10.0 ALTERNATIVES ANALYSIS

10.1 Whitehouse Avenue and 10th Street Problem Area

Flooding along Whitehouse Avenue has been a persistent problem for many years. The structure at 14741 10th Street was flooded during the 2004/2005 wet season and it is reported that the roads and yards frequently flood in this area. The estimated floor elevation of the above particular home is 74-74.5" NAVD.

Field and flood routing analysis of the area determined the cause of the flooding to be primarily due to four factors as described below.

1. The area is simply lower than the surrounding areas and so stormwater naturally collects and ponds there. The intersection of Whitehouse and 10th Street is approximately 5 feet lower than US Highway 98 located to the east and 4 feet lower than the old railroad embankment located to the west of the City"s 10th Street Public Works complex. This would not necessarily be problematic except it is exacerbated by the other three factors as well.

2. The existing storm sewer system is undersized to convey the stormwater draining to it. The system is constructed to drain the area eastward, across US Highway 98 and eventually through the Pasco Cogeneration Plant stormwater pumping station ("Cogen lift station"). The pipe sizes are simply too small to convey the stormwater adequately and thus the area"s natural ponding is made even worse because the water cannot be conveyed out of the area fast enough.

3. The third reason is related to the second and is the simple fact that stormwater actually is forced to flow westward in the storm sewer system due to high water levels to the east. This is due to several factors – undersized culverts, reliance on the Cogen lift station, large areas (much of which are impervious) all ultimately draining to a single culvert that discharges from the Cogen facility to the east, etc. The stormwater in this area simply cannot drain eastward until the high water levels in the storm sewer at and around US Highway 98 have receded – which is often hours after the storm event. Instead, the stormwater simply tries to flow westward, exceeds the low elevations of the system and surcharges out of the storm sewer into the streets and low areas where it remains until the flood waters receded to the east. Several homes have particularly low floor elevations and are most susceptible to the flooding.

4. The Pasco County Housing Authority (PCHA) has a pump station located at 14th Street as well as one located just west of the City"s 10th Street public works complex drainage pond. These pumps are turned on during significant rainfall events to provide flood protection of the areas located west of 14th Street and managed by the PCHA. The introduction of these flood waters by mechanical means worsens the flooding experienced along the Whitehouse Avenue and 10th Street location.

As part of the alternatives analysis, AMEC investigated several options that could be implemented to increase pump capacity and/or add additional pipes from the "Cogen" facility under the railroad to the east. While those options would help, neither provides the magnitude of benefits provided by the third alternative.

First Alternative

To increase the pump capacity is simple enough conceptually in that it involves increasing the existing pump system capacity. The "hidden costs" involve the likely required upgrades to the electrical supply and possible miscellaneous improvements to the existing lift station to accommodate the new pump. For the analysis, it was estimated that a new pump could increase the existing pumping rate by 50%. When that change was made, lower flood elevations did occur near US Highway 98 but the extent of the reductions were fairly small and the reduced flood elevations in the vicinity of Whitehouse Avenue and 10th Street do not produce significant reductions in flood areas. A limiting factor is that even though the pump itself can be upgraded, its discharge is still conveyed with other areas to a single 30" culvert discharging to the east through the existing railroad toward the Withlacoochee River. The 30" culvert has a limited capacity as well and the energy grade line will have to be assessed along the entire 30" culvert to ensure no undesired surcharge occurs.

Second Alternative

The second alternative addresses that single 30" culvert limitation. There are multiple pipes that ultimately drain to the Cogen lift station that individually are larger than the 30" culvert discharging eastward to the river. The single 30" culvert simply cannot convey those flows adequately and thus the flooding problems are worsened. A potential option would thus be to add an additional 30" (or larger) culvert to serve as a discharge conveyance. For the analysis, the new 30" culvert tie into the existing system immediately upstream of the lift station and provides a second outfall opportunity. This culvert would require a flap gate on its discharge end to prevent the unintended consequence of floodwaters backing into the system and inadvertently contributing additional water to the problem areas during times of high flood elevations east of the railroad track embankment. This option provides slightly lower flood elevations than the first option, but not enough to significantly reduce the flooding hazard.

Third Alternative

The third alternative conceptualizes a solution to significantly reduce the severity and frequency of these flooding events through excavation of four properties. The City of Dade City already has control over three of the parcels including a small parcel located along the outfall ditch line on 10th Street. The fourth parcel is owned by the Pasco County School Board (PCSB) as part of the Cox Elementary parcel but the land is not currently utilized by the PCSB and a cooperative use agreement or equivalent may make this property available to the City for flood control. **Table 10.1** provides a summarized

comparison of the reduction in flood levels at Whitehouse Avenue and 10th Street by each alternative.

This project would likely be implemented in a two phase approach with the first phase being limited to the excavation of the small parcel and the expansion of the existing pond located on the City Public Works facility.

Fourth Alternative

The fourth alternative for this area represents a revised combination of Alternatives 2 and 3 discussed above. Under this alternative, a smaller expansion of the existing pond at the 10th Street Public Works Complex is proposed (1.5 + acres, resulting in an approximate top of berm area of 2.8 acres), and no excavation is proposed along the abandoned railroad grade to the east. A smaller area on the PCSB property would also be excavated under this alternative, with the intent of avoiding the estimated wetland jurisdictional area, so that no wetland impacts would be necessary. The area proposed for excavation on the school board property is approximately 2.4 acres. An additional cross drain pipe under the active CSX tracks would be constructed under this alternative providing an effective outlet of floodwaters from the Whitehouse Avenue problem area. The areas proposed for excavation are identified on the attached **Exhibit 1**.

Similar to the Third Alternative, this project would also likely be implemented in a two-phase approach with the first phase being limited to the excavation of the small parcel and the expansion of the existing pond located on the City Public Works facility.

Table 10.1
Comparison of Flood Elevations Resulting From Each Alternative

Concept Alternative Considered	5 Year Flood Elevations	25 Year Flood Elevations
Existing Conditions	73.9	74.8
1. Pump Station Capacity Expansion	73.7	74.9
2. Additional pipes under CSX Railroad	73.6	74.5
3. Excavation at 10th St. Complex/PCSB Parcel	72.0	73.0
4. Limited Excavation at 10th St. Complex, Reduced Excavation on PCSB Parcel, Addition of Cross drain under CSX	71.6	73.1

The following describes Alternative 3 in more detail. The attached **Exhibit 1** identifies the concept areas proposed for excavation. **Exhibits 2 through 5** approximately show the estimated reduction in the extent of flooding for the 5, 25, 100 and mean annual (2.33) year design flood events. Current conceptual improvements include excavation of approximately 1.8 acres around the City"s existing pond located on the 10th Street Public Works Complex. In addition, approximately 6 acres of the existing forested area at the north end of the school board property (north of the power line crossing) is conceptualized for excavation as well. The two excavated areas would be connected by means of a 30" pipe crossing under the old railroad embankment since this is a proposed future trail path. It is our understanding that the past City public works director had contact with PCSB about the project and there was some positive dialogue on this project. Among the potential benefits to the PCSB would be an educational component (environmental restoration and flood control) available for student field trips. The exact dimensions and elevations of the proposed flood control facility will need to be based on site specific survey data and wetland elevations, but for the analysis it was estimated to excavate each area to elevation 69. This elevation approximates the lowest ground area of the existing wetland and is also approximately three feet lower than the low spot along Whitehouse Avenue.

