Immokalee Stormwater Improvement Program

(ImmSIP)

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Project No. 60143

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Table of Contents

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SECTION 1: Background:

In 2005, the Big Cypress Basin of the South Florida Water Management District contracted H.W. Lochner, Inc. (Lochner), to conduct a study to develop the Immokalee Stormwater Master Plan (ISWMP) to address flooding and water quality concerns within the urban Immokalee area. The study involved an analysis of problems and needs, data collection, hydrologic and hydraulic modeling, water quality analysis, evaluation of alternative solutions, initial cost estimates, and development of a recommended alternative.

The problem areas that were identified included the following:

- Fish Creek Ditch – Inadequate storage capacity and conveyance, ditch banks significantly eroded
- Lake Trafford Road Ditch – Inadequate storage and conveyance capacity, existing undersized culverts that create upstream flooding and standing water conditions
- Slough Conveyance – Inadequate conveyance capacity of existing road crossings and flooding
- Main Street/5th Street area – Flooding
- Immokalee Drive area – Flooding
- Market Street/Madison Avenue area – Flooding
- Water quality issues

The consultant developed four alternatives to present to the Immokalee Community Redevelopment Agency (CRA) Advisory Board. These alternatives were presented to the Advisory Board at the public meeting on March 2, 2005. The Advisory Board selected alternative four as the best option and recommended the consultant move forward with the conceptual design. The selected alternative identified five improvements in the following areas:

- Madison Ditch
- Slough Conveyance
- Lake Trafford Road and Fish Creek
- Immokalee Drive
- Downtown Immokalee

During 2005 to 2008 the Collier County Stormwater Management Section completed work on three (3) separate, previously planned and prioritized projects in the Immokalee area. These projects were:

- Farm Worker Village Box Culvert Improvements (SR-29)
- Fish Creek Box Culvert Extension
- Fifth Street Ditch Enclosure

During this time frame, the Immokalee CRA and its staff also assumed control of implementing the stormwater projects identified in the ISWMP.

On June 9, 2009, the ISWMP was accepted by the Board of County Commissioners. Under the 2008 Supplemental Community Development Block Grant (CDBG) Appropriations for the Disaster Recovery Initiative (DRI), the Collier County Department of Housing and Human Services Selection Committee awarded the CRA a construction grant in the amount of $3,533,124 for the stormwater improvements in the downtown Immokalee area. The award was received in mid-2010 with a requirement that construction be completed within two (2) years of award. At that time the CRA also contracted with a consultant team of Camp, Dresser and McGee (CDM) along with Agnoli, Barber and Brundage (ABB) for the preparation of construction plans and permitting leading to construction of the Downtown Immokalee stormwater improvements and updating and prioritization of the ISWMP. Subsequently, the Immokalee Drive stormwater improvements were also designed and constructed. A draft document for updating the ISWMP was prepared by CDM, but never finalized.

By 2015, due to staffing changes and reorganizations, the Collier County Stormwater Management Section staff resumed responsibility for completing the updating of the ISWMP that had been started by CDM. To avoid confusion with the previously developed documents, the name was changed to the Immokalee Stormwater Improvement Program (ImmSIP).

SECTION 2: Development of the Immokalee Stormwater Improvement Program (ImmSIP) Concept:

In mid-2015, staff began the process of gathering information from existing files, reading various reports, reviewing plans, and developing an overall understanding of the existing conditions of the various Immokalee stormwater components and the proposed improvements. In a separate asset management program already under way by the Growth Management Department - Operations and Management Division - the Stormwater Asset Inventory Program (SAIP) was locating and logging all stormwater system components (assets) into a GIS database. A coordinated decision was made by management to switch the field work portion of the asset collection staff to the urban Immokalee area to collect the data that could then be utilized by Stormwater staff in preparing future stormwater improvements and asset management and maintenance activities. The Immokalee stormwater data collection effort extended through the 2015/2016 dry season and follow-up data entry continued through 2017.

To develop water level information usable for hydrologic/hydraulic stormwater modeling, five (5) surface water level staff gauges were installed and a weekly reading was initiated in 2016.

Stormwater staff conducted several field trips through the Immokalee area and utilized the various GIS information sources available to develop the ImmSIP concept of locating proposed stormwater treatment assets (primarily ponds) at the discharge points of known existing major outfalls. They also utilized their historic flooding knowledge to develop major routes for stormwater improvements that supported the ISWMP. Discussions were held with other interested participants in making improvements to Immokalee, including Collier County Transportation Planning (street, sidewalk and pathway improvements), Immokalee Water and Sewer District (existing and proposed utility lines), Seminole Tribe of Florida (improvements on or adjacent to the Immokalee reservation), South Florida Water Management District, and the Immokalee CRA.

Conceptual Hydrologic/Hydraulic Modeling:

In the development of the original ISWMP, H.W. Lochner utilized the XPSWMM model with its abilities to address surface water flow along with limited groundwater impact and surface water quality impact analyses. CDM's draft update to the ISWMP also utilized the XPSWMM model. The ImmSIP maintains continuity with the previous work by utilizing the XPSWMM model to develop a more detailed model that includes much of the stormwater assets located by the SAIP staff. There are two (2) ultimate outfall directions for stormwater in Immokalee – that which discharges into Lake Trafford and that which discharges down the SR-29 canal. As identified in the conceptual project discussions, the ImmSIP is designed to address some current cross flow which creates existing stormwater capacity problems.

With the utilization of proposed treatment ponds at the major discharge points leaving Immokalee, the ImmSIP also includes water quality analyses utilizing the Harvey Harper (HH) methodology, a tool to calculate nutrient uptake that is well accepted by the South Florida Water Management District in the Environmental Resource Permit (ERP) process. The nutrient removal calculations were made to address Total Nitrogen, Total Phosphorus, and BOD

(Biochemical Oxygen Demand or also called Biological Oxygen Demand). BOD is defined as the amount of dissolved oxygen that must be present in water for microorganisms to decompose the organic matter in the water, and is used as a measure of the degree of pollution. Nutrient removal calculations using the HH methodology are based upon standardized nutrient loadings for identified land uses, average annual rainfall (for this report the consultant used mean annual rainfall from 1997 to 2014), and the total available residence time of the water within a pond or lake. The calculations for the conceptual projects below can be expected to vary from the final calculations for the detailed engineering designs to follow as those later design plans will determine the specific volume of storage available in the ponds.

Another aspect of the conceptual hydrologic/hydraulic modeling is the development of opinions of probable cost (OPCs) for the various proposed projects using the conceptual components of the model. As new projects are added or revisions made to currently proposed but unconstructed projects, the OPCs can be updated.

Stormwater staff contracted with a local engineering consulting firm, Robau and Associates, LLC (Robau), to update the previous hydrologic and hydraulic computer model developed by Lochner. In the development of the original ISWMP, Lochner utilized the XPSWMM model with its abilities to address surface water flow along with limited groundwater impact and surface water quality impact analyses. CDM's draft update to the ISWMP continued usage of the XPSWMM model. The ImmSIP maintains continuity with the previous work efforts by also utilizing the XPSWMM model to develop a more detailed model that includes much of the stormwater assets located by the SAIP staff.

There are two (2) ultimate outfall directions for stormwater runoff in Immokalee to discharge:

- into Lake Trafford and
- into the SR-29 canal.

As identified in the conceptual project discussions that follow, the ImmSIP is also designed to address some current cross flow which affects existing stormwater capacity problems.

Robau's tasks in the development of the ImmSIP modeling included:

- updating the data files within the model to reflect current information;
- addressing the previous projects identified by Lochner;
- analyzing new alternatives for both the original projects as well as new projects proposed by Stormwater staff;
- identifying a current flooding level of service (LOS) provided by the existing stormwater facilities;
- developing a proposed achievable flooding level of service (LOS);
- preparing new water quality treatment benefit analyses for new ponds proposed by Stormwater staff; and
- preparing current probable costs for constructing the projects.

For the stormwater LOS analyses, Robau modeled the current flooding impacts from a 10-yr/3-day design storm event as well as a 25-yr/3-day design storm event. For urban areas, the County's Growth Management Plan identifies the desired LOS as being established for the 25-

year/3-day design storm event. However, much of the Immokalee area is constructed utilizing a shallow roadside swale system which has a very limited capacity and functions to receive runoff from adjacent properties as well as the roads. The computer storm modeling analyses showed that the 10-yr/3-day design storm appears to be an achievable LOS, and the subsequent project concepts identified in this ImmSIP report.

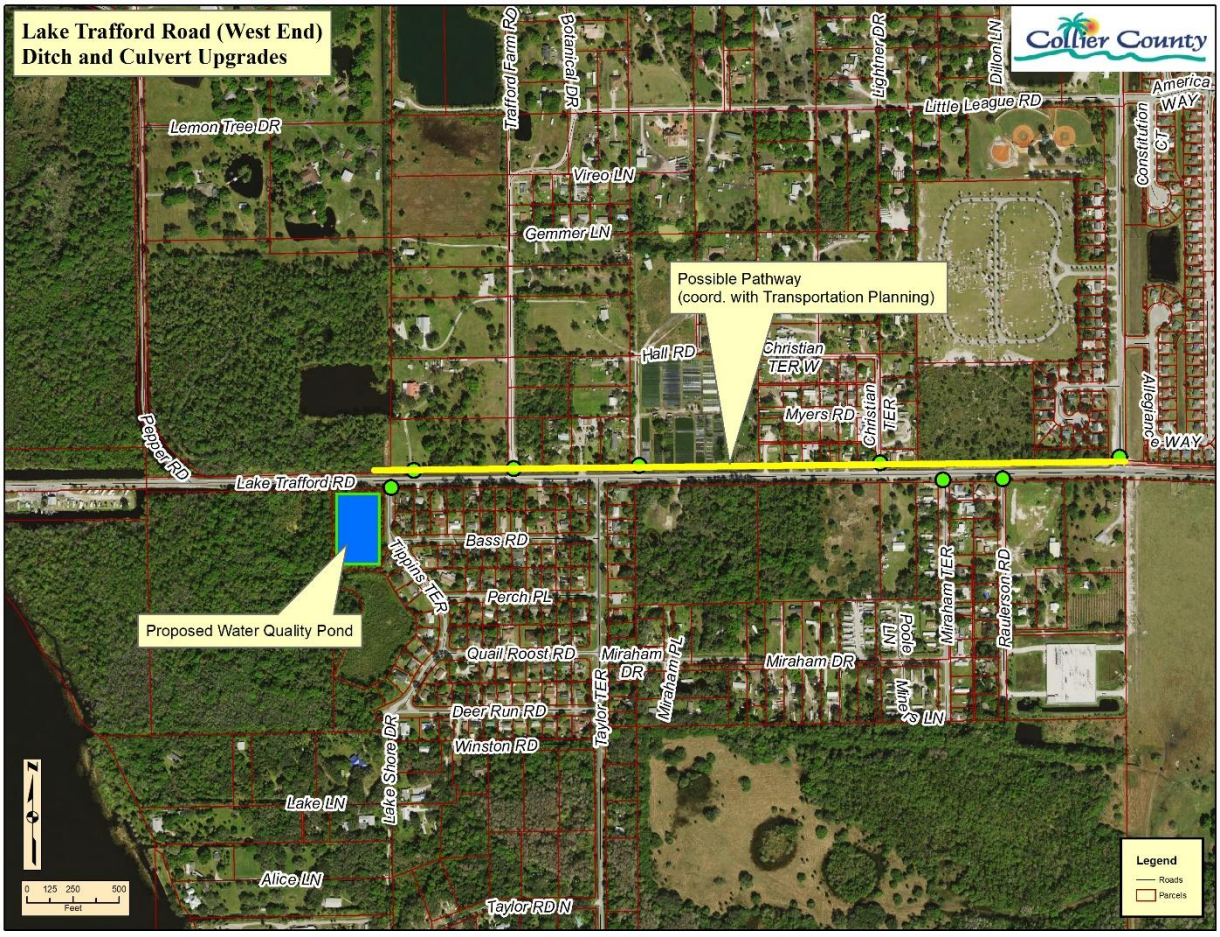
For purposes of source documentation used in this report, information gleaned from Lochner will be identified as [L], information gleaned from CDM will be identified as [C], and information gleaned from Robau will be identified as [R].

The ImmSIP was developed as a follow-up to the previous ISWMP draft update document prepared by CDM. While maintaining continuity with that draft update document, the ImmSIP does propose some different concepts to go beyond the draft document discussions. The basic format of the ImmSIP is designed to allow for future expansion as needs arise.

SECTION 3: Conceptual Project Identification and Analysis:

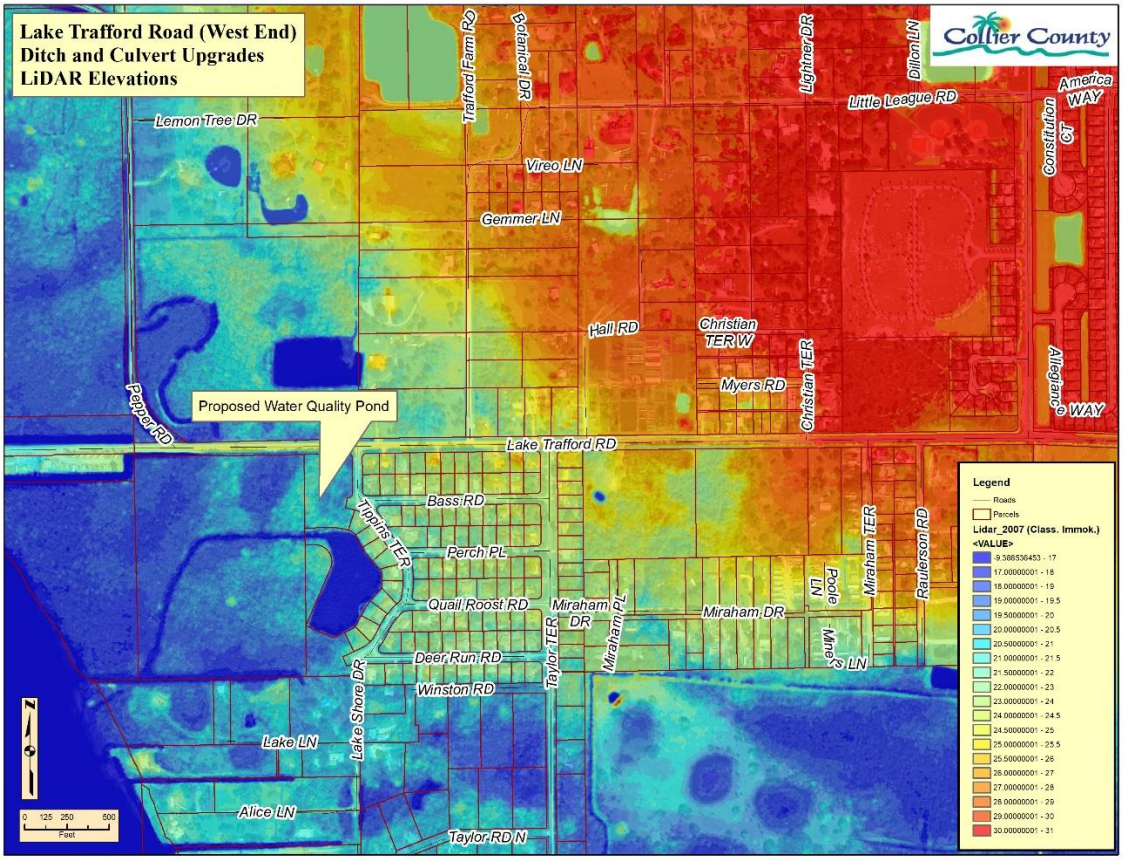
3.1 Lake Trafford Road (West End) Ditch/Culvert Upgrades Project:

The Lake Trafford Road Ditch/Culvert Upgrades project was developed as a follow-up to the original Lochner ISWMP to correct identified flooding problems. The project was expanded to also address pedestrian safety along Lake Trafford Road between Little League Road and Tippins Terrace. The Lochner investigation identified a need to increase the sizes of existing culverts along the north side of Lake Trafford Road to reduce existing flooding conditions. The Immokalee Community Redevelopment Agency Advisory Board has long advocated for the construction of a pathway along the north side of Lake Trafford Road between Little League Road and Trafford Farms Road to address safety for pedestrians, including children walking to and from Lake Trafford Elementary School. The current pathway ends at the eastern side of Little League Road.



