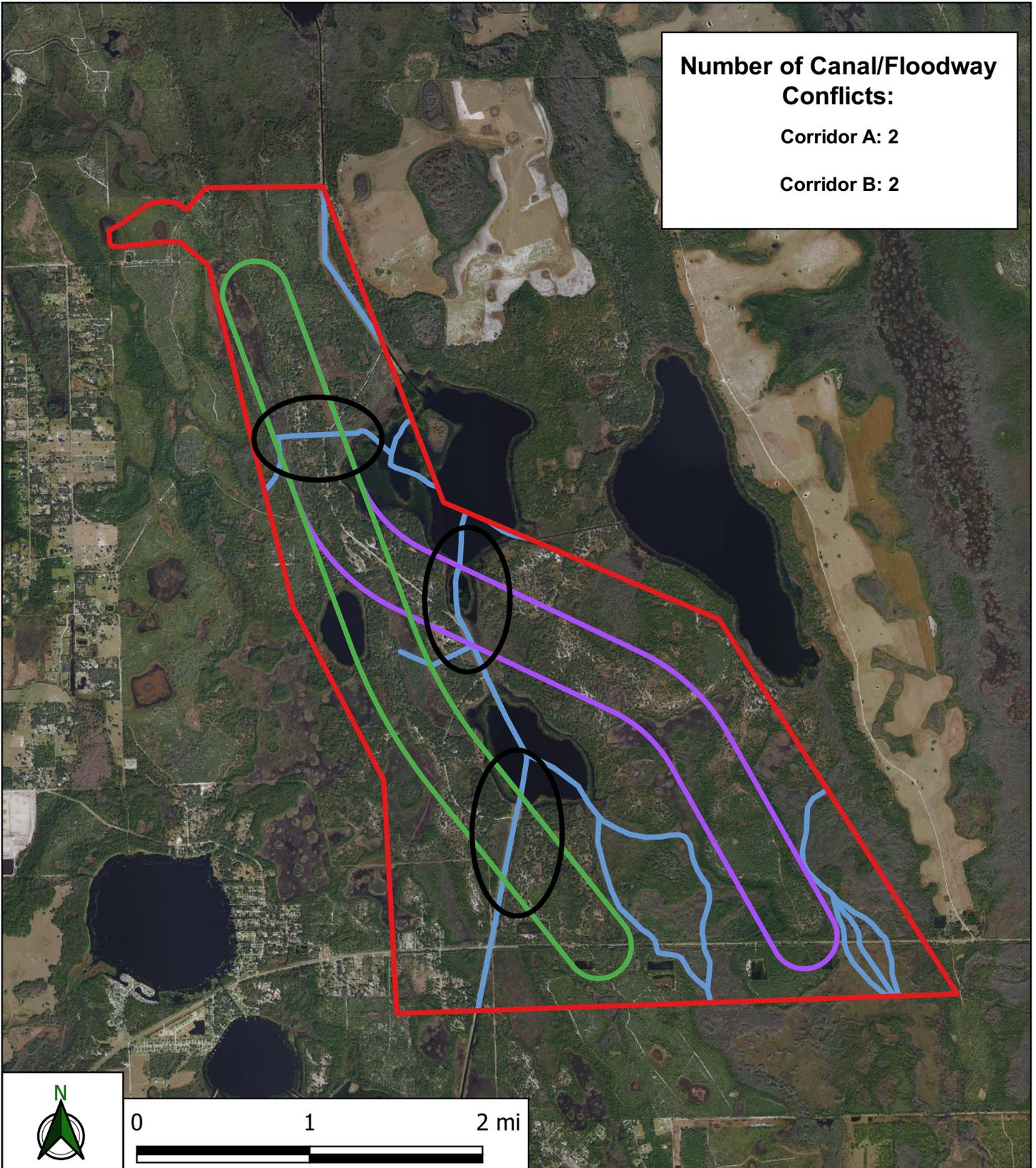
**FIGURE 1**

Northeast Connector  
PD&E Study  
Acres of Ponds/Lakes Impacted

**Number of Canal/Floodway Conflicts:**

**Corridor A: 2**

**Corridor B: 2**



0 1 2 mi

**Legend**

-  Canals/Floodways
-  Corridor A
-  Corridor B
-  Study Area

The Balmoral Group  
165 Lincoln Avenue  
Winter Park, FL 32789  
Phone: (407) 629-2185  
www.balmoralgroup.us