Excavating these areas provides significant flood relief in the Whitehouse vicinity. The exhibits illustrate the reduction in flood areas for different storm events. Approximate cost estimates are provided for each of the considered alternatives in **Tables 10.2 through 10.7** as well. **Table 10.8** identifies the estimated costs/benefits of the options considered for this problem area. Cooperation of the PCSB will be required for this project and wetland mitigation will have to be permitted however the possible benefits of this option far exceed those of first two alternatives.

The Level of Service, though improved significantly, remains officially at LOS-F for a 25 year – 24 hour storm event with the above noted improvements. Additional measures can be considered by the City with this improvement serving as the initial and significant flood control phase.

An engineer"s opinion of probable cost for the fourth alternative inclusive of Phases I and 2, respectively, is given in **Table 10.6** and **Table 10.7** below. The estimated cost of construction for this alternative is $795,626, and considerably higher than the cost of Alternative 3. This alternative provides similar flood relief benefits to those provided by Alternative 3, except for the five-year storm, where it offers a lower predicted maximum flood stage This alternative avoids the difficulties associated with wetlands such as the associated permitting and mitigation area construction, monitoring and maintenance requirements. However, the challenges associated with easement acquisition and permitting through CSX Transportation discussed in Alternative 2 would also apply to this alternative.

It is recommended that the City pursue Alternative 3 or 4 for the flooding solutions to this area. Cooperation of the PCSB will be required for either alternative however the possible benefits of either option far exceed those of Alternatives 1 and 2.

Table 10.2
Upgrade of Existing Cogen Pump Station Alternative
Engineer's Estimate of Probable Construction Cost
Concept Level
September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1.0	Mobilization	$ 10,000.00	$ 10,000
LS	1.0	Maintenance of Traffic	$ 2,000.00	$ 2,000
LF	100.0	Orange Construction Fence	$ 2.00	$ 200
LS	1.0	Dewatering	$ 5,000.00	$ 5,000
LS	1.0	New Pump	$ 10,000.00	$ 10,000
LS	1.0	Electrical Upgrade to Lift Station Power Supply	$ 30,000.00	$ 30,000
LS	1.0	New Wet well/Lift Station	$ 30,000.00	$ 30,000
LS	1.0	Utility Allowance/Coordination with Cogen	$ 10,000.00	$ 10,000
LS	1.0	Survey and Engineering for Design and Permitting	$ 30,000.00	$ 30,000
			Subtotal	$ 127,200
			Contingency 30%	$ 38,160
			TOTAL	**$ 165,360**

Table 10.3
Construction of Additional 30" Outfall Alternative
Engineer's Estimate of Probable Construction Cost
Concept Level
September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1.0	Mobilization	$ 15,000.00	$ 15,000
LS	1.0	Clearing and Grubbing	$ 10,000.00	$ 10,000
LS	1.0	Maintenance of Traffic	$ 2,000.00	$ 2,000
LF	2,500.0	Staked Silt Fence (Type III)	$ 4.63	$ 11,575
LF	1,310.0	30" RCP	$ 68.98	$ 90,363
EA	1.0	Type 8 Manhole (<10')	$ 3,000.00	$ 3,000
EA	2.0	30" RCP Mitered End Section	$ 2,383.13	$ 4,766
TN	10.0	Riprap-Rubble w/Filter Fabric (DOT Spec. 530-2.2.2)	$ 53.26	$ 532
SY	450.0	Performance Turf (Sod)(Bahia/St. Augustine)	$ 1.62	$ 729
LF	2,500.0	Orange Construction Fence	$ 2.00	$ 5,000
LS	1.0	Dewatering	$ 10,000.00	$ 10,000
LS	1.0	Removal Existing Structures/Unknown Facilities	$ 5,000.00	$ 5,000
LS	1.0	Permitting/Coordination with CSX for Crossing Track	$ 30,000.00	$ 30,000
LS	1.0	Jack and Bore 30" Culvert Through CSX Track	$ 40,000.00	$ 40,000
LS	1.0	NPDES Compliance	$ 5,000.00	$ 5,000
LS	1.0	Utility Allowance/Coordination with Cogen	$ 15,000.00	$ 15,000
LS	1.0	Survey and Engineering for Design and Permitting	$ 50,000.00	$ 50,000
			Subtotal	$ 297,966
			Contingency 30%	$ 89,390
			TOTAL PHASE I	**$ 387,356**

Table 10.4
Alternative 3: Maximized Excavation Areas at Whitehouse Alternative
Phase 1 – Limited Excavation on City Pond Parcel and 10th Street Parcel Only
Engineer's Estimate of Probable Construction Cost
Concept Level
September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1	Mobilization	$5,000.00	$5,000
LS	1	Clearing and Grubbing	$1,000.00	$1,000
LS	1	Maintenance of Traffic	$2,000.00	$2,000
LF	1,000	Staked Silt Fence (Type III)	$2.00	$2,000
CY	7,750	Earthwork Cut	$8.50	$65,875
SY	2,250	Performance Turf (Sod)(Bahia/St. Augustine)	$1.62	$3,645
LS	1	NPDES Compliance	$1,000.00	$1,000
LS	1	Design and Permitting, Survey and Engineering	$3,000.00	$3,000
			Subtotal	$83,520
			Contingency 30%	$25,056
			TOTAL	**$108,576**