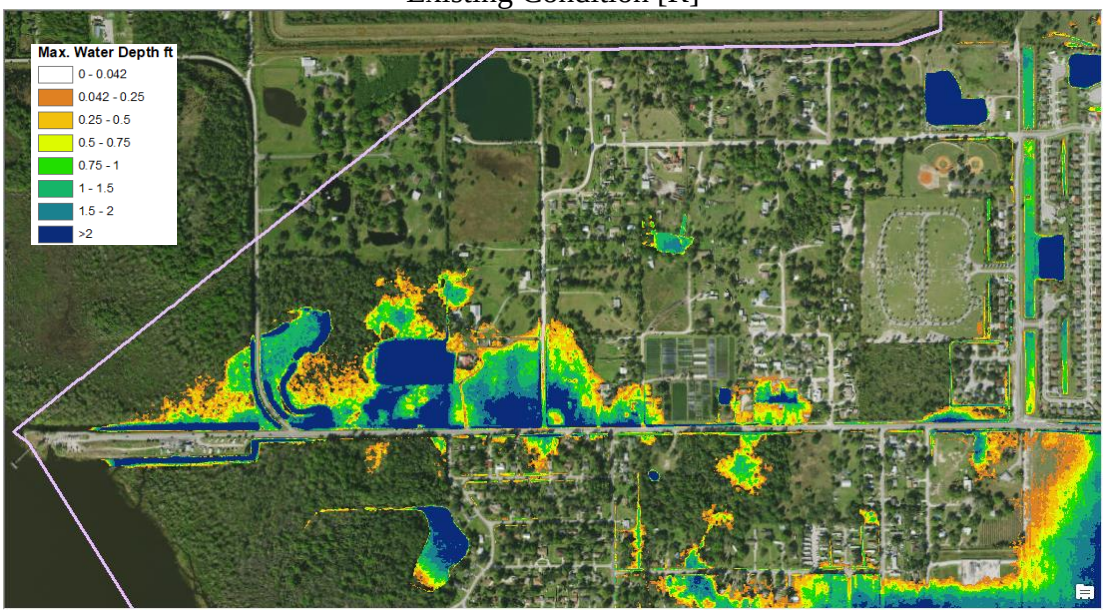
To construct the pathway, the existing ditch along the north side of Lake Trafford Road would have to be relocated northward. This would result in negative impacts to existing properties and wetlands. To accommodate the joint needs, the ImmSIP project proposes to enclose the existing ditch with a storm drain pipe sufficiently sized to provide the needed

flooding relief while also providing a physical location for the pathway. The site selected for the proposed water quality treatment pond is immediately adjacent to an existing channel connecting the small pond west of Tippins Terrace to Lake Trafford, and would also provide a means of distributing flows into wetlands along the eastern shore of Lake Trafford if that was a preferred option, depending upon the engineering design of the pond. The existing channel location can be seen in the following picture utilizing LiDAR elevation information. LiDAR is the acronym for **Li**ght **D**etection **A**nd **R**anging which is an electronic method for obtaining ground elevation information. The LiDAR elevation are based upon the North American Vertical Datum of 1988 (NAVD).

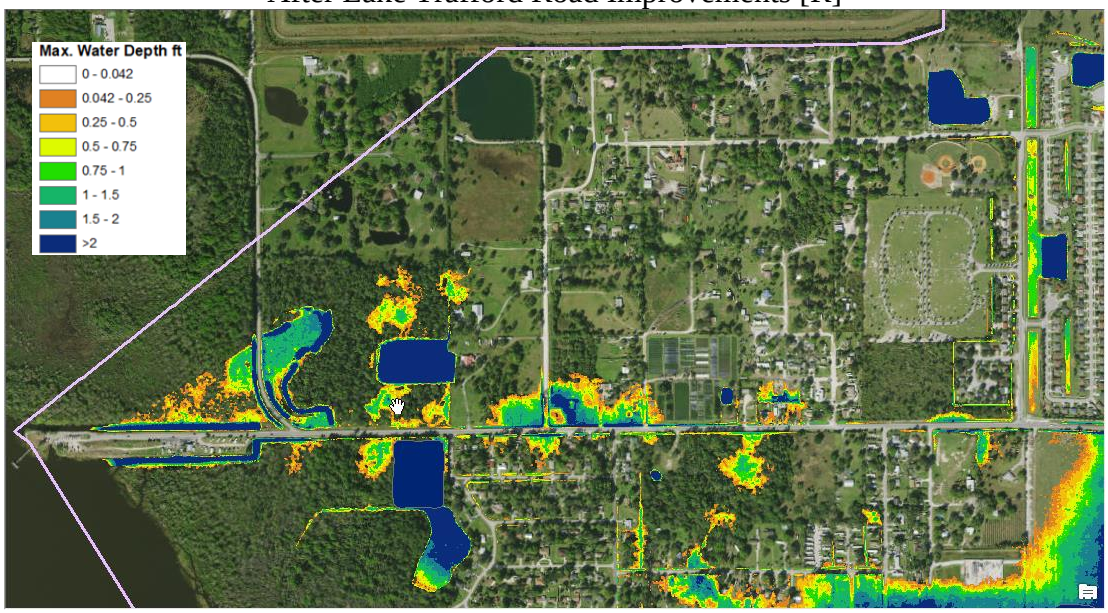


The consultant firm of Robau and Associates, Inc. evaluated this project as a part of the conceptual computer stormwater modeling contract for the ImmSIP. The results of their analysis identified that current flooding conditions along the north side of Lake Trafford Road could be substantially improved by enclosing the ditch with a 36" diameter or larger stormwater pipe. Replacing the culvert crossings on the north side of Lake Trafford Road with a larger 36" diameter storm drain pipe results in lower peak stages and shorter inundation periods near Lake Trafford Farms Road and Hall Road. [R] Short sections of Lake Trafford Farms Road and Hall Road were still shown to be inundated for a short period of time, but an initial assessment indicates that it would probably be a more economical and environmentally permittable solution to elevate a short section of these roads rather than attempt to increase the stormwater discharge.

Flooding Scenarios (10-year/3-day design storm event)
Existing Condition [R]



After Lake Trafford Road Improvements [R]



Construction of the water quality pond was shown to provide an overall water quality improvement and reduction of nutrient loading to Lake Trafford. Based upon an assumed size of pond site available, the following results were obtained.

- Total Nitrogen removal was calculated at 41% (0.163 kg/year avg.)
- Total Phosphorus removal was calculated at 72% (0.032 kg/year avg.)
- BOD removal was calculated at 100% (0.954 kg/year avg.). [R]

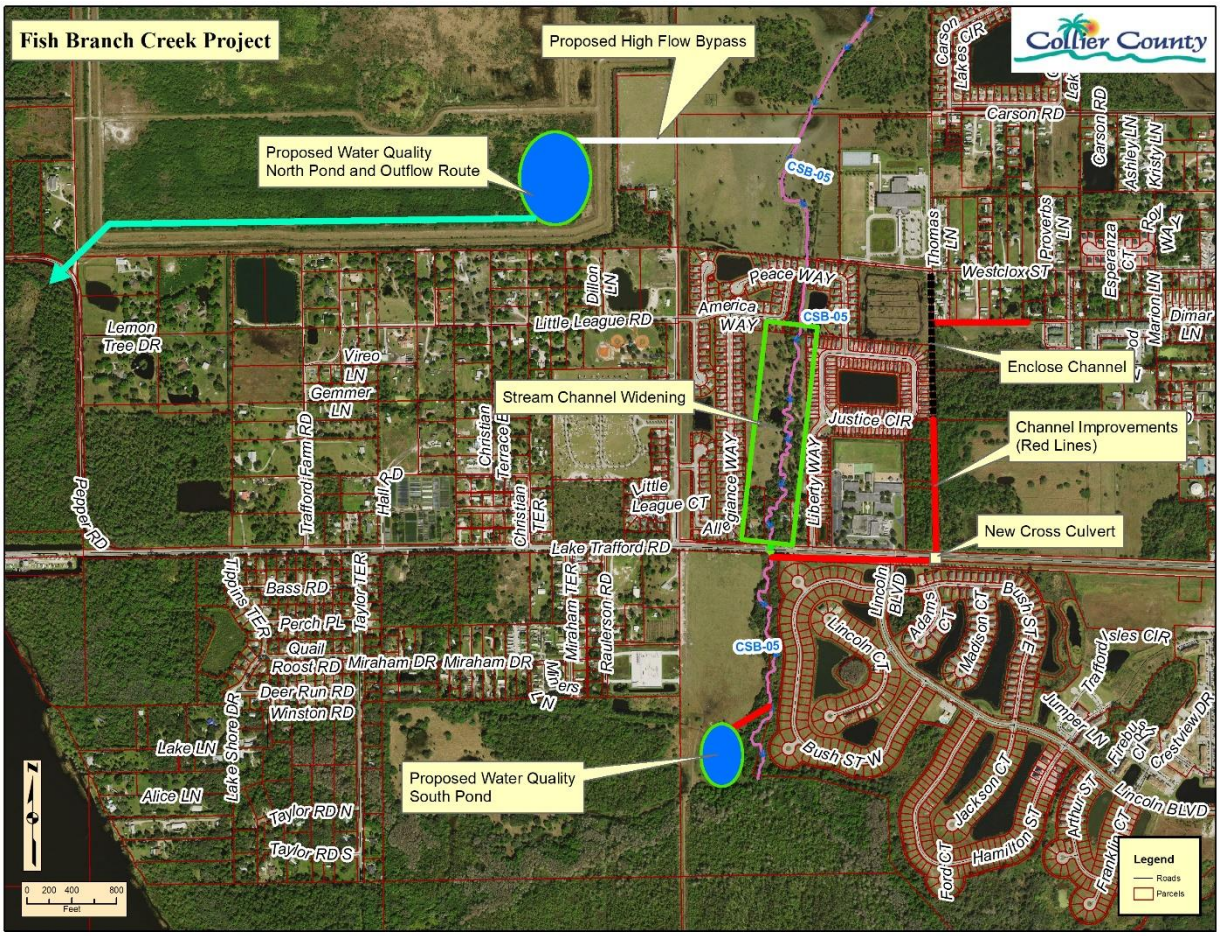
The OPC for the Lake Trafford Road Improvements project is projected to be approximately $2.5 million. [R]

3.2 Fish Creek Project (Fish Branch Creek Project):

The Fish Creek project (also known as and hereinafter called Fish Branch Creek) was proposed by Lochner as a combination of channel improvement between Lake Trafford Road and Peace Way along with construction of a detention pond on vacant agricultural property north of Peace Way. The detention pond would provide some water quality treatment and temporary storage to help reduce the peak flows while the proposed channel improvements would allow the peak flows to safely pass to the existing box culverts under Lake Trafford Road. This project was not well received by land owners of the impacted properties.

To address the impacted property owner concerns as well as provide for improved flood protection and improved stormwater quality treatment the Fish Branch Creek project scope was expanded to provide additional options for consideration.

- The original location of the proposed detention pond north of Peace Way was moved westward to a location within the South Florida Water Management District owned area utilized for dredged material disposal from Lake Trafford. The relocated pond (Water Quality North Pond) would be connected to Fish Branch Creek by a high flow bypass channel to allow normal low flows to continue southward in the existing Fish Branch Creek channel to maintain the current meandering stream condition. The outflow route for this bypassed flow through and from the Water Quality North Pond would be westward through the southern edge of the disposal site and into lands owned by the County to then allow sheetflow through wetlands and into Lake Trafford.
- Stream channel widening of Fish Branch Creek between Lake Trafford Road and Peace Way was still considered for evaluation within the list of options to reduce flooding.
- The Westclox Street West Outfall consists of improvements to the existing ditch system at the western end of Westclox Street. These improvements include the proposed enclosure of the northern end of the ditch with a pipe sufficiently sized to reduce flooding potential where the drainage easement is insufficient to allow for ditch expansion and provide access for maintenance. Other portions of the existing ditch system are proposed for channel expansion and improvements, including access for maintenance. A new culvert crossing under Lake Trafford Road and channel improvements on the south side of Lake Trafford Road westward to Fish Branch Creek are proposed to address existing restricted flow capacities.
- A second stormwater quality treatment pond was proposed south of Lake Trafford Road to capture normal flow conditions in Fish Branch Creek while the existing channel would continue to handle high flow conditions.

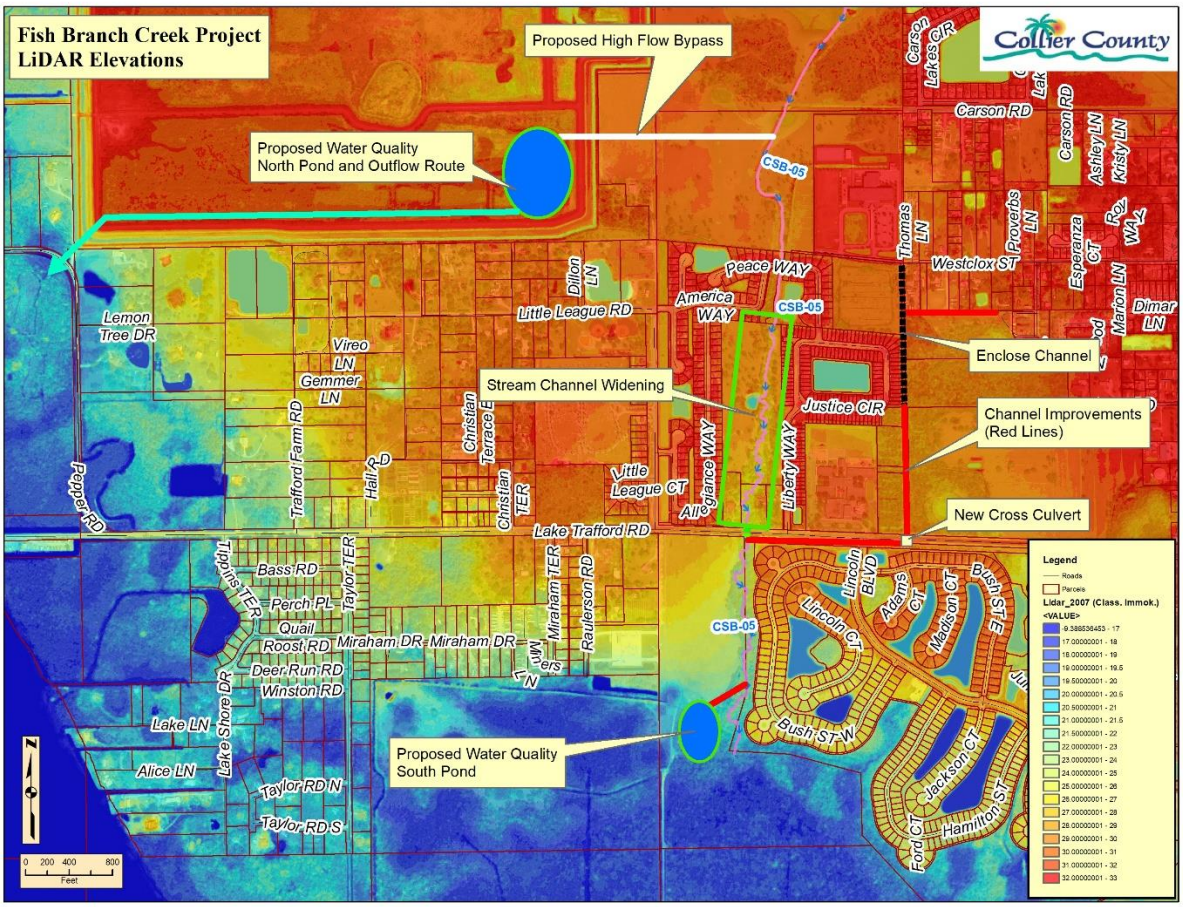


In developing these project options for consideration, the large size of the upper drainage basin boundary for Fish Branch Creek was a major factor. Fish Branch Creek's upper drainage boundary encompasses a large portion of the lands between Westclox Street and SR-82 to the north and extends eastward to SR-29. The area has a long history of major land inundation from heavy rainfalls and negatively impacts flooding conditions along the northern perimeter of Immokalee west of SR-29. The objective is to reduce the peak stage and duration of flood waters while not over draining the area's wetlands. In addition, the inclusion of stormwater treatment ponds will help reduce the nutrient loading coming from this area into Lake Trafford.

Flow restrictions within the Fish Branch Creek channel from Peace Way down to the southern end of the channel south of Lake Trafford Road have caused repeated flooding impacts to properties between Peace Way and Lake Trafford Road.

Flow restrictions south of the western end of Westclox Street have also caused repeated flooding impacts to properties north and south of Westclox Street.

The following picture with the LiDAR elevation information illustrates the existing generalized ground slope.



The ImmSIP modifications to the original Lochner Fish Creek conceptual project provide increased flexibility in selecting the order and timing of future stormwater facilities construction.

- Relocating the proposed 5-acre north pond westward into South Florida Water Management District owned land continues to provide the desired stormwater detention volume with potential opportunity to increase the storage volume while minimizing impacts to privately owned land and creating a new point of discharge to relieve flows in the downstream portions of Fish Branch Creek. The proposed discharge from the relocated north pond out through the southwest corner of the South Florida Water Management District owned property provides opportunity for sheetflow restoration to wetlands on the north side of Lake Trafford.
- Use of a high flow bypass system provides opportunity for adaptability to address flooding within the upper and lower sections of Fish Branch Creek. Bypassing the high flows also better addresses flood reduction to properties near Lake Trafford Road than utilizing the option for stream channel widening between Peace Way and Lake Trafford Road.
- Proposed stream channel widening and straightening of Fish Branch Creek between Peace Way and Lake Trafford Road would involve removal of mature, well established vegetation along the channel banks and extensive channel bank reshaping and revegetating. The channel widening and straightening concept proposed by

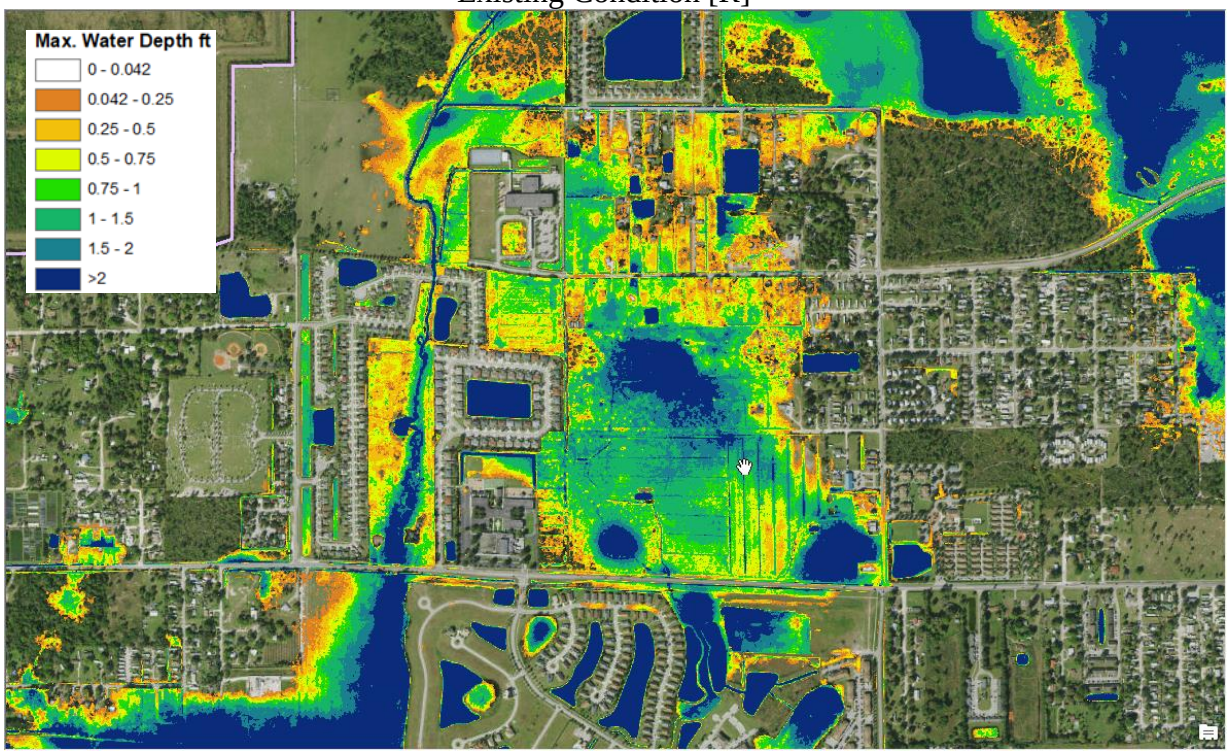
Lochner was not well received by property owners along Fish Branch Creek. Additionally, the flood reduction benefit of channel widening did not prove to be as effective in the SWMM modeling analyses as the proposed bypass channel system to a relocated north pond. For these reasons the stream channel widening is not recommended as a preferred project for implementation.