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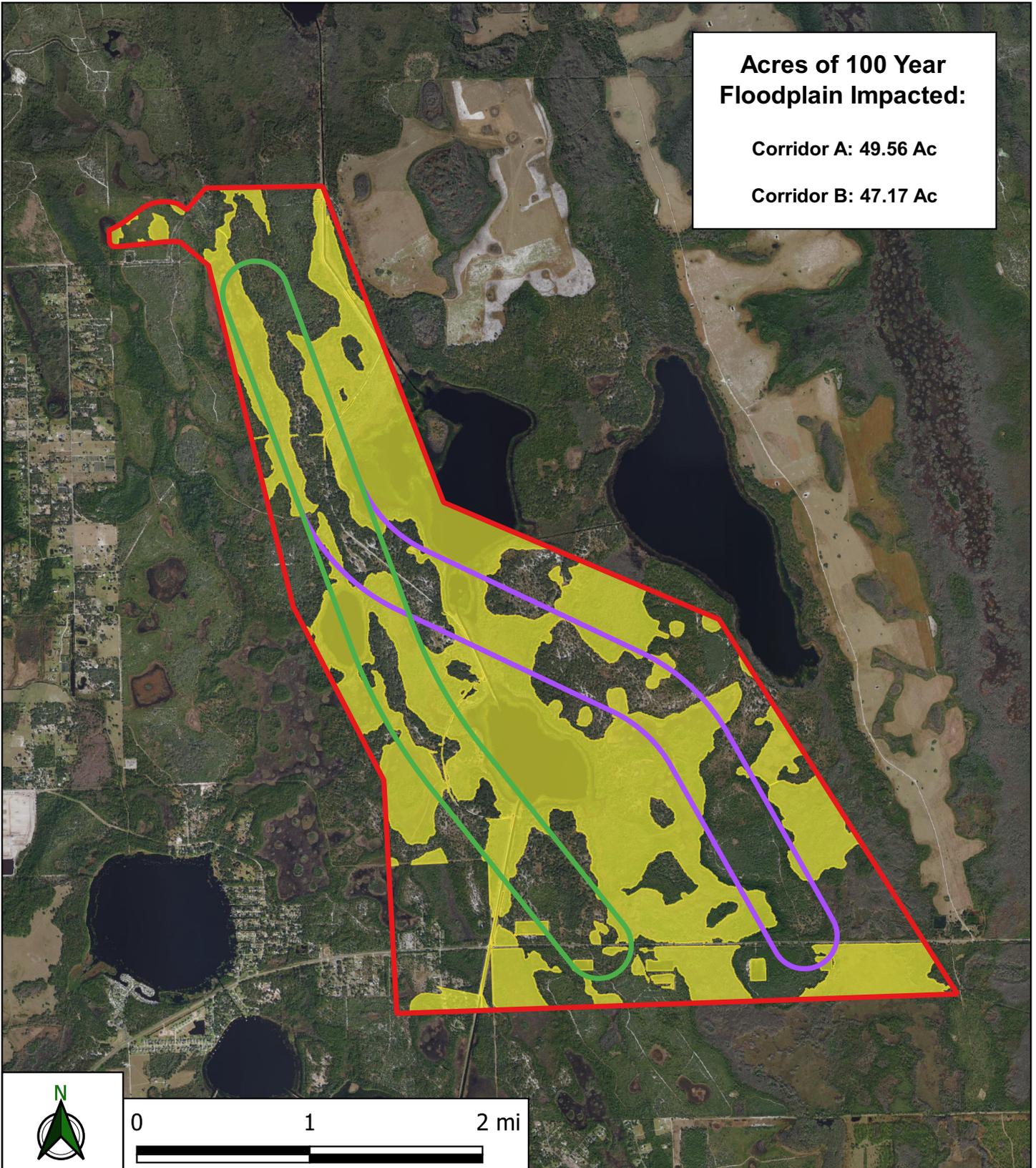
**FIGURE 2**

Northeast Connector  
PD&E Study  
Canal/Floodway Conflicts

**Acres of 100 Year  
Floodplain Impacted:**

**Corridor A: 49.56 Ac**

**Corridor B: 47.17 Ac**



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**Legend**

-  Corridor A
-  Corridor B
-  Study Area

**Flood Zone**

-  AE

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Northeast Connector PD&E Study  
from Cyrils Drive to Nova Road  
CFX Project No.599-228

**FIGURE 3**

Northeast Connector  
PD&E Study

Acres of 100 Year Floodplain  
Impacted

**Clip Files:**

- Waterbody\_StudyArea – SFWMD, AHED\_20171102.gdb, WATERBODY.shp
- Waterbody\_CorrA – SFWMD, AHED\_20171102.gdb, WATERBODY.shp
- Waterbody\_CorrB – SFWMD, AHED\_20171102.gdb, WATERBODY.shp
- Hydroedge\_StudyArea – SFWMD, AHED\_20171102.gdb, HYDROEDGE.shp
- Fldhaz\_StudyArea – FEMA, dfirm\_NFHL\_oct19.gdb, dfirm\_fldhaz\_oct19.shp
- Fldhaz\_CorrA – FEMA, dfirm\_NFHL\_oct19.gdb, dfirm\_fldhaz\_oct19.shp
- Fldhaz\_CorrB – FEMA, dfirm\_NFHL\_oct19.gdb, dfirm\_fldhaz\_oct19.shp