Table 10.5
Alternative 3: Maximized Excavation Areas at Whitehouse Alternative
Phase 2 – Remaining Excavation on City Pond Parcel and PCSB Parcel
Engineer's Estimate of Probable Construction Cost
Concept Level - September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1	Mobilization	$10,000.00	$10,000
LS	1	Clearing and Grubbing	$24,000.00	$24,000
LS	1	Maintenance of Traffic	$3,000.00	$3,000
LF	1900	Staked Silt Fence (Type III)	$2.00	$3,800
CY	19000	Earthwork Cut	$8.50	$161,500
LF	100	30" RCP	$69.00	$6,900
EA	2	30" RCP Mitered End Section	$2,400.00	$4,800
TN	10	Riprap-Rubble w/Filter Fabric	$55.00	$550
SY	5000	Performance Turf (Sod)(Bahia/St. Augustine)	$1.62	$8,100
LF	2900	Orange Construction Fence	$2.00	$5,800
LS	1	Dewatering	$20,000.00	$20,000
LS	1	Removal Existing Structures/Unknown Facilities	$5,000.00	$5,000
LS	1	Wetland Mitigation Planting *	$40,000.00	$40,000
LS	1	NPDES Compliance	$4,000.00	$4,000
LS	1	Utility Allowance	$10,000.00	$10,000
LS	1	Design and Permitting, Survey and Engineering	$72,000.00	$72,000
			Subtotal	$379,450
			Contingency 30%	$113,835
			TOTAL	**$493,285**

***Wetland planting costs do not include monitoring and maintenance activities that likely will be required.**

Table 10.6
Alternative 4, Phase 1 – Reduced Excavation at Whitehouse Alternative & Added Pipe Outfall under CSX
Engineer's Estimate of Probable Implementation Cost
Concept Level - September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1	Mobilization	$5,000.00	$5,000
LS	1	Clearing and Grubbing	$1,000.00	$1,000
LS	1	Maintenance of Traffic	$2,000.00	$2,000
LF	1,000	Staked Silt Fence (Type III)	$2.00	$2,000
CY	7,750	Earthwork Cut	$8.50	$65,875
SY	2,250	Performance Turf (Sod)(Bahia/St. Augustine)	$1.62	$3,645
LS	1	NPDES Compliance	$1,000.00	$1,000
LS	1	Design and Permitting, Survey and Engineering	$3,000.00	$3,000
			Subtotal	$83,520
			Contingency 30%	$25,056
			TOTAL	**$108,576**

Note: This phase only includes excavation at the City's 10th Street parcel and limited expansion of the City's Public Works Facility pond.

Table 10.7
Alternative 4, Phase 2 – Reduced Excavation at Whitehouse Alternative & Added Pipe Outfall under CSX
Engineer's Estimate of Probable Implementation Cost
Concept Level - September 2012

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1	Mobilization	$25,000.00	$25,000
LS	1	Clearing and Grubbing	$20,000.00	$20,000
LS	1	Maintenance of Traffic	$7,000.00	$7,000
LF	5500	Staked Silt Fence (Type III)	$2.00	$11,000
CY	15500	Earthwork Cut	$8.50	$131,750
LF	1460	30" RCP	$69.00	$100,740
EA	5	30" RCP Mitered End Section	$2,400.00	$12,000
EA	1	Type 8 Manhole (<10')	$3,000.00	$3,000
TN	20	Riprap-Rubble w/Filter Fabric	$55.00	$1,100
SY	5500	Performance Turf (Sod)(Bahia/St. Augustine)	$1.62	$8,910
LF	5500	Orange Construction Fence	$2.00	$11,000
LS	1	Dewatering	$20,000.00	$20,000
LS	1	Removal Existing Structures/Unknown Facilities	$10,000.00	$10,000
LS	1	Permitting/Coordination with CSX; Track Crossing	$30,000.00	$30,000
LS	1	Jack and Bore 30" Culvert Through CSX Track	$40,000.00	$40,000
LS	1	NPDES Compliance	$5,000.00	$5,000
LS	1	Utility Allowance	$20,000.00	$20,000
LS	1	Design and Permitting, Easement Acquisition, Survey and Engineering	$72,000.00	$72,000
			Subtotal	$528,500
			Contingency 30%	$158,550
			TOTAL	**$687,050**

* = Wetland planting costs do not include monitoring and maintenance activities that likely will be required.
Note: This phase includes all remaining improvements not constructed during Phase 1.

Table 10.8
Cost/Benefit Summary for Each Alternative

Concept Alternative Considered	Estimated Benefits for 5 Year Design Storm Event (5.75 inches)	Estimated Benefits for 25 Year Design Storm Event (8.5 inches)[1,2]	Cost Estimate	Potential Funding Sources	Comments
Pump Station Capacity Expansion	16 Structures near and large segments of Whitehouse Ave. and 10th St. flood	23 Structures near and large segments of Whitehouse and 10th St. flood	$165,000	PCHA SWFWMD FDOT	Detailed analysis of existing lift station is required to determine if the likely electrical upgrades are required. Limited effectiveness due to reliance on existing 30" outfall pipe. SWFWMD will object to increasing discharge downstream.
Additional 30" pipe under CSX Railroad	16 Structures near and large segments of Whitehouse Ave. and 10th St. flood	23 Structures near and large segments of Whitehouse Ave. and 10th St. flood	$387,000	PCHA SWFWMD FDOT	CSX approval is challenging: permitting additional pipe crossings under their tracks will take negotiations and time. CSX employs a team that does jack and bore of new culverts under their tracks all over the county. SWFWMD will require assessment of increasing peak discharge rates downstream (limits of impacted area will likely be limited in size). New or Modified easement likely required.
Excavation at 10th St. Complex and PCSB Parcel	**No structures flood.** Segment of 10th Street floods but nowhere else.	Only 12 Structures and segments of Whitehouse Ave. and 10th St. still flood	$602,000	PCHA SWFWMD FDOT	Wetland permitting will be difficult and may require additional mitigation to replace existing forested system with a marsh/pond system that approximates the historic wetland. At a minimum, the area will need to be planted and likely monitored for several years.

Concept Alternative Considered	Estimated Benefits for 5 Year Design Storm Event (5.75 inches)	Estimated Benefits for 25 Year Design Storm Event (8.5 inches)[1,2]	Cost Estimate	Potential Funding Sources	Comments
Limited Excavation at 10th St. Complex and PCSB Parcel with Construction of Additional Cross drain under CSX	**No structures flood.** Segment of 10th Street floods but nowhere else.	Only 12 Structures and segments of Whitehouse and 10th St. still flood	$796,000	PCHA SWFWMD FDOT	CSX approval is challenging: permitting additional pipe crossings under their tracks will take negotiations and time. CSX employs a team that does jack and bore of new culverts under their tracks all over the county. SWFWMD will require assessment of increasing peak discharge rates downstream (limits of impacted area will likely be limited in size). New or Modified easement likely required. Avoids wetland impacts of Alternative 3 and the need for mitigation and monitoring of created wetlands. Construction of smaller pond reduces impact on Public Works Complex for similar flood relief benefits to those provided by recommended Alternative 3.