- The south water quality pond was proposed to provide for additional water quality treatment capacity to Fish Branch Creek as well as treatment for stormwater runoff from properties along the western end of Westclox Street and portions of Lake Trafford Road itself. Being located south of Lake Trafford Road, the south pond is not intended to provide temporary stormwater detention storage, as the Immokalee Slough lying just to the south is well able to perform that function. The south pond's major function is to capture pollutant loadings and debris during normal flow conditions, while allowing high flows to continue to pass directly into the Immokalee slough. The south pond is designed to work in combination with the north pond to provide water quality treatment for all storm flow conditions.
- The Westclox Street West Outfall project was developed to reduce existing flooding conditions while being confined to a narrow corridor of easement width. This area has a long history of difficult access for maintenance, so where the existing easements do not provide sufficient width for a ditch and maintenance access road, the ditch is proposed to be enclosed with a piped system. Additionally, where the ditch comes into the Lake Trafford Road right-of-way, there are additional flow capacity restrictions. It is proposed to install a new culvert crossing under Lake Trafford Road and then direct the flow westward through an improved swale along the south side of Lake Trafford Road to discharge into Fish Branch Creek. During final design, additional features can be addressed to assist getting some of the flow to pass through the Arrowhead development's preserve flowway system while also preventing over drainage of some naturally wet areas on properties north of Lake Trafford Road.

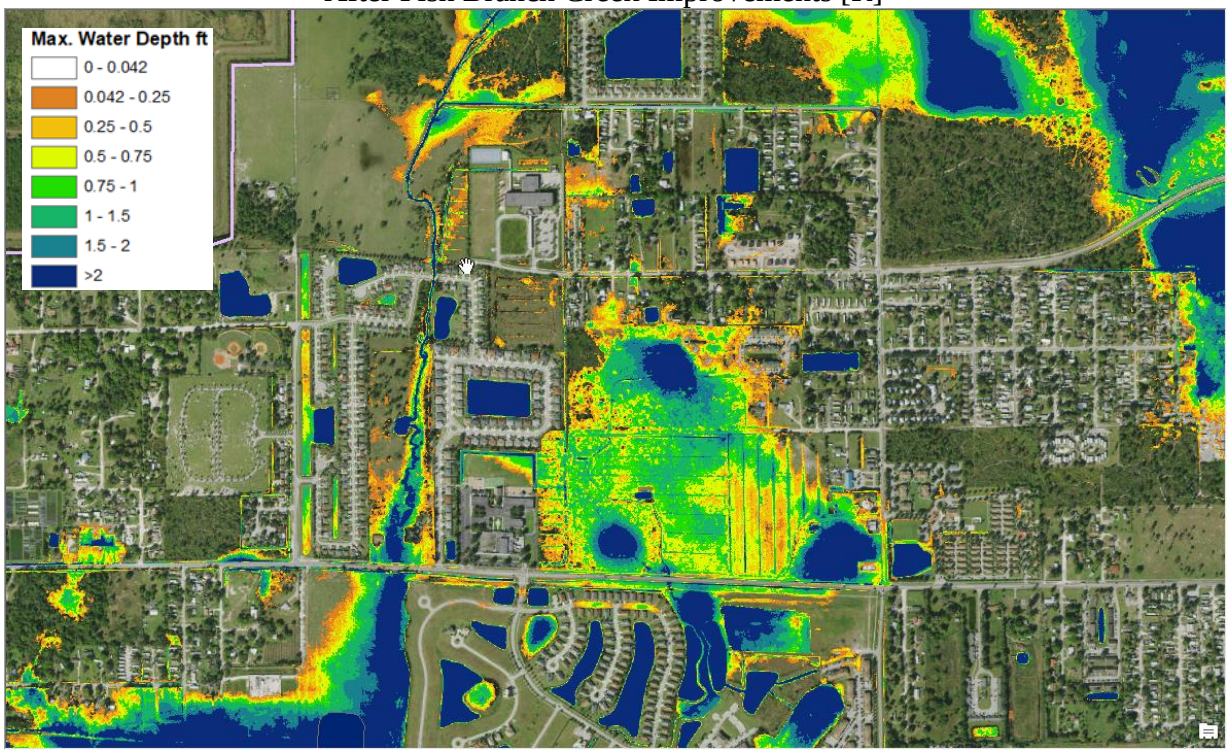
With so many variables included within the proposed Fish Branch Creek project, multiple computer simulations were conducted to determine which single components or combinations of components would produce the best overall project for reduction of flooding and then calculate the nutrient loading reductions. As shown in the following pictures, a significant reduction in flooding area was attained in the modeling exercise. Creating the bypass system to the north detention and water quality pond had a very significant impact in flood reduction along Fish Branch Creek. That also allowed for some reduction to flooding in the Lake Trafford Road/Little League Road area by allowing that area to drain eastward to Fish Branch Creek. The proposed Westclox Street West Outfall improvements allow discharge into Fish Branch Creek without having to compete against excessive flows in the creek itself. By designing the south water quality pond to have entrance and exit connections with Fish Branch Creek for normal flows only and the high storm flows to bypass, the south pond could continue to provide full water quality treatment for the early part of the storm event. During the peak high flow conditions, the south pond would continue to provide water quality treatment for a portion of the flows, but would bypass and not impede the flow that could not enter the pond.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After Fish Branch Creek Improvements [R]



Construction of the water quality ponds was shown to provide an overall water quality improvement and reduction of nutrient loading to Lake Trafford. Based upon an assumed size of pond site available, the following results were obtained. [R]

North Pond:

- Total Nitrogen removal was calculated at 37% (1.057 kg/year avg.)
- Total Phosphorus removal was calculated at 63% (0.257 kg/year avg.)
- BOD removal was calculated at 91% (3.861 kg/year avg.).

South Pond:

- Total Nitrogen removal was calculated at 33% (1.688 kg/year avg.)
- Total Phosphorus removal was calculated at 58% (0.435 kg/year avg.)
- BOD removal was calculated at 74% (6.236 kg/year avg.).

The OPC for the Fish Branch Creek Improvements project, without including the channel widening north of Lake Trafford Road, is projected to be approximately $5.0 million. [R]

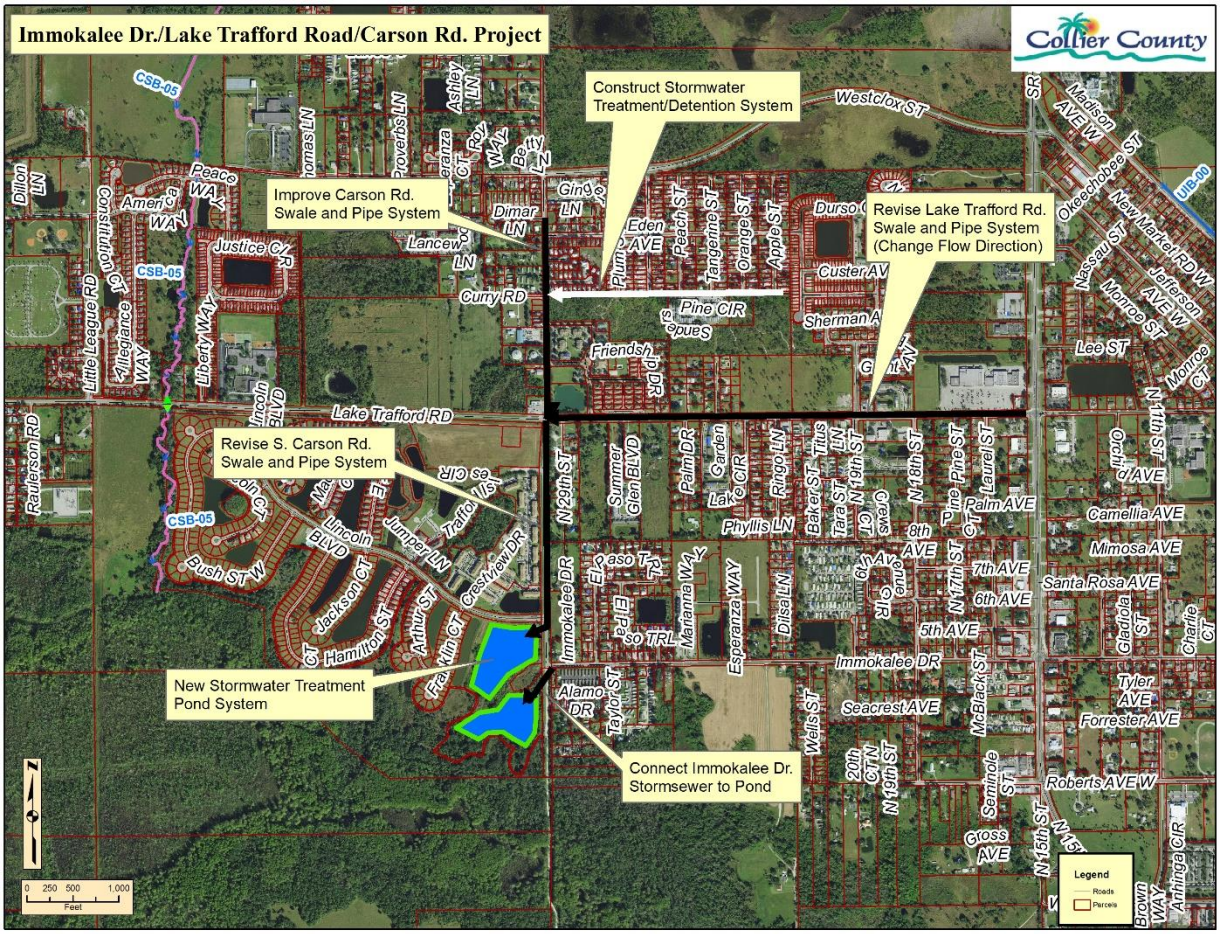
3.3 Immokalee Drive/Lake Trafford Road/Carson Road Project:

The Immokalee Drive/Lake Trafford Road/Carson Road project is envisioned as addressing ongoing flooding and stormwater quality treatment needs of a substantial portion of the northwestern portion of Immokalee. As previously mentioned, the Immokalee CRA staff obtained grant funding for the design and construction of a stormwater drainage project along Immokalee Drive. That completed work collects stormwater flowing into Immokalee Drive from the north and transports it to the western end of Immokalee Drive at the junction with Carson Road. The ISWMP had identified a need for the Immokalee Drive project to also address stormwater treatment, but the constructed project utilized two special debris capture chambers for physical removal of large debris and trash items and did not include a stormwater treatment pond at the point of discharge due to the unavailability of land.

A key component of the Immokalee Drive/Lake Trafford Road/Carson Road Project is the creation of a stormwater quality treatment facility that also provides a good outfall location for passing of stormwater into the Immokalee slough which flows into Lake Trafford. Immediately west of the Immokalee Drive/Carson Road junction is a relatively large tract of vacant (Tract 3 as of date of this document) land that is part of the Arrowhead PUD. The Arrowhead PUD has already been designed and permitted by the South Florida Water Management District (Permit No. 11-02200-P) to accept offsite flows passing through the property. The pass-through flow is directed into preserve areas without any stormwater quality treatment. This project is proposed to reduce the amount of untreated offsite flows entering the Arrowhead PUD preserve areas, and instead direct it to a created stormwater treatment area prior to discharge to preserve area along the southern border of Arrowhead PUD.

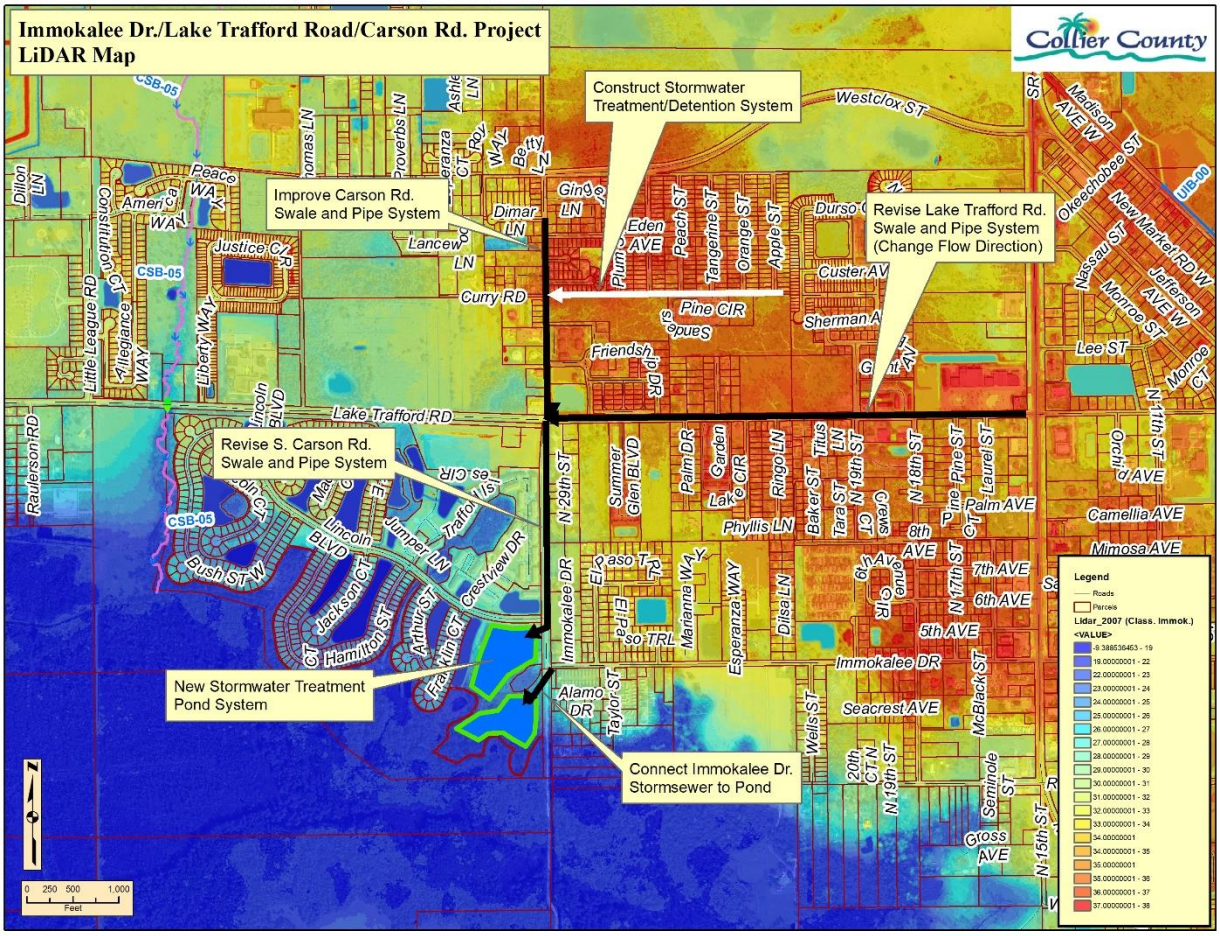
Conceptually the stormwater quality treatment system will consist of a created wetland/pond system that utilizes a cascading effect on the treatment and discharge of the flows. This

would be similar to the current stormwater treatment provided by Freedom Park (located at the NE corner of Golden Gate Parkway and Goodlette-Frank Road).



- It is proposed to improve the stormwater conveyance capacity along Carson Road south of Westclox Road to help alleviate existing flooding problems north of Lake Trafford Road.
- It is proposed to address localized flooding problems within the Eden Park area by directing all flows to the south side of Eden Park and utilizing an existing 30’ wide drainage right-of-way for a shallow linear detention area and then discharging through a control structure into the Carson Road drainage system.
- It is proposed to re-route the flow of stormwater along Lake Trafford Road from SR-29 in a westward direction back to Carson Road and direct this stormwater south into the wetland/pond system. Currently much of this section of Lake Trafford Road discharges its stormwater eastward toward SR-29 where it is severely restricted and creates increased flooding problems for properties on the east and west sides of SR-29.
- It is proposed to connect the existing stormwater system on Immokalee Drive into the wetland/pond system.