Note:
[1] Structure floor elevations were not available for this study. Therefore actual structure flooding numbers must be confirmed with survey information.
[2]The level of service for the roadways remains at LOS-F however the extent of flooding in this area is significantly reduced on the basis of more frequent rainfall events.

There is very limited room to do much in the way of stormwater quality improvements at the MS4 discharges to the Cogen Plant pumping station. It is possible to put a gross pollutant/ solids separation device such as a baffle box at the confluence of the stormwater discharges along Citrus Country Drive. This potential stormwater quality-specific capital improvement project would include a "second generation" baffle box which captures not only the majority of the sediments discharging in this location but also trash, vegetation and debris. A screening device is included in these units to maintain the floating vegetative debris above the water column to prevent nutrient leaching. These systems therefore have some nutrient removal value. The general concept location of the baffle box and the contributing drainage area of 77± acres are shown in **Appendix B, Figure B-2**. This water quality project may be a necessary element for the improvements associated with the Whitehouse Avenue problem area in order to secure other agency funding. The estimated cost of this conceptual CIP is $160,000± but could be higher should utility conflicts be an issue at this particular location.

Other Capital Improvement Projects Proposed in Area 1

Oak Court & 17th Avenue

Repeat flooding of the residence on Oak Court can be prevented through either paving or frequent maintenance (mowing and sediment removal) of the drainage ditch that runs west to east behind the homes located on Oak Court (**Figure 3-2**). It is assumed that the City would desire reduced routine maintenance and predictable long-term hydraulic efficiency and use of the ditch pavement will be implemented. There is also a concern that the stormwater runoff from the end of this ditch must run overland over Oak Court to drain to the Beauchamp pond drainage collection system. This isolated lack of drainage conveyance can create safety concerns and potentially could be part of the reason the residence was previously flooded. **Figure 10-1** depicts a concept project for including a drainage inlet and storm sewer to pipe stormwater under Oak Court to an existing drainage structure located further north.

The City has also indicated there is a problematic pipe that currently serves the intersection of 17th Avenue and Meridian Avenue. The pipe is exposed and dead ends at grade on the east side of 17th Avenue right-of-way. Recurring erosion occurs at this location. To address problems associated with this pipe, a storm sewer was conceptualized to convey the drainage from the existing pipe north to the previously mentioned concept drainage inlet for the Oak Court CIP. Construction costs for this storm sewer may be exacerbated due to the tight right-of-way, the brick roadway and utilities. A concept storm sewer is shown on **Figure 10-2** and runs down the roadway alignment. In anticipation that the existing storm sewer serving 17th Avenue at the Beauchamp pond system is inadequate to properly handle these improvements, a potential system upgrade of that system is depicted on **Figure 10-3**. The estimated costs for these four CIP"s is $48,000, $25,000, $149,000 and $70,000, for the ditch paving, Oak Court culvert, 17th Avenue storm sewer and pipe/structure replacements, respectively (total combined cost of all four projects is estimated as $292,000).

One additional CIP that the City may want to consider is the vacation of Beauchamp Avenue as a through street between 15th Street and 17th Street and the expansion of the Beauchamp Avenue

ponds at that location (Exhibit 10-3A). This would provide more floodwaters storage during significant storm events reducing the impact of peak stages to the adjacent homes. It is possible the City could turn this area into a passive recreation area with a walking trail and other amenities. Additionally, educational information could be added in conformance with the City"s NPDES MS4 permit. Maintenance access for the existing sanitary lift station and utility lines will have to be preserved with these improvements. The estimated cost for implementing this BMP assuming a short boardwalk is constructed where the two ponds connect is $115,000±.

Moceri Avenue

The City owns several parcels on Moceri Avenue which is located in the previously referenced Area 1C, a subunit to the Whitehouse Avenue problem area. A concept CIP is depicted on **Figure 10-4** showing the three parcels the City owns, with shallow ponds excavated on the parcels. The purpose of this CIP would be to reduce stormwater runoff volume from contributing to the flooding problem at the Dade Oaks Apartments. The concept ponds may or may not be interconnected depending on the final design. Excess runoff from the ponds could be conveyed along the street by curbing located along the south side of Moceri Avenue. Another option would be to connect the ponds with a pipe, but this would likely be cost-prohibitive and unnecessary.

This CIP would serve a drainage area of approximately 3.2 acres, bounded by Clinton Street to the north, Moceri Avenue to the south, 17th Street to the west and the eastern end of Moceri Avenue to the east. The approximate cost of this CIP is $58.000±.

Osceola Street at Davis Avenue

The City received a flooding complaint after the passage of Tropical Storm Debby in June 2012 from the property owner south of the intersection of Osceola Street and Davis Avenue (Area 1B). The backyard ditch in this area overtopped its bank at the south end of the 24" cross drain under Davis Avenue, resulting in yard flooding. This ditch originates at the intersection of Main Avenue and 15th Street, runs east and then turns north to convey drainage behind the backyards of the properties on 15th Street and Osceola Street between Main Avenue and North Avenue. At North Avenue the ditch intersects with another roadside ditch and then runs easterly, discharging through a cross drain under North Avenue approximately 80 feet west of the intersection of North Avenue and 14th Street, near the entrance drive for the electrical substation. All roadway crossing pipe sizes are 24" in diameter.

A concept CIP to address this flooding is depicted on **Figure 10-5**. This CIP includes excavation and reshaping of approximately 870 linear feet of ditch, to provide a nominal 5-foot bottom width. Finished ditch bottom grades would match the inverts of the existing cross drain structures. The ditch bottom and the lower sections of the ditch side slopes would be lined with concrete ditch pavement, to improve hydraulic efficiency and reduce future cleaning and maintenance costs. All cross drains would be replaced with 24" x 38" elliptical concrete pipes and all existing headwall structures would be replaced with sand-cement endwall structures. The estimated cost of this CIP is $134,000±.

7th Street at Pond Avenue (Church of God in Christ)

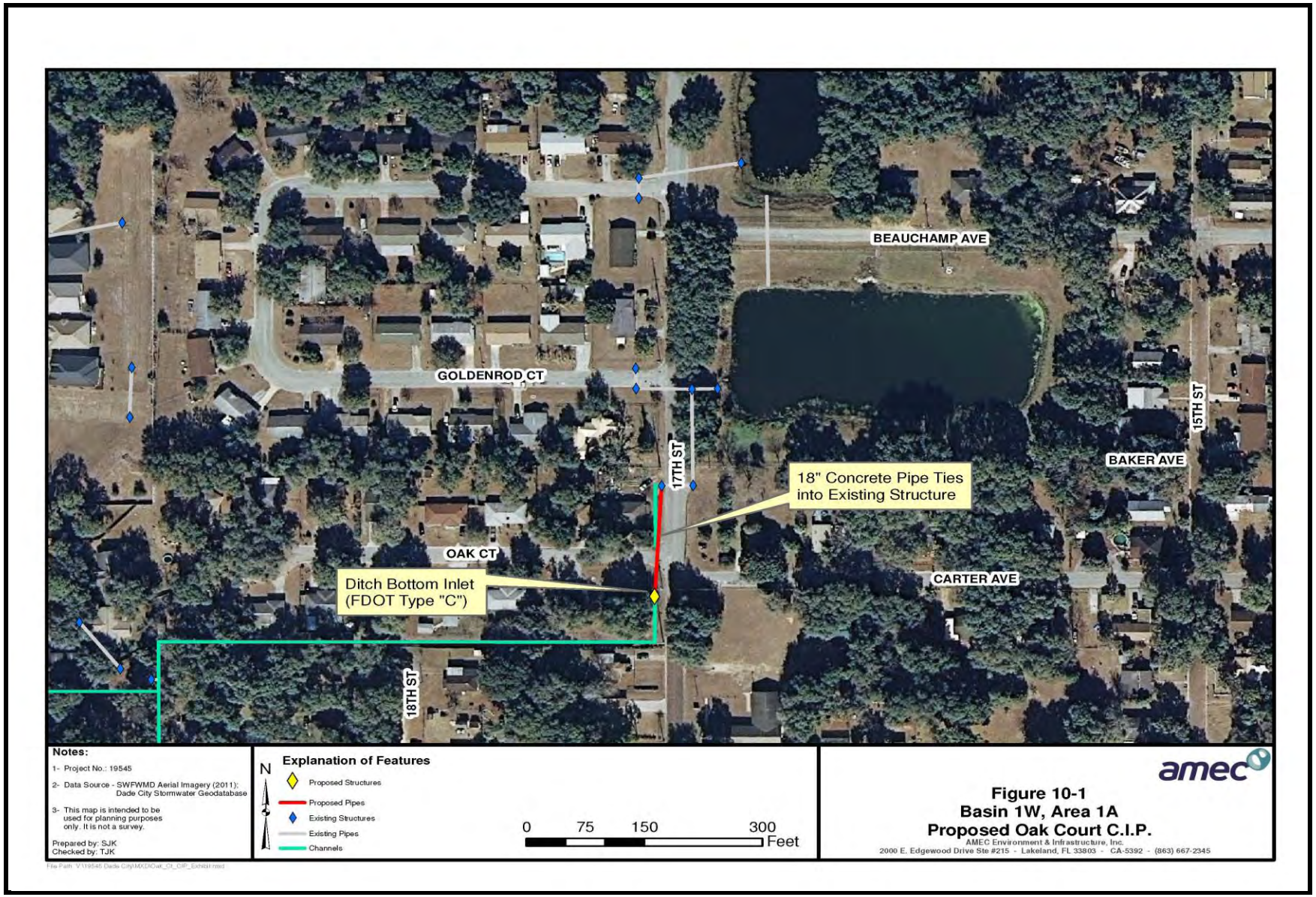
The Church of God in Christ is located in a topographic low point at 14665 North 7th Street, immediately south of a City-owned stormwater pond. The City pond has a stormwater pump to discharge excess stormwater runoff from the pond to the storm sewer system serving North 7th Street. Visual examination of the pump showed it to be in poor condition, and likely undersized for the volume of runoff it is intended to handle. The pond is connected to another recently-constructed pond immediately to the east by means of a 12" PVC pipe. The new pond site, located at the intersection of 6th Street and Pond Avenue, also houses a sanitary sewer lift station. In the past, the City installed a small stormwater lift station to remove stormwater from the church's northern parking area and pump it into the City pond. This helped reduced flooding to some extent; however the church property still floods as a result of more intense rainfall events and the source of the excess floodwaters are reported by City staff to come from overflows from the 6th Street right-of-way.

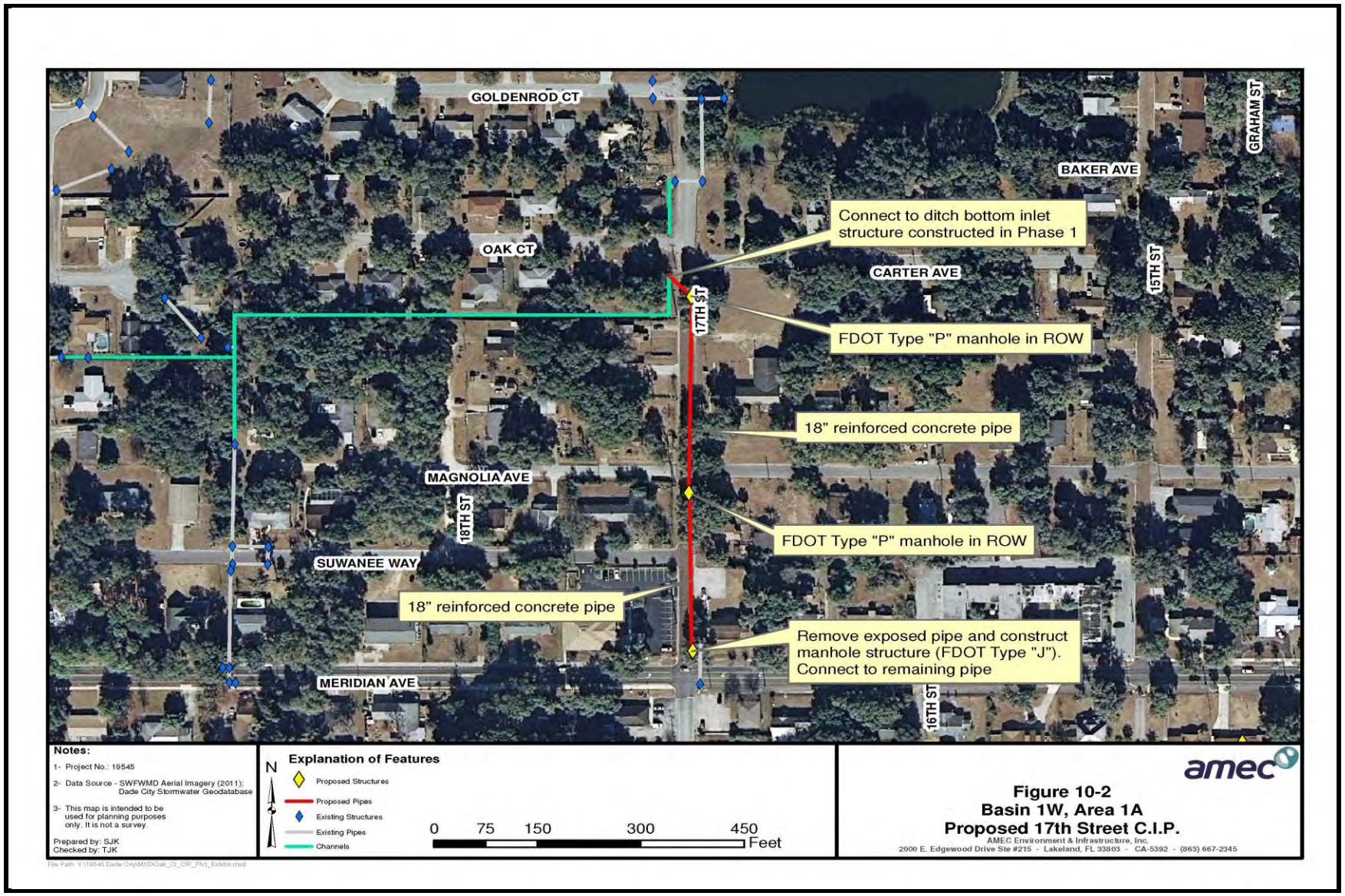
A conceptual CIP to attempt to address flooding at this location is depicted on **Figure 10-6**. Under this CIP, a small berm would be constructed between the 6th Street entrance to the church property and the fence line of the new City pond. This berm would serve to more efficiently contain stormwater runoff from 6th Street within the roadway rights-of-way. During design and permitting, the existing flood model would need to be more detailed in this area. Design efforts must confirm that no adverse impacts occur to adjacent properties as a result of constructing the berm. The existing 12" PVC pipe connecting the City ponds would be replaced by a 24" pipe. This pipe would serve to better equalize the water levels in the two ponds and improve conveyance to the existing pump station. The estimated cost of the concept CIP, excluding studies or proposed upgrades to existing pumps, is $25,000±.