As shown in the following map using LiDAR topographic elevation information, the project area includes a low ridgeline running northwest to southeast. This results in some stormwater runoff flowing eastward along Lake Trafford Road where it then must pass under SR-29 and into a very flow restricted Mockingbird Lake system. In a similar but smaller way the Eden Park area incurs ponding of stormwater.

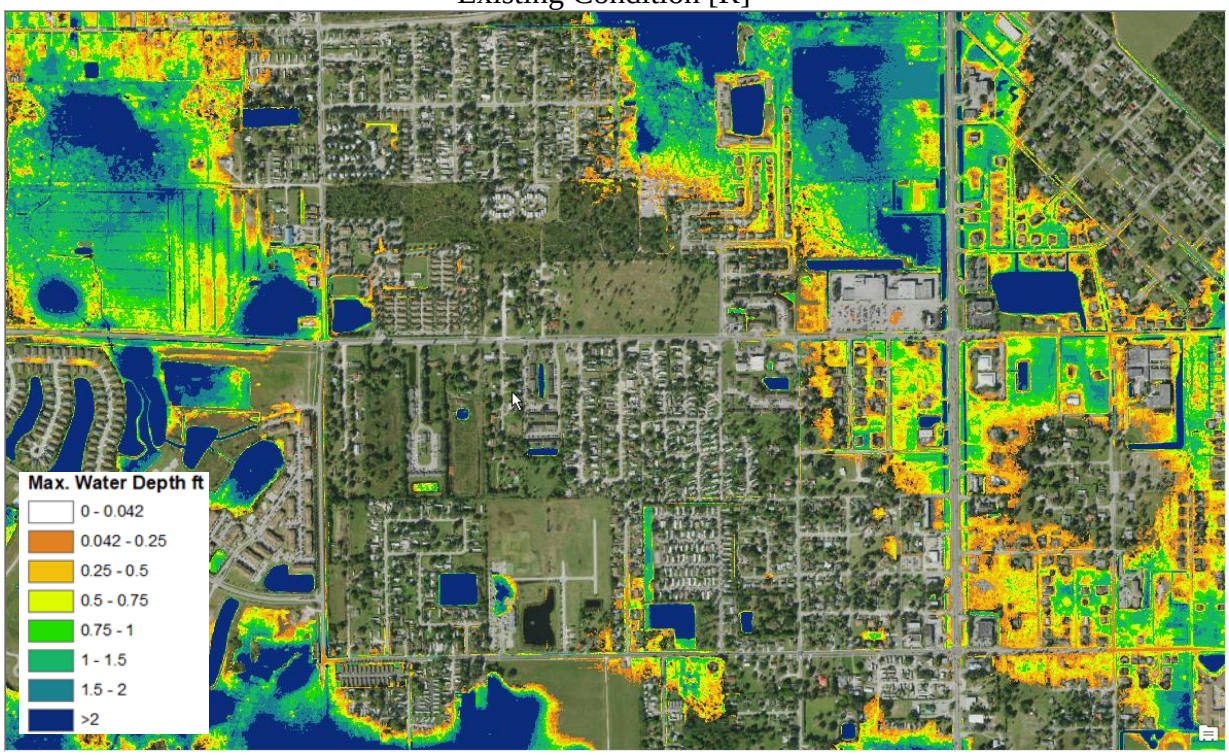


As shown in the following pictures, the conceptual stormwater modeling analysis by Robau identified flooding reduction in areas along Lake Trafford Road both east and west of Carson Road. The proposed stormwater piping along Lake Trafford Road between Carson Road and SR-29 will lower peak flooding stages in the southwest quadrant of the Lake Trafford Road/SR-29 intersection. Similarly, improved stormwater conveyance capacity in the Carson Road drainage system south of Lake Trafford Road will lower peak flooding stages in the northwest quadrant of the Carson Road/Lake Trafford Road intersection.

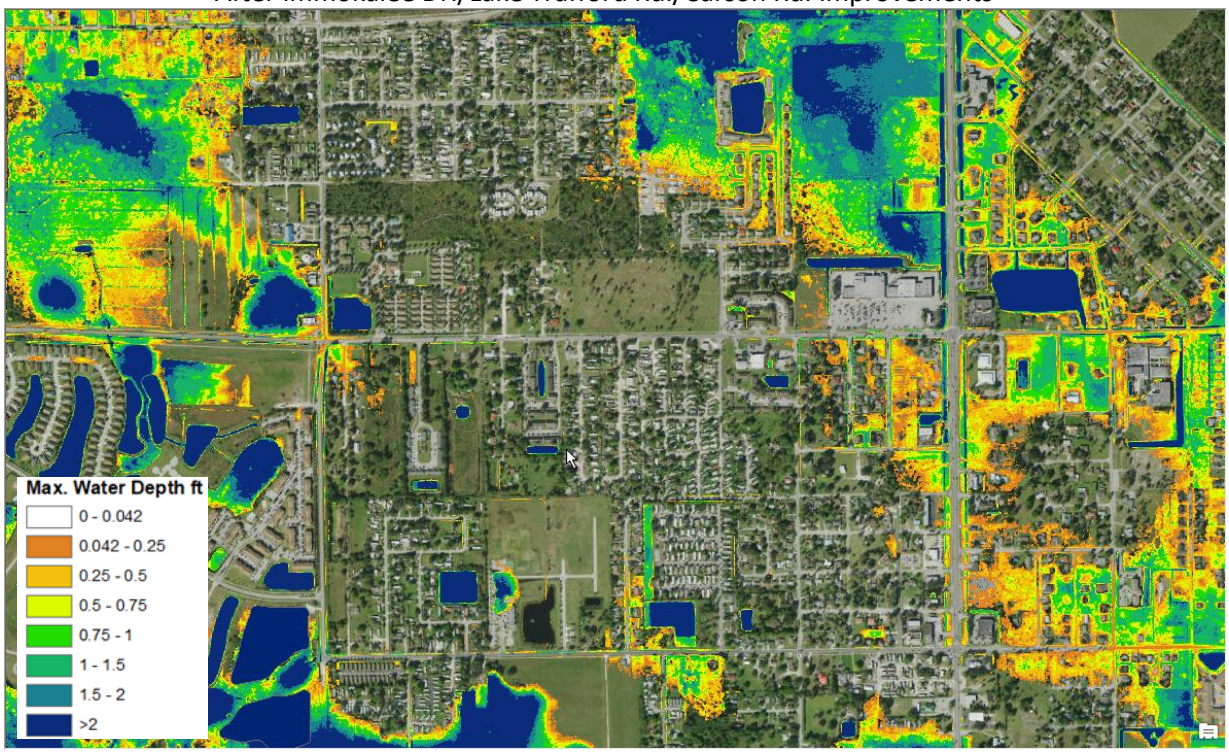
The proposed improvements in the Eden Park area are primarily intended to create a positive flow direction away from an upper reach of the Fish Branch Creek drainage basin and towards Carson Road and into the new stormwater quality treatment wetland/pond system. The benefits gained from a regional flooding perspective are too subtle to be reflected within the stormwater model's mapping.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After Immokalee Dr./Lake Trafford Rd./Carson Rd. Improvements



Construction of the new stormwater quality treatment pond system was shown to provide an overall water quality improvement and reduction of nutrient loading to Lake Trafford. Based upon an assumed size and configuration of the pond site available, the following results were obtained. [R]

- Total Nitrogen removal was calculated at 42% (0.463 kg/year avg.)
- Total Phosphorus removal was calculated at 76% (0.121 kg/year avg.)
- BOD removal was calculated at 100% (3.014 kg/year avg.).

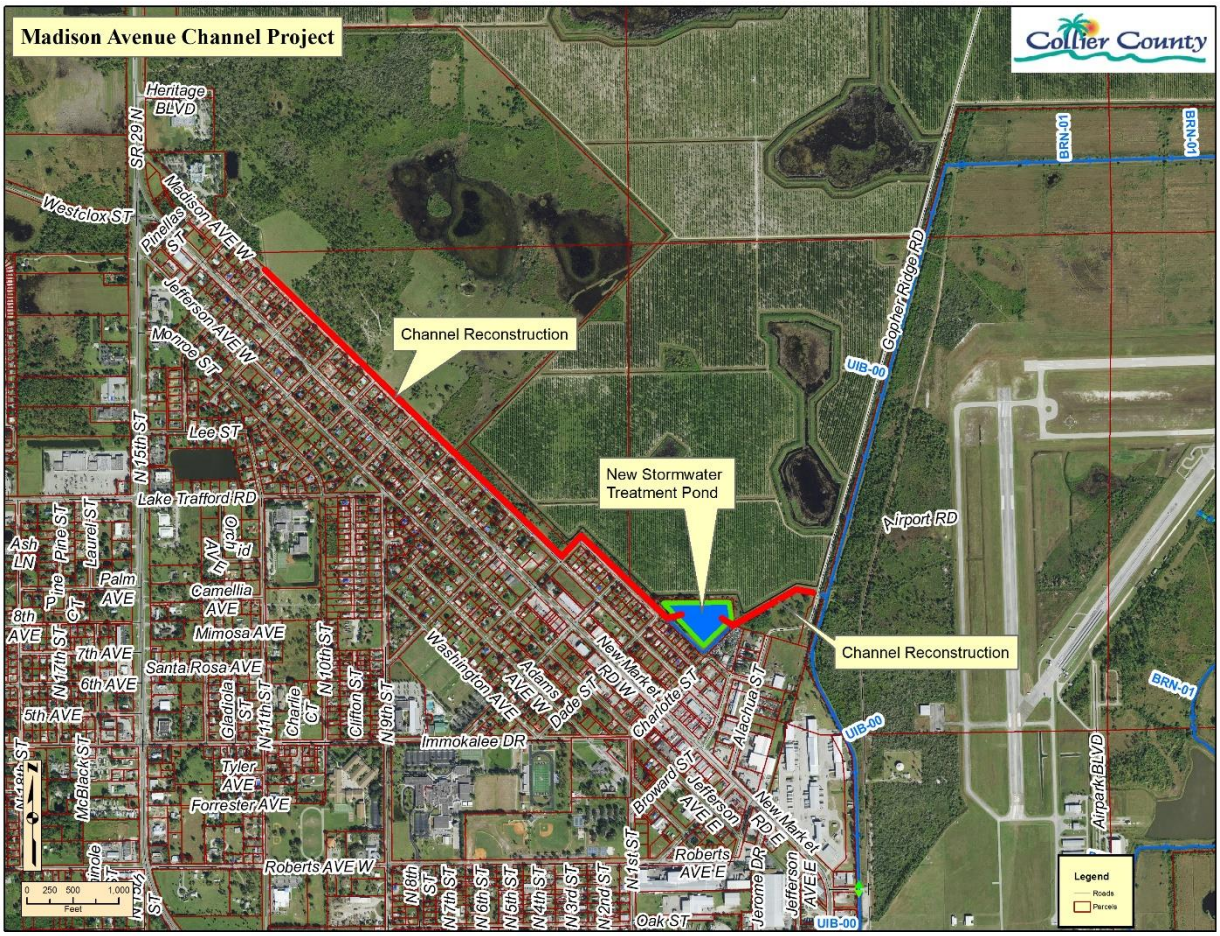
The OPC for the Immokalee Dr./Lake Trafford Rd./Carson Rd. Improvements project is projected to be approximately $7.8 million. [R]

3.4 Madison Avenue Channel Project:

The Madison Avenue Channel project was proposed by Lochner as the Madison Creek Ditch project in the original 2005 ISWMP. The 2005 ISWMP report identified flooding problems along Madison Avenue and New Market Road and limited flow capacity of the existing channel. As a part of the ImmSIP conceptual stormwater modeling effort by Robau, they compared the recommended channel improvements to the Madison Avenue channel to current conditions as measured by channel cross sections extracted from LiDAR elevation information. Their comparison identified that the existing channel was already larger than the proposed channel improvements by Lochner.

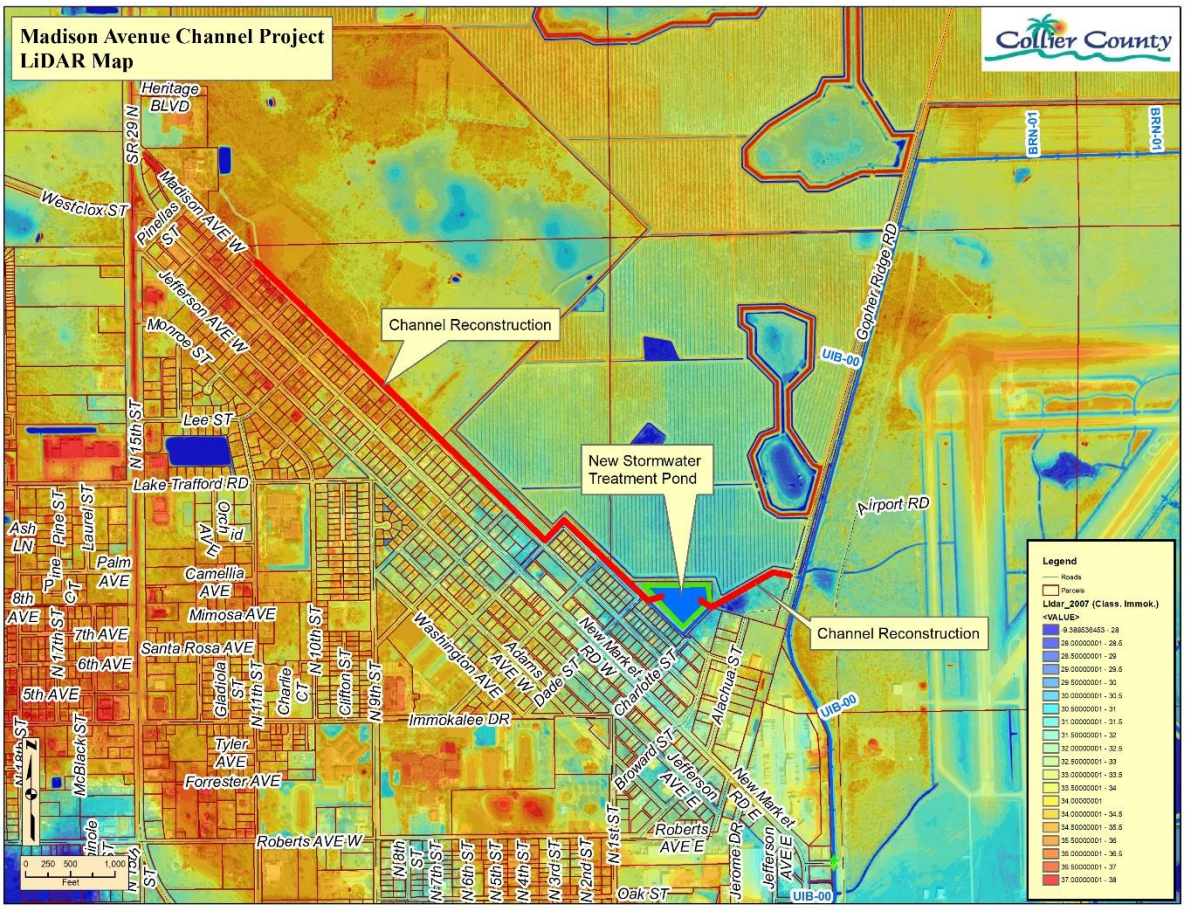
The Madison Avenue Channel project added a stormwater quality treatment pond utilizing an existing vacant parcel of land along the north side of the existing channel. Inclusion of the pond would provide for additional temporary stormwater storage as well as improve the ability to capture debris, sediments, and remove some of the nutrient loading before the stormwater was discharged into the SR-29 canal.

Stormwater modeling identified streets being flooded if the Madison Avenue Channel and the existing roadway crossing culverts at Gopher Ridge Road and Airport Access Road were kept at their current size. Repeated model runs were performed to increase the channel and culvert sizes until the street flooding began to be reduced. However, it was observed that this tended to pass the flooding problem to properties further downstream on the south side of SR-29. To address the existing flooding problem without negatively impacting other areas, channel enlargement to the existing canal around the Immokalee Airport perimeter was modeled. This did lead to a workable solution to address the Madison Avenue and New Market Road area flooding without requiring the purchase of other properties or obtaining drainage easements south of SR-29.



In developing the project options for consideration, the purpose was to create a sufficiently sized outfall system so that as improvements are made to streets, roadside swales and culverts within the northeastern portion of the urbanized Immokalee area, the proper connections can be made to then direct stormwater flows to the Madison Avenue Channel. The Collier County Transportation Planning Division recently received federal grant approval for a major project to establish sidewalks and associated roadside swale system improvements within the Madison Avenue Channel's drainage basin.

The following picture with the LiDAR elevation information illustrates the existing generalized ground slope. The improved roadside swale system will be designed to transport stormwater from Jefferson Ave. (and other streets further uphill that currently drain to Jefferson) in a northeasterly direction to the Madison Avenue Channel.