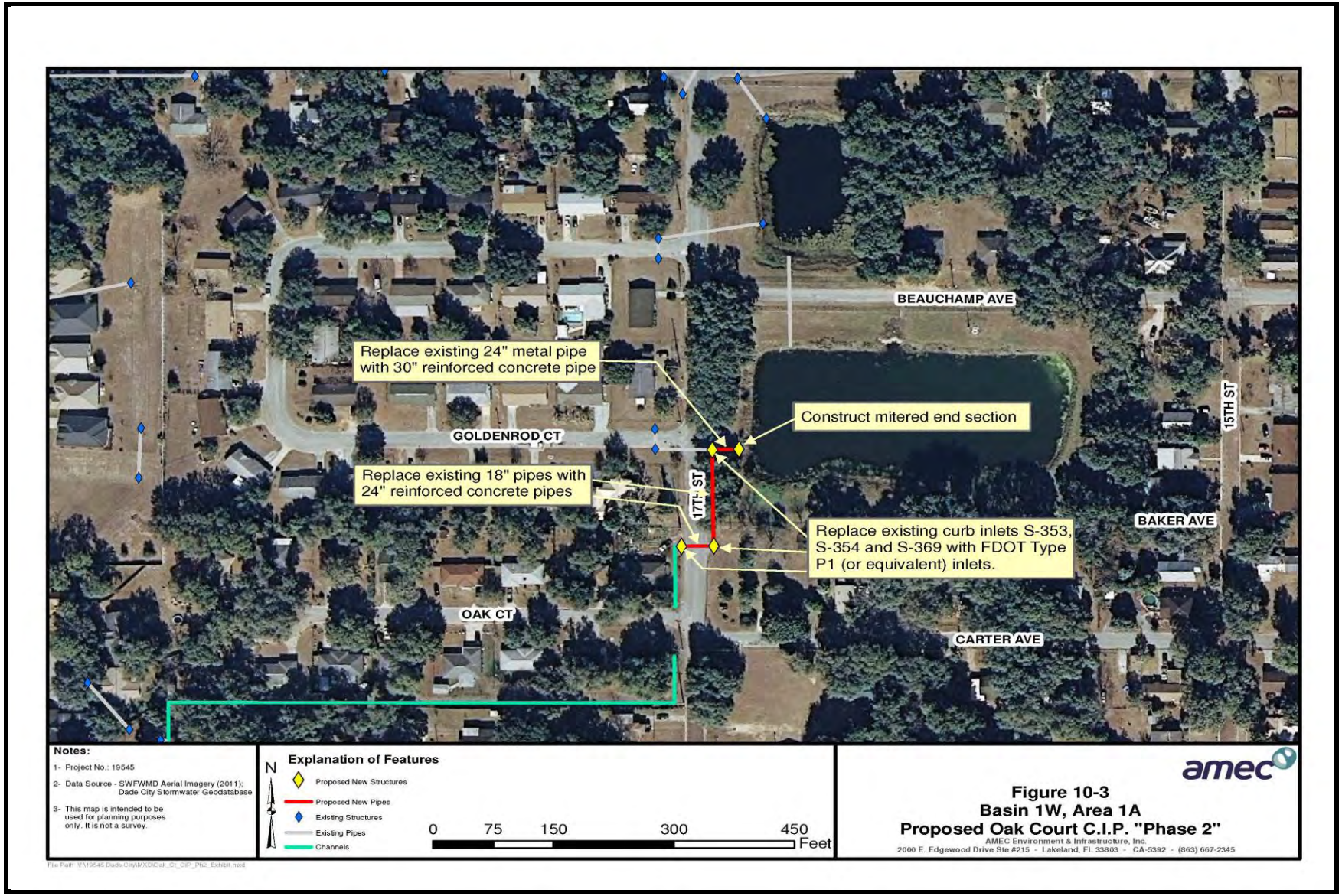
It should be noted that only limited relief for local flooding would be provided from this conceptual alternative. Consideration should be given to upgrading the pumping systems that serve this low lying area. This would require a detailed engineering study of the area which is beyond the scope of this project. Additionally, it is possible that the Church can consider several forms of structural flood proofing such as the use of temporary flood barriers on the affected access door and/or windows. Temporary flood barriers could be installed when significant rainfall is expected in the area and can be removed when the flood danger passes.

Erosion at St. Joe Road West of 22nd Street

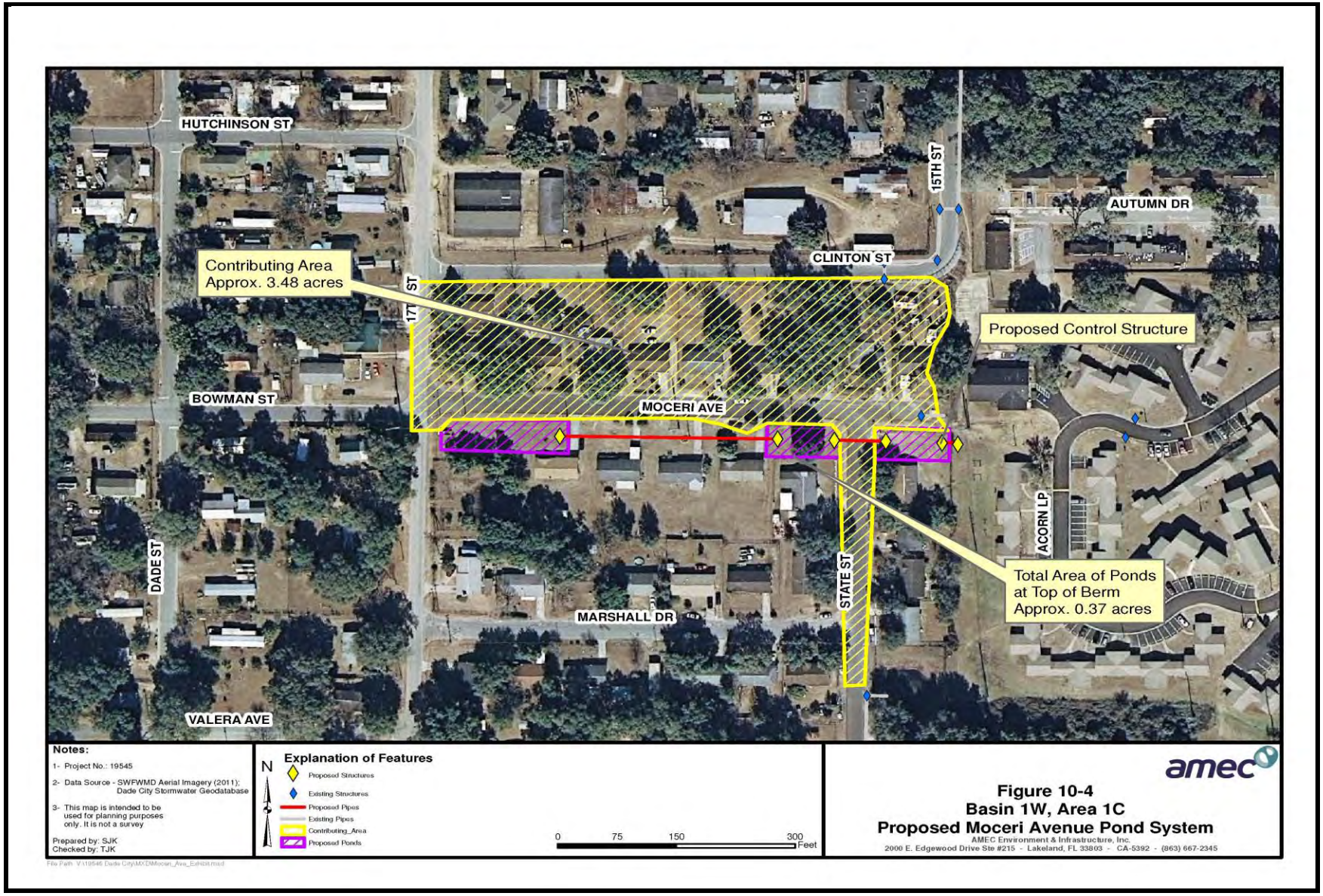
Currently a significant amount of stormwater runoff from up gradient areas collects on the south side of St. Joe Road just west of 22nd Street. Stormwater runoff is collected in several curb inlets and discharges to the south into an eroding ditch section located on the south side of the road. The proposed capital improvement project will eliminate the curb inlets and include a flume and ditch pavement to safely convey the stormwater down the hill in a non-erosive manner. The estimated implementation cost for this CIP is approximately $36,000.