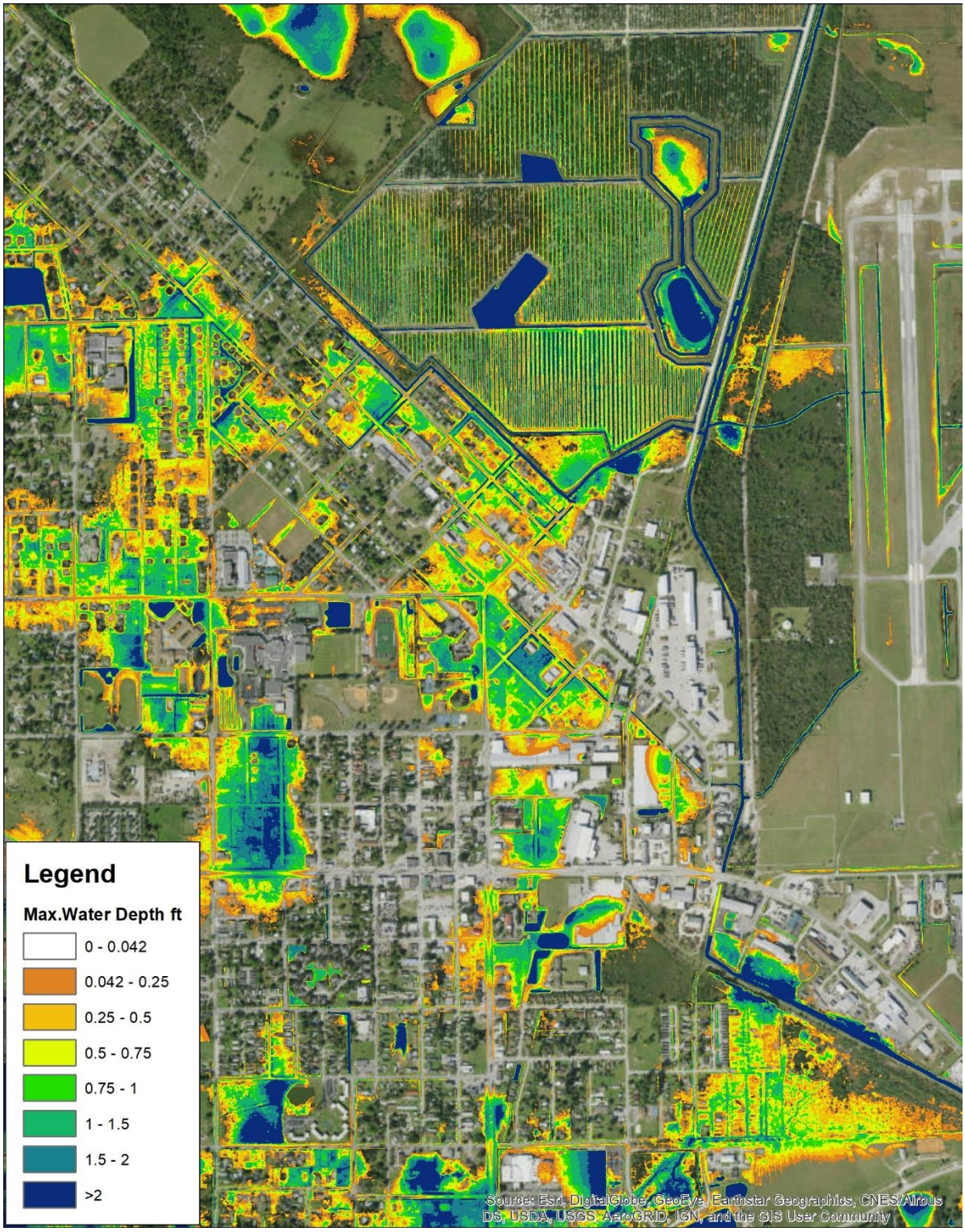


As shown in the following pictures flooding conditions will be improved in the area, but not eliminated by just improving the channel and culvert sizing. Some road reconstruction may be required to eliminate low areas, as identified by the LiDAR elevation mapping. As part of a follow-up detailed design of the proposed Madison Avenue Channel improvements it is recommended that detailed surveying be completed to verify existing roadway elevations and conditions. The channel reconstruction will also address safety concerns for channel location and stabilized side slopes. The pond is for water quality treatment and not flow capacity. The drainage basin will attain significant flood reduction as the sidewalks and swale system improvements funded in part by the federal grant, as previously discussed, are constructed and connected to the Madison Avenue Channel.

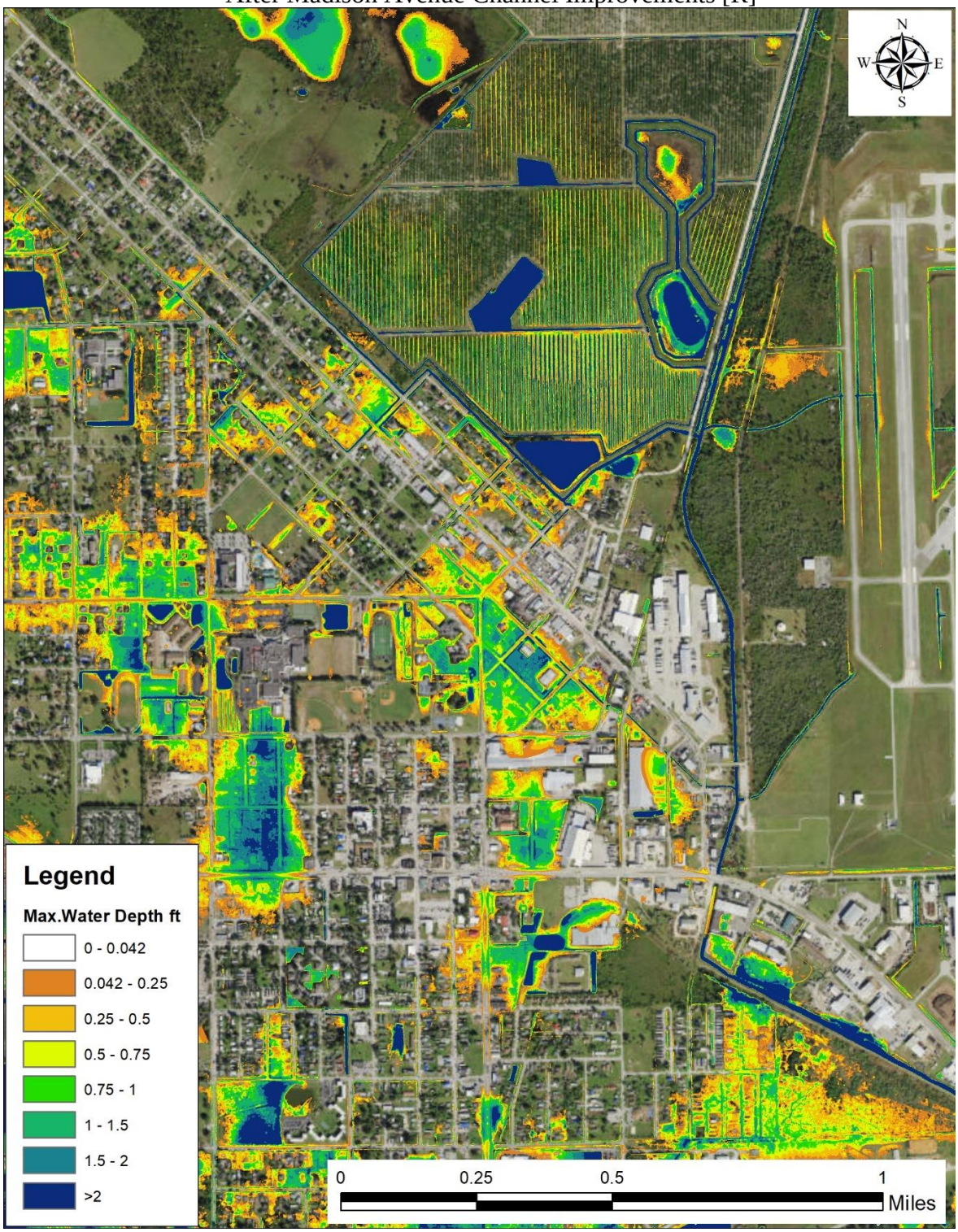
The extensive length of the existing Immokalee Airport perimeter canal creates a substantial cost increase to the project. It is recommended that at the time of detailed design of the Madison Avenue Channel improvements, an analysis be performed on whether it may be more feasible to upsize existing culverts and channels south of SR-29 after confirming the availability of the required land to increase the channel size down to the existing triple box culvert that takes the flow under SR-29 and into the canal on the east side of SR-29.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After Madison Avenue Channel Improvements [R]



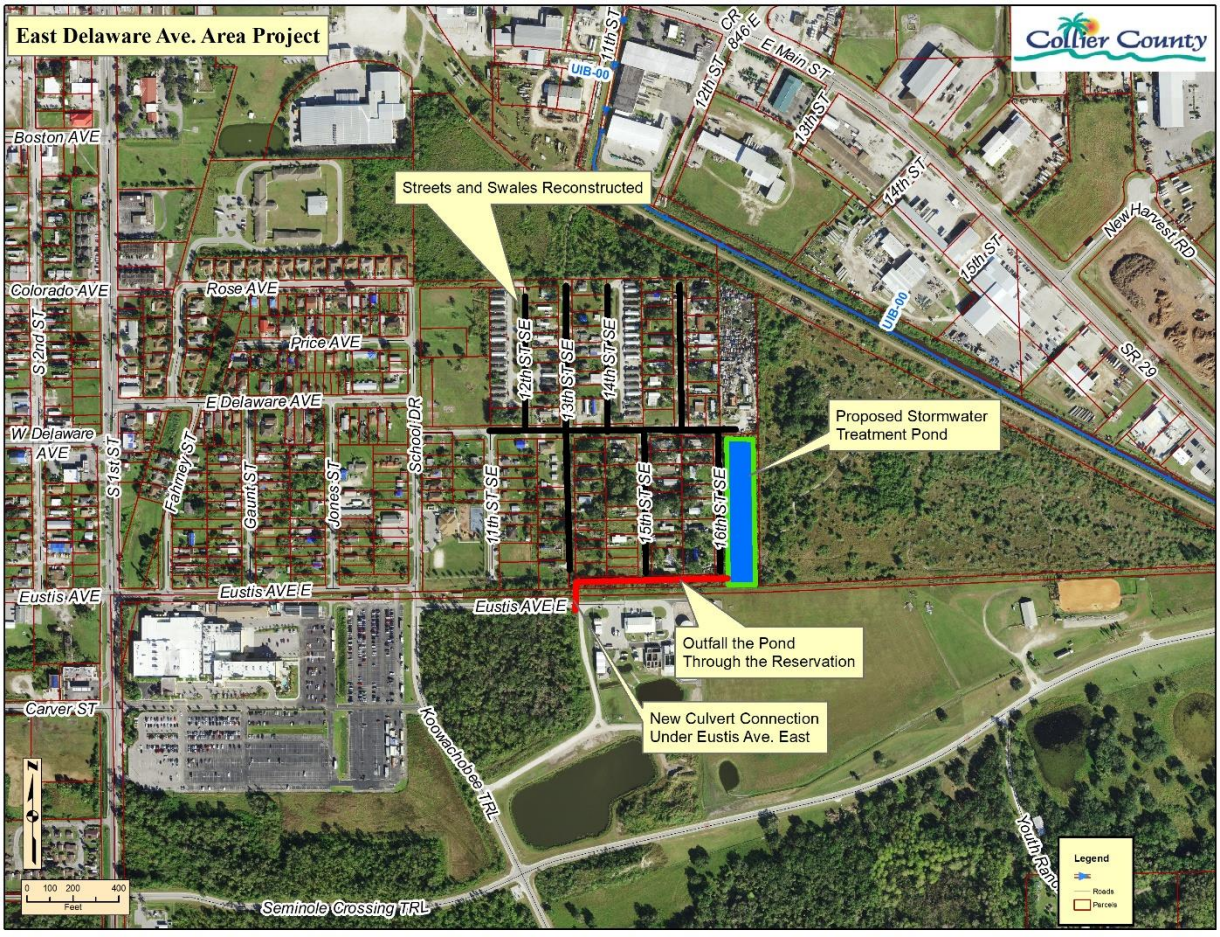
Construction of the water quality pond was shown to provide an overall water quality improvement and reduction of nutrient loading to the SR-29 canal. Based upon an assumed size of pond site available, the following results were obtained. [R]

- Total Nitrogen removal was calculated at 37% (1.264 kg/year avg.)
- Total Phosphorus removal was calculated at 62% (0.385 kg/year avg.)
- BOD removal was calculated at 89% (10.083 kg/year avg.).

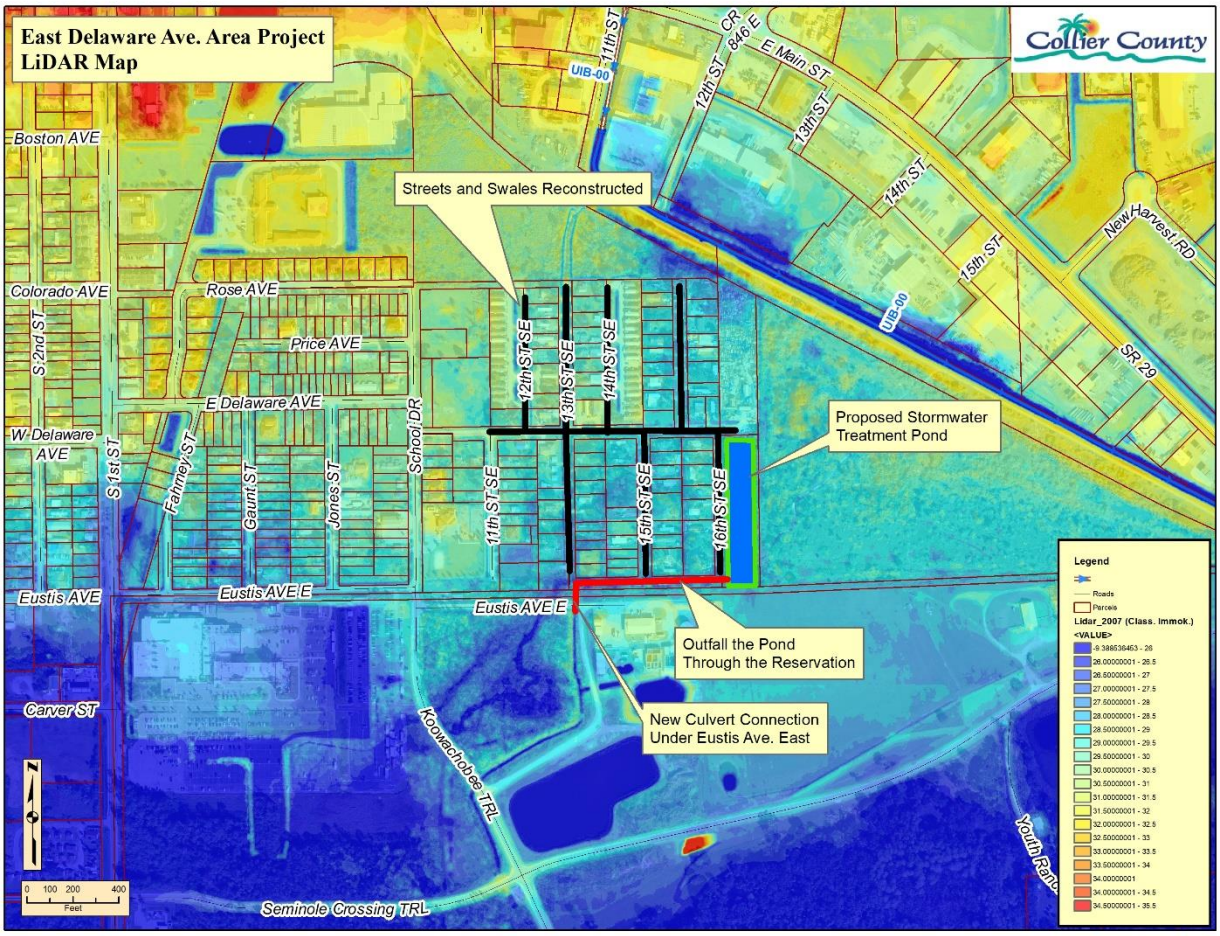
The OPC for the Madison Avenue Channel project is projected to be approximately $5.1 million. [R]

3.5 East Delaware Avenue Area Project:

The East Delaware Avenue Area project is proposed in the ImmSIP to address existing street and yard flooding conditions east of School Drive and north of the Seminole Reservation. The streets and right-of-way are a combination of County and private ownerships, with an equal division of maintenance responsibility. Stormwater collects in the area with no established outfall to the Immokalee slough located to the south and within the boundaries of the Seminole Reservation.



The proposed East Delaware Ave. Area project proposes to establish a street and roadside swale system constructed to County standards that will collect and direct stormwater flows to the eastern end of East Delaware Ave. A stormwater treatment pond is proposed to receive and treat the stormwater flow before discharging into an outfall connected to an existing channel within the Seminole Reservation that then conveys the stormwater to the Immokalee slough. The following picture with LiDAR elevation information shows existing ground slope and most noticeably the location of the existing channel within the Seminole Reservation south of Eustis Avenue East.



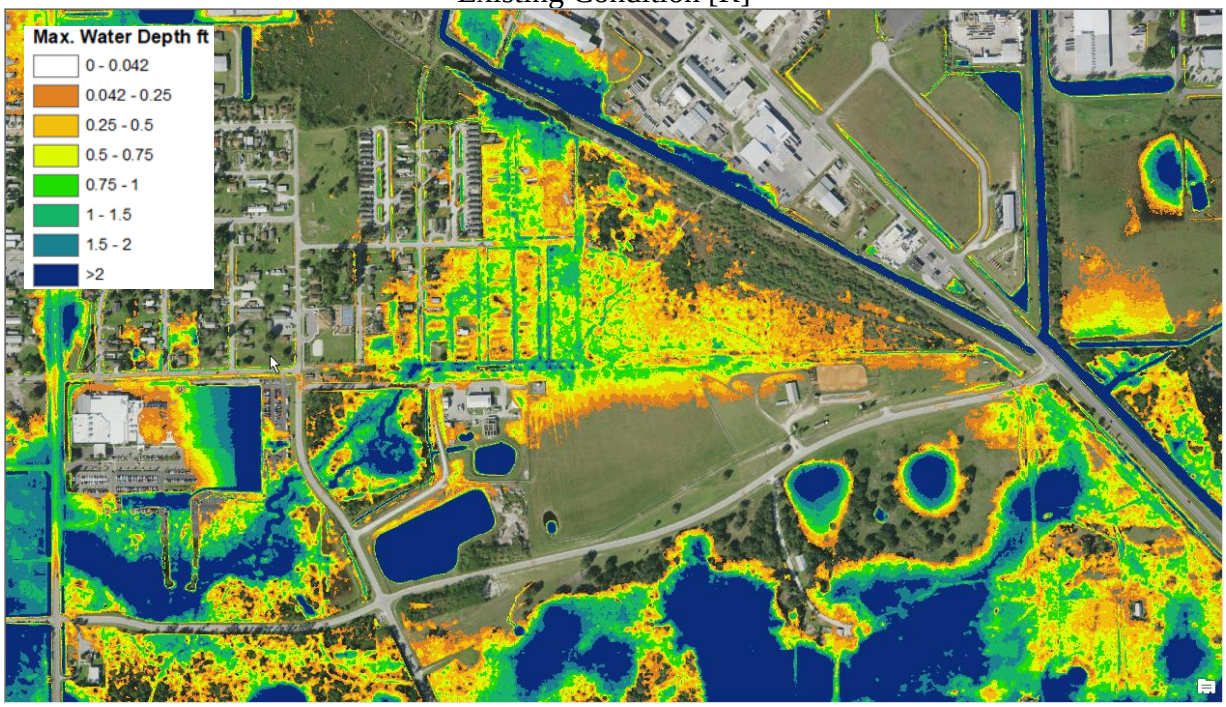
For the East Delaware Avenue Area project to be successful as proposed, there are two key considerations that must be achieved.

- Acceptance of right-of-way and construction/maintenance responsibility for those streets that are currently private and are not constructed to County standards. Typically, the County only accepts right-of-way and maintenance responsibility for streets that have been built to County standards.
- Agreement by the Seminole Tribe of Florida to accept stormwater flow from the area by constructing a new culvert connection under Eustis Avenue East.

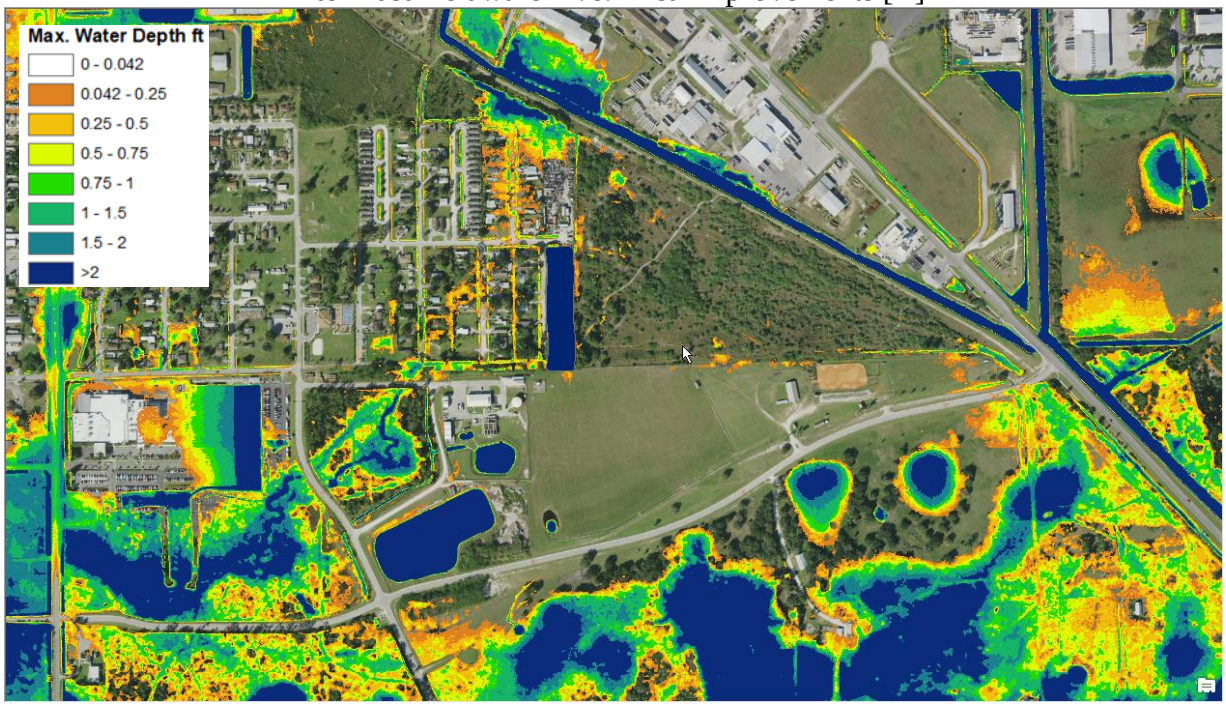
The potential flooding relief benefits are shown in the following two pictures. Both the East Delaware Avenue area and the northern side of the Seminole Reservation would have reduced aerial extent and depth of flooding by creating an outfall for the trapped stormwater.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After East Delaware Ave. Area Improvements [R]



Construction of the stormwater treatment pond was shown to provide an overall water quality improvement and reduction of nutrient loading to the Seminole Reservation if the flow connection was created. Based upon an assumed size of pond site available, the following results were obtained. [R]

- Total Nitrogen removal was calculated at 42% (0.082 kg/year avg.)
- Total Phosphorus removal was calculated at 73% (0.015 kg/year avg.)
- BOD removal was calculated at 100% (0.520 kg/year avg.).

The OPC for the East Delaware Avenue Area project is projected to be approximately $1.0 million. [R]

3.6 Immokalee Slough Flow Capacity Project:

The Immokalee slough is a large natural wetland system immediately south of Immokalee that conveys overland sheetflow in a generally westward direction to Lake Trafford. The construction of a railroad from Immokalee to Everglades City severed any possible connection of sheetflow from lands northeast of the Immokalee slough by creating a canal as a source of material for the railroad bed. The railroad has long been abandoned and replaced by SR-29. The canal along the east side of SR-29 conveys flows to the south.

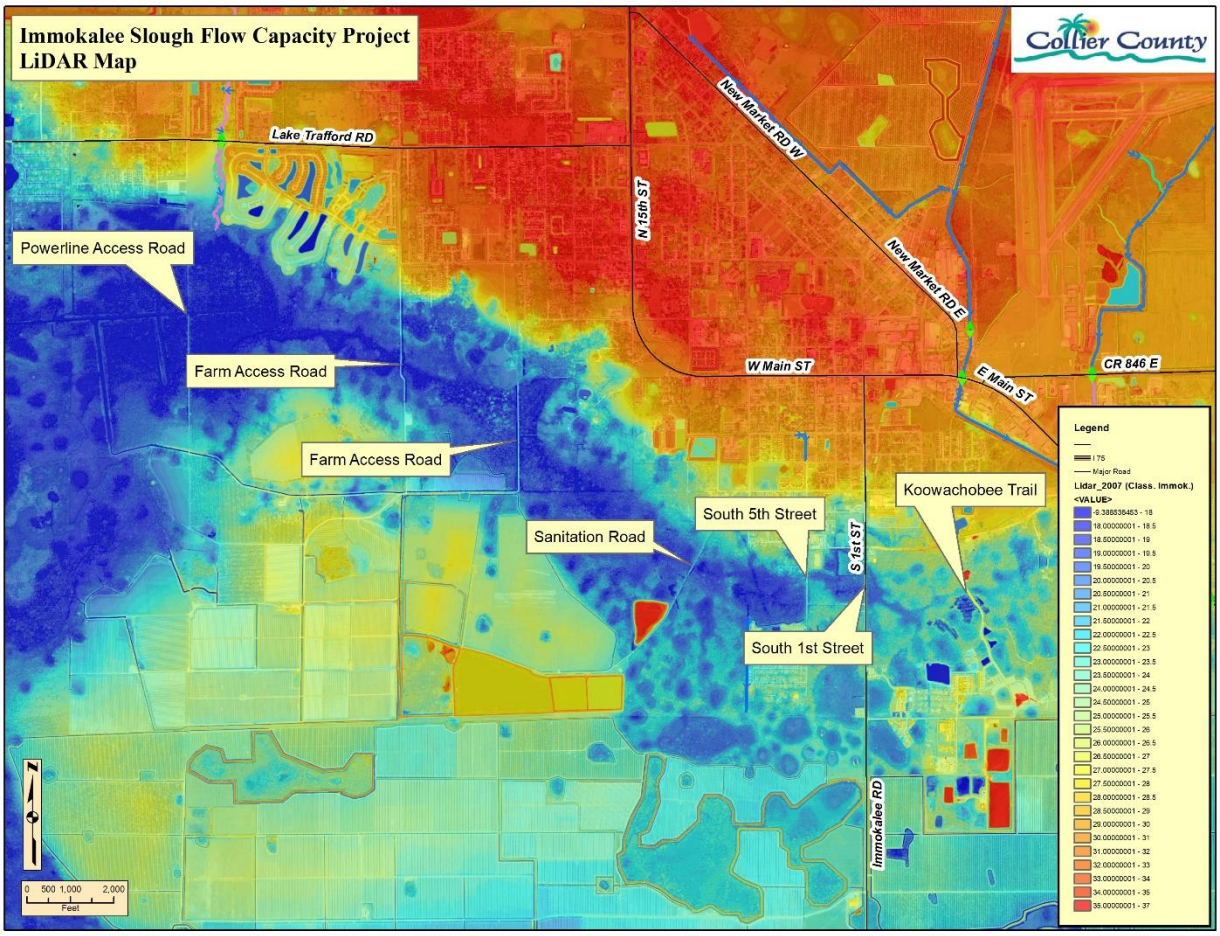
The upstream (eastern) extent of the Immokalee slough is the western side of SR-29. Through the years as the Immokalee area developed several roadways were constructed across the Immokalee slough. Following an east to west direction, the roadway crossings consist of the following streets.

- Koowachobee Trail (located within the Seminole Reservation)
- South 1st Street (also known as Immokalee Road or CR-846)
- South 5th Street
- Sanitation Road
- Two (2) unnamed private roads for access to privately owned agricultural land
- A privately-owned powerline maintenance access road

Where access was available the existing culvert crossings under these roadways were measured for inclusion in the computer modeling. Where access was not available, or standing water elevations in the slough made culvert locating and measuring impossible, the best available information from researched records and the 2005 Lochner ISWMP was used for inputs into the modeling.

In addition to the roadway crossings, the slough was also impacted years ago by some channelization attempts near the connection to Lake Trafford and construction of a bypass/drainage ditch system through portions of the agricultural lands along the southern edge of the slough.

The slough is heavily vegetated with both native and exotic species that create restrictions to flow. Ground elevation information, as shown in the following LiDAR mapping, provides an indication of the depth and width of the slough.



Water level staff gauges were installed at Sanitation Road and South 1st Street to be used as a comparison to staff gauge readings of the Lake Trafford water level. Water level readings from August 2016 to August 2017 showed the following approximate water surface elevation differences:

Location	Dry Season	Wet Season
Lake Trafford to Sanitation Road	0 feet	0.7 feet
Lake Trafford to South 1st Street	1.3 feet	2 feet

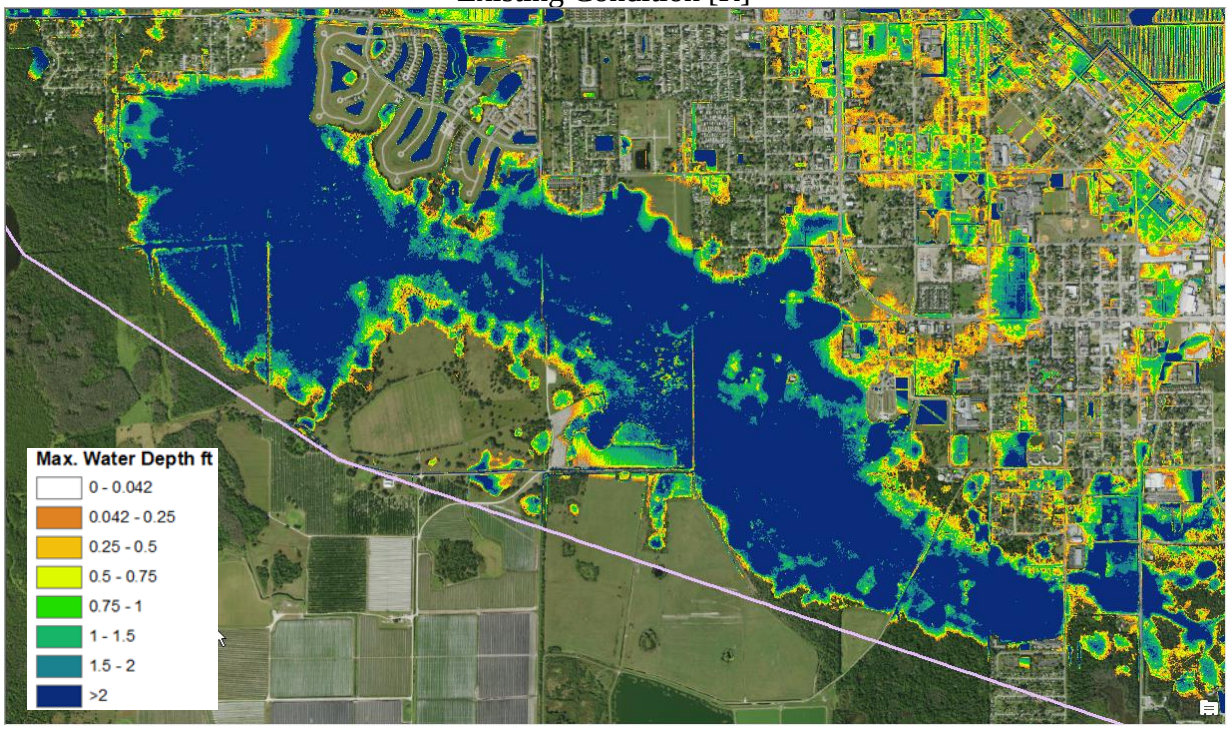
This indicates there is some blockage of flow, with the largest measured restriction being between Sanitation Road and South 1st Street. LiDAR imaging shows this portion of the slough to have a relatively narrow flow channel. Several staff gauges suffered damage during the 2017 wet season and need to be re-established to allow further data collection.

In modeling flow through the slough, Robau~~,~~ used a similar approach as Lochner had previously done by increasing pipe sizes at the road crossings. Robau did propose setting the bottoms of the pipes at an elevation that would place the tops of the pipes one foot below the road crown elevations since existing pipe elevations were not known or were too high when pipe sizes were increased.

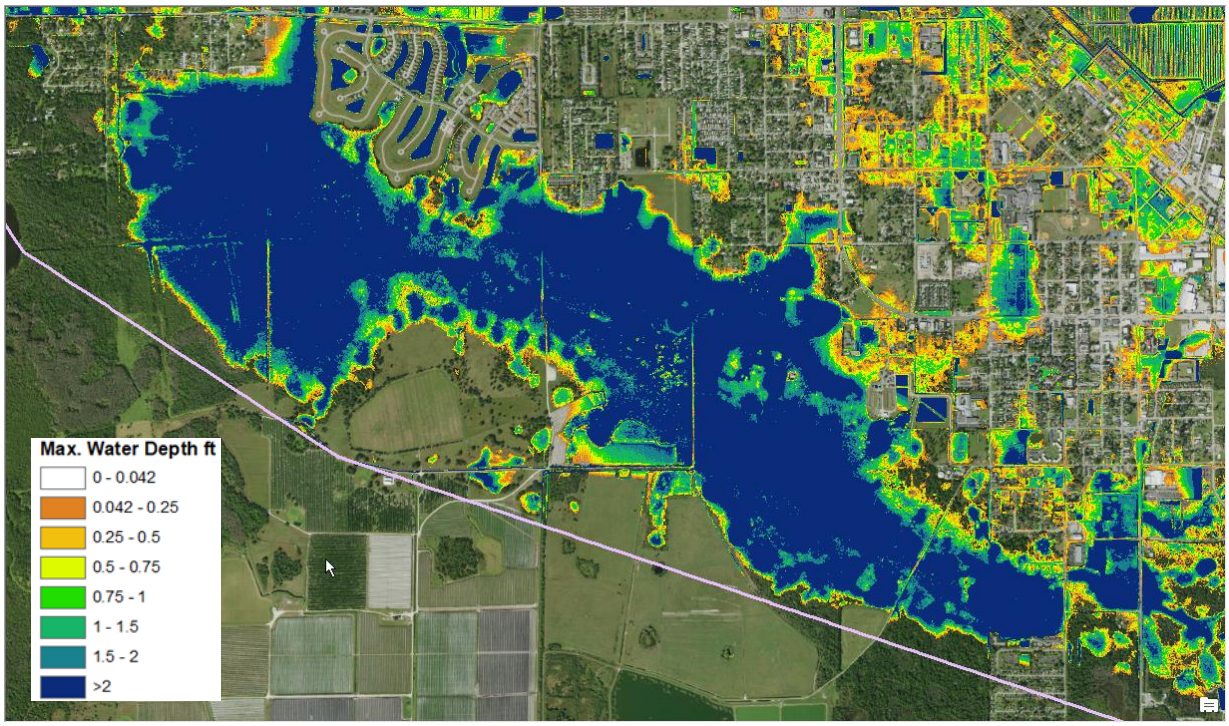
The analysis showed that by increasing some pipe sizes until the pipe flow restrictions from the upstream end of the pipes to the downstream ends of the pipes was less than 0.1' there would be some increase in flow through the slough. However, the overall benefits were negligible and differences in flooding extent were not discernable in the mapping. The water surface elevation differences between the downstream end of the slough at Lake Trafford and the upper end of the slough at Koowachobee Trail remained at roughly three (3) feet.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After Immokalee Slough Road Crossing Culverts Improvements [R]



It is recommended that a comprehensive evaluation of the Immokalee slough be initiated in a separate study specifically focused on obtaining detailed existing condition information. 2017 was a wet year which made good data collection efforts very difficult, if not impossible to achieve. Additionally, a linear slough vegetation and flow depth survey during a winter "dry" season following a relatively dry summer "wet" season, conducted with the approval and cooperation of the land owners, could help identify points of flow restriction for input into future modeling efforts.

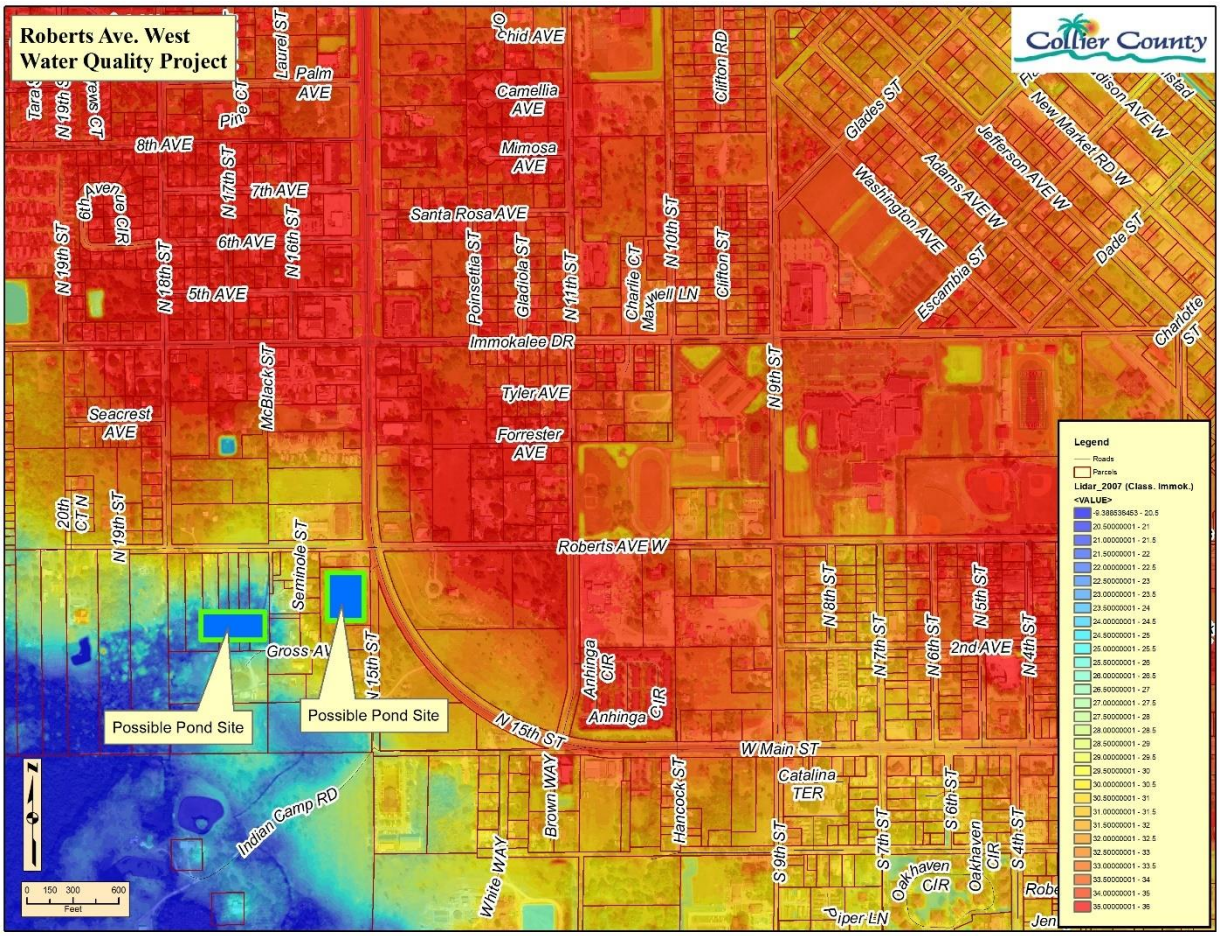
There was no pollutant loading evaluation prepared for the Immokalee Slough Flow Capacity Improvement project. However, an opinion of probable cost to upgrade some of the roadway crossing pipes was calculated at $0.3 million.

3.7 Roberts Avenue West Water Quality Project:

The Roberts Avenue West Water Quality Project was developed to address stormwater pollutant loadings from Immokalee into Lake Trafford. While not intended as a flood reduction measure for the design storms modeled in the ImmSIP, the project could be evaluated for flood reduction benefits from smaller, more frequent rainfall events at the time the project is advanced into the detailed final design for construction.

The sites selected as possible pond locations are adjacent to an existing outfall ditch along Roberts Avenue West that has a direct discharge into the Immokalee slough. The contributing drainage area includes properties south of Immokalee Drive on both sides of SR-29 from North 18th Street to North 11th Street. This existing outfall ditch is uncontrolled and the location offers a good opportunity to develop a smaller scale water quality component to capture debris and reduce nutrient loading into the slough.

The following map provides LiDAR elevation information to show the direction of ground slope in the area. Two possible pond sites are shown, although the analysis is based upon constructing only one pond, based upon availability of land acquisition.



Construction of the stormwater treatment pond was shown to provide an overall water quality improvement and reduction of nutrient loading to the Immokalee slough. Based upon an assumed size of pond site available, the following results were obtained. [R]

- Total Nitrogen removal was calculated at 41% (0.128 kg/year avg.)
- Total Phosphorus removal was calculated at 69% (0.031 kg/year avg.)
- BOD removal was calculated at 100% (0.877 kg/year avg.).

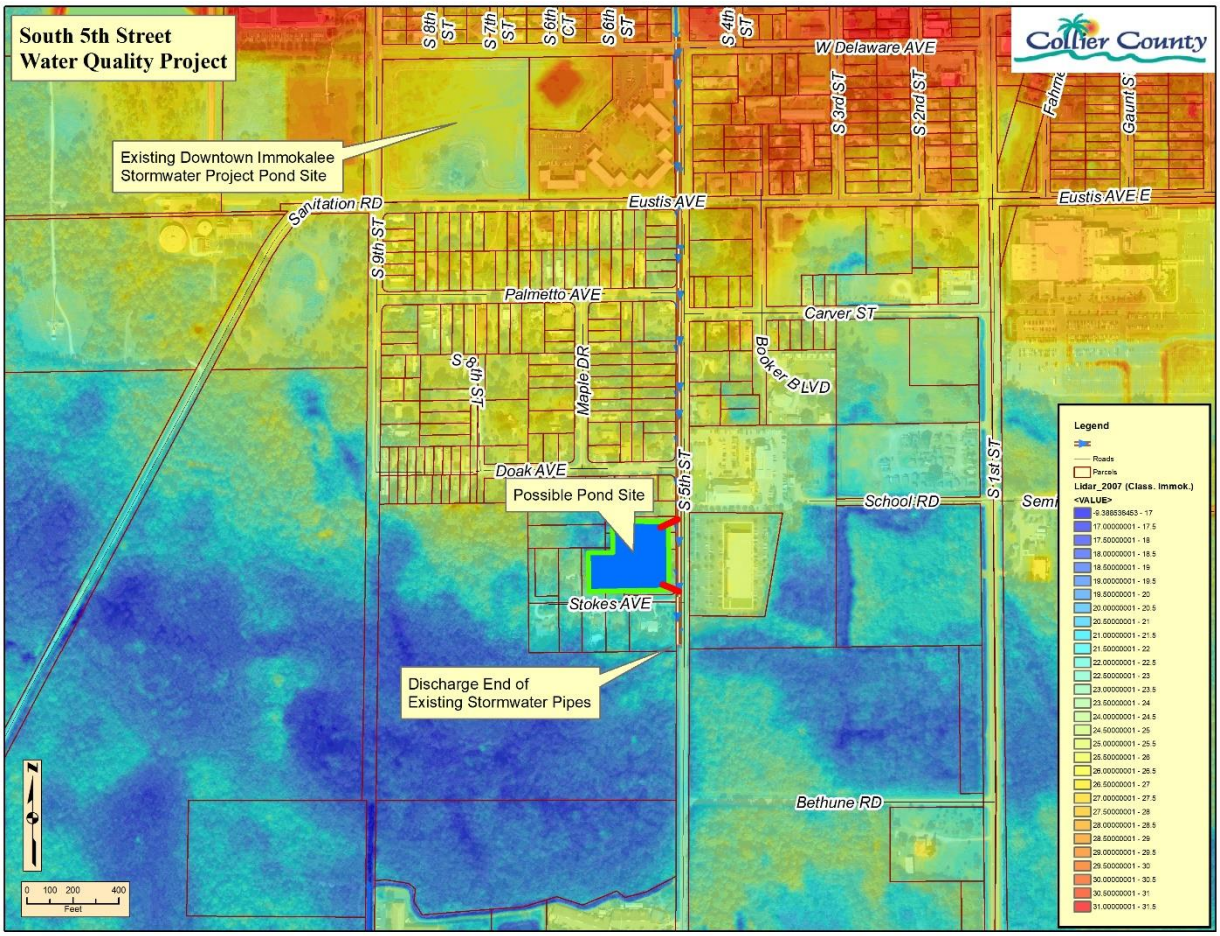
The OPC for the Roberts Avenue West Water Quality project is projected to be approximately $0.5 million. [R]

3.8 South 5th Street Water Quality Project:

The South 5th Street Water Quality Project was developed to supplement the existing water quality treatment features of the previously constructed Downtown Immokalee stormwater improvements project and provide additional treatment to reduce stormwater pollutant loadings from Immokalee into Lake Trafford. While not intended as a flood reduction measure for the design storms modeled in the ImmSIP, the project could be evaluated for flood reduction benefits from smaller, more frequent rainfall events at the time the project is advanced into the detailed final design for construction.

The site selected as a possible pond location is just north of Stokes Avenue on the west side of South 5th Street. Several years ago, the County enclosed the deep ditch on the west side of South 5th Street as a safety measure to residents and to retain needed flow capacity. The Downtown Immokalee stormwater project connects to the upper end of that previously enclosed South 5th Street stormwater outfall. Although the Downtown Immokalee stormwater project includes a pond and several in-line trash and sediment capture devices, it was observed that substantial amounts of trash and debris continue to be discharged into the slough south of Stokes Avenue. This proposed stormwater treatment pond can capture and reduce an additional percentage of the pollutant loading discharging from the South 5th Street system.

The following map provides LiDAR elevation information to show the direction of ground slope in the area. The proposed pond site was chosen based upon vacant land close to the discharge end of the existing enclosed stormwater system.



Construction of the stormwater treatment pond was shown to provide an overall water quality improvement and reduction of nutrient loading to the Immokalee slough. Based upon an assumed size of pond site available, the following results were obtained. [R]

- Total Nitrogen removal was calculated at 29% (0.422 kg/year avg.)
- Total Phosphorus removal was calculated at 55% (0.108 kg/year avg.)
- BOD removal was calculated at 58% (3.309 kg/year avg.).

The OPC for the Roberts Avenue West Water Quality project is projected to be approximately $0.5 million. [R]

3.9 Seminole Reservation Pump Station(s) Project:

The Seminole Tribe of Florida Immokalee Reservation is located at the upper end of the Immokalee slough. Coordination of planning efforts for the ImmSIP helped identify some of the flooding concerns experienced on the reservation land. Their observations were that through the years they have seen an increased surface water elevation in the slough, most noticeably during heavy rain events when the slough seems to not discharge or possibly reverse direction and flow from west to east at the South 1st Street (CR-846) crossing.

In considering the location of the reservation east of South 1st Street, the relief from flooding depends entirely upon the Immokalee slough flowing from east to west to Lake Trafford. Discussions with members and representatives of the Tribe brought out several options for consideration which included:

- Install a slide gate weir on the east side of South 1st Street to prevent backflow conditions.
- Install a large stormwater pump and discharge excessive water from the slough into the SR-29 canal to the east.
- Install a perimeter berm along the north and south sides of the slough to separate the slough from the adjacent slightly higher developed lands and then use stormwater pumps to discharge stormwater over the berm into the slough.

The installation of a slide gate weir on the east side of South 1st Street was not recommended, as it would not actually help flows in the slough to discharge out of the reservation. Staff gauge measurements at the South 1st Street culvert crossing did not show evidence of higher water elevations on the west side of South 1st Street and no one could document they had ever observed the reverse flow condition. Additionally, constructing an operable slide gate weir could worsen the upstream flooding condition if the gate was left in a closed (up) position.

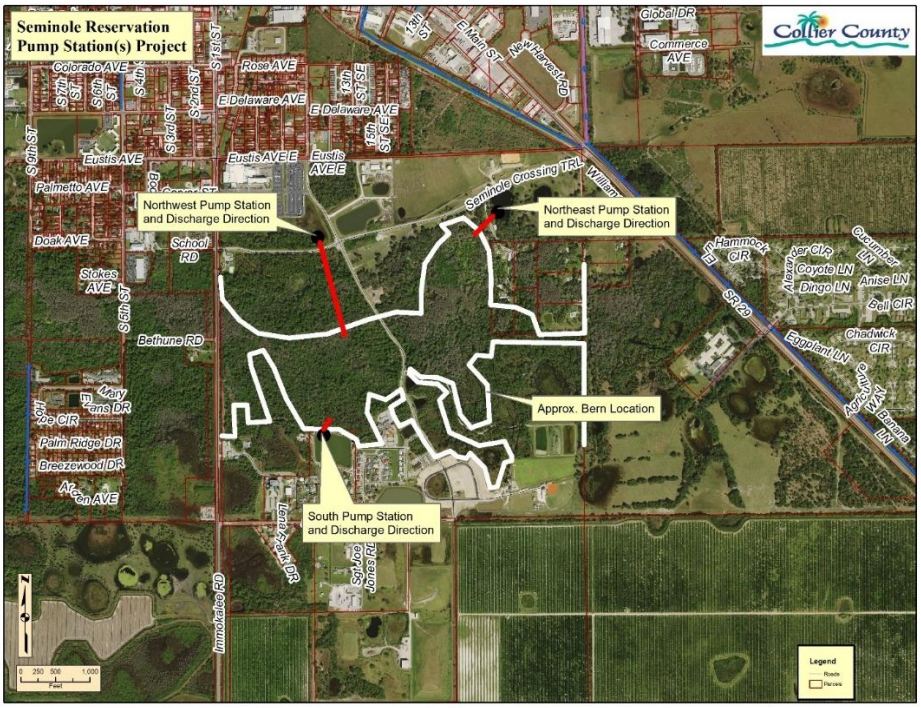
The installation of a large stormwater pump to pump water out of the slough and into the SR-29 canal has two major hurdles:

1. Required federal and state permits to construct the pump station to drain the upper end of the slough would be difficult to obtain; and,
2. The SR-29 canal has existing capacity and nutrient loading problems, so the addition of new pumped discharge from the slough would only further degrade that system.

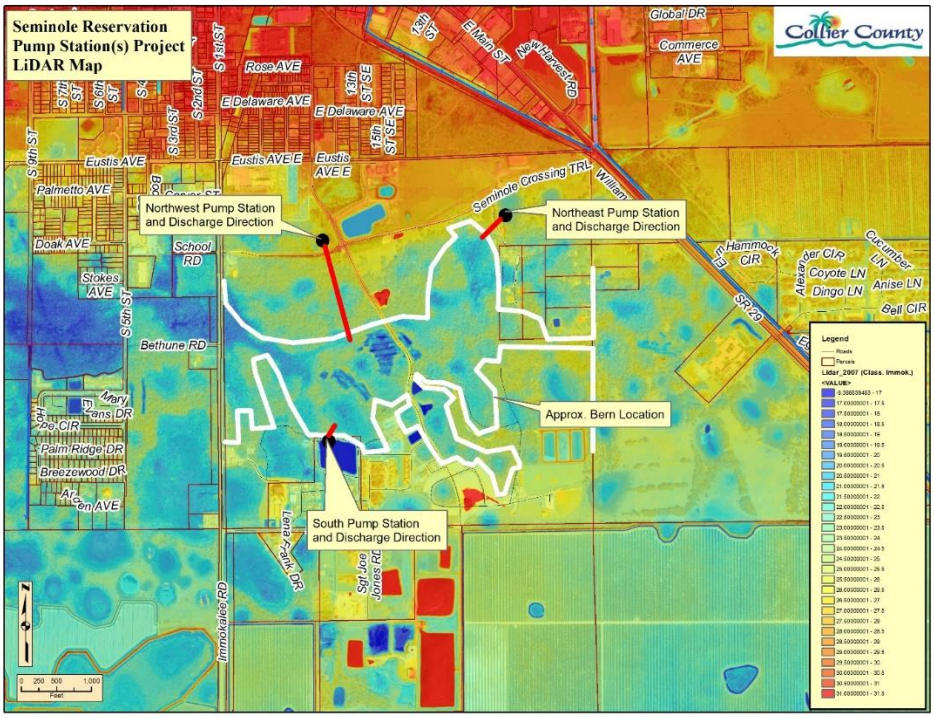
Neither of the first two options were modeled by Robau for stormwater flooding benefits/impacts.

The construction of a slough and upland separating berm was modeled by Robau to show the benefits that could be obtained. The Tribe provided information to identify possible long-range development planning areas within the reservation. Using those approximate boundaries, as well as currently developed areas, Robau was able to approximately locate where a separation berm could be constructed, along with stormwater pumping stations on the north and south sides of the slough. A portion of the south side properties currently utilize a stormwater pump out of an existing pond, so that became the location of a proposed pump station. For the north side properties, eastern and western pump station sites were selected based upon proposed stormwater flow directions and the protected acreages involved. The western north pump station would also work well in coordination with the proposed East Delaware Avenue Area Project.

The proposed pump capacities would be in the 20 to 25 cubic feet per second (cfs) range. With new development projects on the reservation, the Tribe would also be constructing additional ponds for stormwater treatment, so the additional storage created and possible additional points of discharge into the slough could reduce the pump capacities.



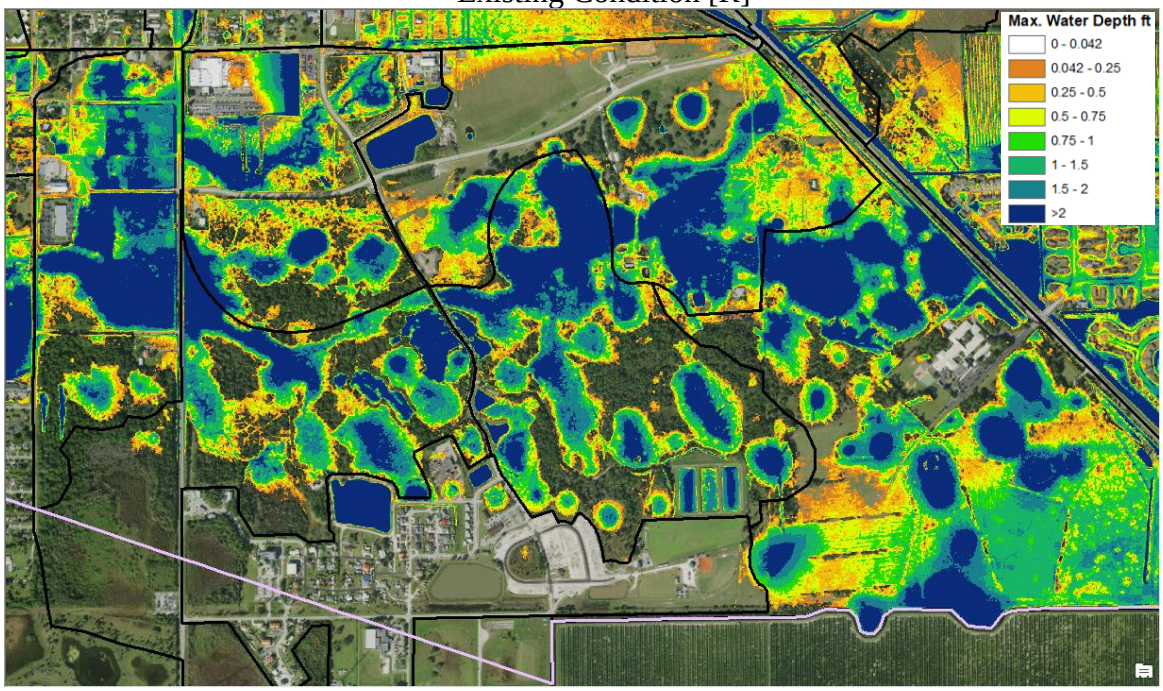
The proposed berm location is very rough in approximating potential development lands within the reservation. Additionally, the shown berm location could be the stormwater containment berms around new development areas and constructed at a sufficient elevation to serve a dual purpose. As shown on the following LiDAR elevation map, the berm location minimizes impacts on the slough wetland areas and storage capacity.



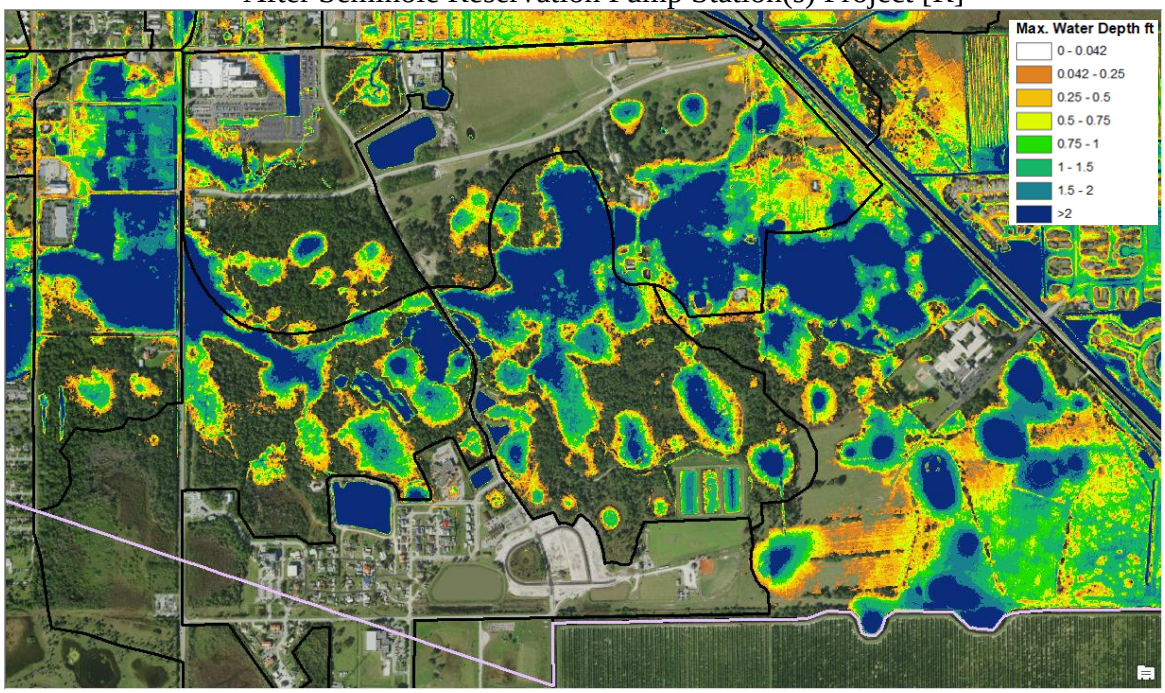
The flood protection benefits of a berm/pump system within the Seminole reservation are seen on the following maps.

Flooding Scenarios (10-year/3-day design storm event)

Existing Condition [R]



After Seminole Reservation Pump Station(s) Project [R]



Construction of the Seminole Reservation Pump Station(s) project was analyzed only from a flooding impact and capacity consideration. The existing southern pump station currently utilizes a pond for collection and treatment, so the installation of a new pump would have negligible change in the current stormwater quality treatment. For both north side pump stations, any new development in those areas would be required to construct stormwater treatment ponds, or other suitable alternatives, as a part of their development permitting. Likewise, new development in properties south of the slough would provide their own stormwater treatment facilities that may, or may not, discharge into the existing south pump system area.

The OPC for the Seminole Reservation Pump Station(s) project has so many variables involved that a realistic opinion of probable cost was not prepared. It was anticipated that most of the berm would be constructed as the individual development areas were constructed, and no separate berm was envisioned. Additionally, decisions made within the reservation are by the Tribe and not the Collier County Board of County Commissioners.

SECTION 4 Land Acquisition (Pond Sites):

An analysis of the ultimate storm water outfall location and adequacy, along with any anticipated real property acquisition or easements rights necessary will also be undertaken as part of the detailed design required for implementation of this ImmSIP as well as any plan updates.

Collier County has been pursuing acquisition efforts for proposed pond sites identified in the ImmSIP.

- Lake Trafford Road (West End) Ditch/Culvert Upgrades Project: The Big Cypress Basin/South Florida Water Management District transferred ownership of five (5) land parcels totaling fifty-one (51) acres of property to Collier County in 2018 to provide a site for the proposed water quality treatment pond.

- Fish Creek Project (Fish Branch Creek Project): Collier County staff contacted owners of the land for the proposed pond sites, but no acquisitions or ownership transfers have occurred.

- Immokalee Drive/Lake Trafford Road/Carson Road Project: Tract 3 of the Arrowhead Reserve at Lake Trafford – Phase I was acquired by the County in 2018.

- Madison Avenue Channel Project: Collier County staff contacted the owner of the parcel for the proposed pond site. A negotiated purchase price, based upon a separate appraisal, was developed, but the purchase is currently on hold at the mutual requests of both the owner and the County.

- East Delaware Avenue Area Project: Collier County staff contacted the owner of the parcel for the proposed pond site and negotiated a purchase price. Acquisition efforts are ongoing for closing on the purchase.

- Immokalee Slough Flow Capacity Project: No pond site is required for this project. However, drainage easements will need to be obtained from the respective property owners where proposed culvert replacements are proposed. Collier County staff has not initiated any discussion with the land owners.

- Roberts Avenue West Water Quality Project: Collier County staff has made several attempts at contacting the various land owners with mixed results and most being non-responsive.

- South 5th Street Water Quality Project: Collier County staff has made several attempts at contacting the various land owners with mixed results and most being non-responsive.

- Seminole Reservation Pump Station(s) Project: This project is entirely on Seminole Tribe of Florida reservation land and does not require pond sites. Collier County staff is coordinating with tribal representatives regarding flooding issues within the reservation.

SECTION 5 Capital Project Design/Permitting/Construction Prioritization

The ImmSIP is developed as an overall stormwater improvement program for the Immokalee area. The conceptual projects discussed in SECTION 3 identify improvements that can be made to the major locations of stormwater discharge to reduce flooding and provide opportunity for stormwater treatment to reduce the debris and nutrient loading entering Lake Trafford or the SR-29 canal. These major stormwater facility locations provide the backbone for the entire Immokalee stormwater drainage system. The identified capacity improvements to these major stormwater facilities should be completed prior to subsequent local street and neighborhood stormwater drainage improvements to ensure localized flooding problems are not simply passed on to another location.

Each of the SECTION 3 projects should be prioritized for funding of the follow-up detailed design and permitting that can lead to construction as additional funding is made available. Establishing the priorities should be a joint process by the various entities that would be involved and responsible for the subsequent funding and/or planning and/or project construction. Suggested entities would be:

- Immokalee Community Redevelopment Agency (CRA)
- Immokalee Municipal Services Taxing Unit (MSTU)
- Collier County Stormwater Management
- Big Cypress Basin
- Immokalee Water and Sewer District
- Private land owner/developer interests

Some prioritization criteria that should be considered include:

- Reduction of structure flooding
- Reduction of street and yard flooding
- Extent (acreage) of flood reduction
- Cost benefit
- Downstream to upstream approach
- Availability of land
- Availability of future funding for follow-up
- Inter-coordination with other planned public infrastructure improvements
- Stormwater quality benefits to Lake Trafford

Localized flooding in the Immokalee area must be addressed in a neighborhood/street-by-street detailed level follow-up program. With the establishment of drainage basins and major outfalls that are sized to sufficiently receive flow from their included neighborhoods, detailed engineering designs need to be prepared to address street level layout of roadside swales, culverts, storm drain systems, minor ground elevation variations, location of public utilities and pedestrian friendly access. The follow-up program needs to be sufficiently developed, funded and timed for implementation so that flood reduction benefits become visible to residents. The follow-up program would also provide planning guidance for stormwater discharge flow direction and capacity of future development or redevelopment activities.

The approval of a large federal grant to address sidewalks and associated roadside drainage issues in much of the central Immokalee urban area is an example of the follow-up program type of work that should be incorporated into the project prioritization effort. The flooding issues in Immokalee have been in existence for many years. Establishing a prioritized approach to steadily complete the correction of these problems in a ten (10) to fifteen (15) year time frame would not be unreasonable. Establishment of a multi-year prioritized approach for dedicated funding and construction also coordinates well with leveraging other grant opportunities.

As other opportunities arise the ImmSIP should be updated to include additional projects that demonstrate an ability to provide stormwater quality treatment and temporary storage. For example, while not a major outfall, there is an opportunity to construct a stormwater treatment area at the south end of South 9th Street adjacent to the intersection with Doak Ave. The existing right-of-way for South 9th Street extends across the Immokalee Slough and is available for use where the existing roadway ends.

SECTION 6 Maintenance:

No stormwater system can function for long without the implementation of a thorough and consistent maintenance program. Stormwater facilities are designed to safely transport and/or treat specific maximum flows when new. Stormwater facilities, by their very nature and location, collect materials washed from adjacent lands.

Much of Immokalee utilizes roadside swales with driveway culverts and street cross drains to collect and transport the stormwater runoff from both the streets and adjacent properties. Grassed roadside swales are an effective method for providing not only the stormwater conveyance but also some water quality treatment as they can filter out sediments and remove some nutrients. However, their natural filtering capabilities lead to swales gradually filling with captured sediments and accumulated layers of plant growth. There is also a frequent desire to utilize the space for parking and expanded yard area as the swales become shallower.

Observations of the roadside stormwater systems in Immokalee identify many areas where no identifiable stormwater conveyance facilities exist. The causes can vary from lack of maintenance to never having been constructed in the first place. The age of many facilities and the gradual deterioration that occurs (e.g. severely rusted culvert pipe) along with damage from various reasons (e.g. crushed pipe ends) were also identified as restrictions to flow.

A well-functioning stormwater maintenance program needs to be established in the Immokalee area. The following recommendations for a stormwater maintenance program could substantially improve flooding conditions in Immokalee as the system currently exists.

- Swale Reconstruction – Implementation of a roadside swale maintenance program to re-establish proper swale depths and widths along the streets that are or should be swaled. Piping of roadside swales should be discouraged as this negatively impacts the available temporary storage and treatment volume of a swale. The swales would be constructed with an engineered direction and depth of flow so they are able to discharge with an appropriate amount of time for nutrient and sediment removal. Swales should not rapidly drain dry, but should temporarily hold the runoff and drain dry within roughly a 24-hour period. It is this gradual draining feature that allows the grasses within the swales to capture some of the sediments and nutrients. Because of this capturing effect, swales require frequent maintenance to restore them to their full capacity. The maintenance program should be sufficient to maintain and reconstruct all swales within a 2 to 3-year maintenance cycle, or more frequently as needed.

- Driveway Pipe Replacement – Implementation of a driveway pipe replacement program, coupled with the swale reconstruction program could correct existing problems with crushed, collapsed, and/or improperly constructed driveway culverts. Often culvert pipes have been constructed without a specific bottom of pipe elevation being identified to ensure that swales can flow at full capacity. Consistency in culvert pipe sizing is also an observed issue. This can result in flow restrictions and excessive periods of standing water, neither of which situations are beneficial to the roadbed or property owner. Past practices of requiring the property owner to be responsible to replace the driveway

culvert pipe while the County attempts to maintain the flow in the swale have not proven to be systematically effective. This effort needs to be combined into a single maintenance program to ensure continuity of flow.

- Frequent Debris Removal – Observations of existing stormwater facilities in Immokalee demonstrate large amounts of debris within the system. This debris restricts the stormwater flow and has the potential to create complete blockages. The debris that does pass through the stormwater facilities then ends up in either the Immokalee slough, Lake Trafford, or the SR-29 canal. Observations of locations where existing stormwater discharges into the Immokalee slough show large accumulations of debris and trash. Likewise, trash and debris floating into the SR-29 canal create flow restrictions due to the large accumulations that become trapped on the upstream side of the culverted canal crossings. While substantially increasing the frequency of debris removal is a matter to address in a well-functioning stormwater maintenance program, a public information and enforcement program needs to be included to stop the source of much of the debris from getting into the stormwater facilities. Expanding upon trash collection and disposal efforts as well as litter prevention and enforcement programs can have substantial impacts in reducing the presence of debris.

As new stormwater facilities are constructed to reduce flooding and treat stormwater discharges, the maintenance program will need to also address the expanded maintenance needs.

SECTION 7 Public Outreach/Information:

A public outreach and information program should be established to inform all Immokalee area property owners and residents of the importance of having and keeping a well-functioning stormwater system. Stormwater facilities tend to be ignored or considered as intrusive when conditions are dry. They are sometimes considered as handy places to dispose of unwanted items (e.g. leftover liquids, lawn debris, shopping carts, litter, etc.) without regards to the impacts to future potential flooding or where these items end up in the system.

As previously mentioned, a well-organized public outreach program should be established in the Immokalee area to make everyone aware of the problems created by trash and debris that can end up in the stormwater system facilities. The success of this outreach program can have great functional benefit to existing and any future expanded stormwater system facilities.

The public outreach/information program should also include information on impacts that stormwater discharges have on Lake Trafford. Lake Trafford is a major recreational and economic generator for Immokalee. Currently Lake Trafford is listed as an impaired water body by the State of Florida, with the impairment being identified primarily as caused by nutrient loadings. The Big Cypress Basin spent approximately $20 million to dredge accumulated sediments from the lake to reduce the accumulated nutrients and improve overall water quality. Improving the lake's water quality has the benefit of improving the lake's recreational value.

Being an impaired water body, the lake's water quality is monitored by the State of Florida to document changes. If water quality improvements cannot be documented as the years pass, the State will be forced to set certain mandated minimum water quality improvement standards upon the County. The projects for stormwater quality treatment identified in SECTION 3 are designed to begin the process of improving the quality of the stormwater discharging into the Immokalee slough, and ultimately Lake Trafford. A public outreach program to inform residents of the importance to keep stormwater as clean as reasonably possible can help these proposed stormwater treatment projects to function efficiently and prevent the establishment of State-mandated requirements.

APPENDIX A
Proposed Stormwater Projects Cost Summary*

Project Name	Opinion of Probable Cost
Lake Trafford Road (West End) Ditch/Culvert Upgrades Project	$2.5 million
Fish Branch Creek Project	$5.0 million
Immokalee Drive/Lake Trafford Road/Carson Road Project	$7.8 million
Madison Avenue Channel	$5.1 million
East Delaware Avenue Area Project	$1.0 million
Immokalee Slough Flow Capacity Project	$0.3 million
Roberts Avenue West Water Quality Project	$0.5 million
South 5th Street Water Quality Project	$0.5 million
Seminole Reservation Pump Station(s) Project	$ Undetermined
Total Cost**	$22.7 million

* Does not include land acquisition or engineering/design costs
** Does not include Seminole Reservation Pump Station(s) costs