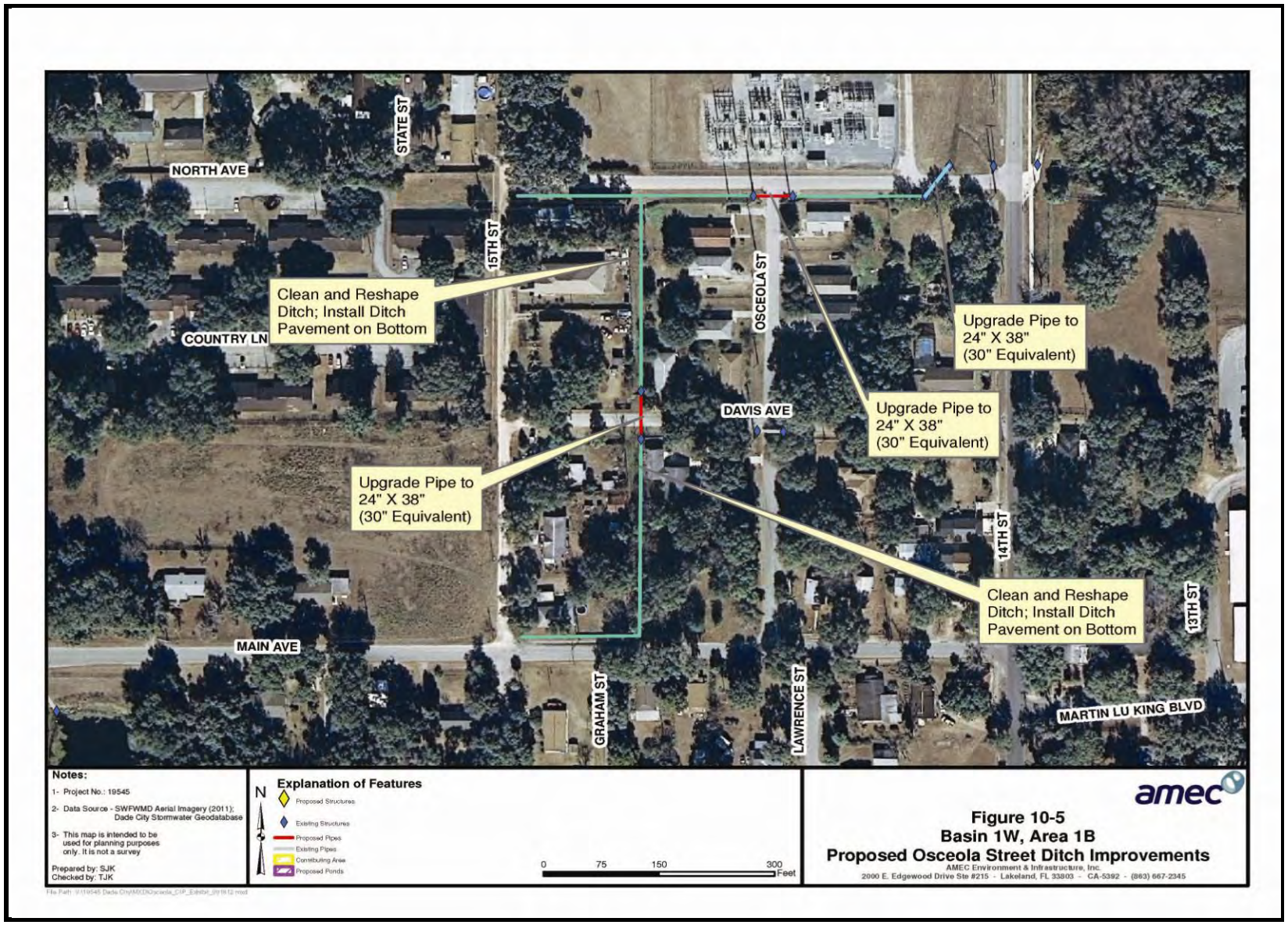

BEAUCHAMP AVE
GOLDENROD CT
17TH ST
15TH ST
BAKER AVE
18" Concrete Pipe Ties into Existing Structure
OAK CT
Ditch Bottom Inlet (FDOT Type "C")
CARTER AVE
18TH ST
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey.
Prepared by: SJK
Checked by: TJK
N
Explanation of Features
Proposed Structures
Proposed Pipes
Existing Structures
Existing Pipes
Channels
0 75 150 300 Feet
amec
Figure 10-1
Basin 1W, Area 1A
Proposed Oak Court C.I.P.
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345

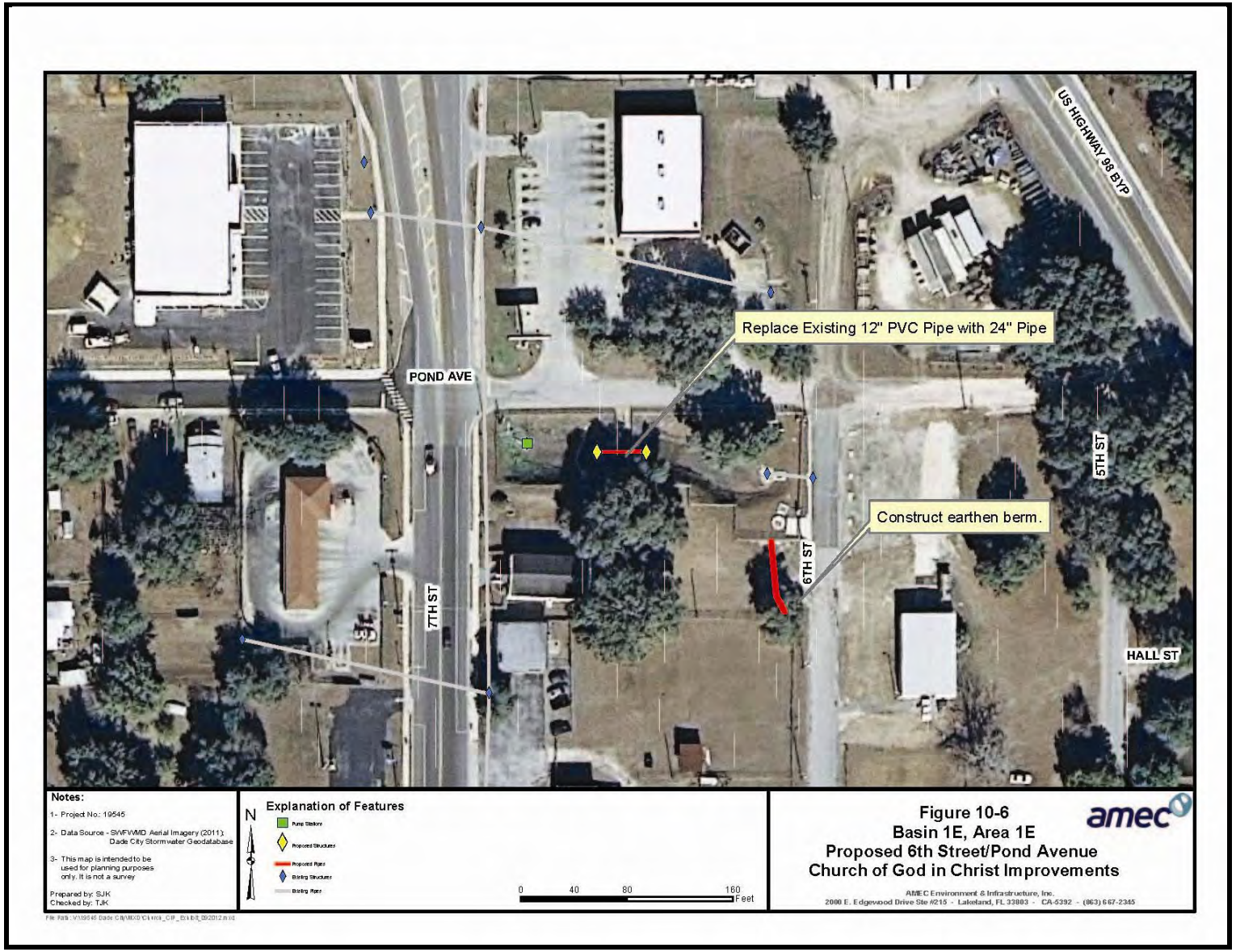

GOLDENROD CT
OAK CT
BAKER AVE
GRAHAM ST
CARTER AVE
15TH ST
17TH ST
MAGNOLIA AVE
18TH ST
SUWANEE WAY
MERIDIAN AVE
16TH ST
Connect to ditch bottom inlet structure constructed in Phase 1
FDOT Type "P" manhole in ROW
18" reinforced concrete pipe
FDOT Type "P" manhole in ROW
18" reinforced concrete pipe
Remove exposed pipe and construct manhole structure (FDOT Type "J"). Connect to remaining pipe
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey.
Prepared by: SJK
Checked by: TJK
N
Explanation of Features
Proposed Structures
Proposed Pipes
Existing Structures
Existing Pipes
Channels
0 75 150 300 450
Feet
amec
Figure 10-2
Basin 1W, Area 1A
Proposed 17th Street C.I.P.
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345


Replace existing 24" metal pipe with 30" reinforced concrete pipe
Construct mitered end section
Replace existing 18" pipes with 24" reinforced concrete pipes
Replace existing curb inlets S-353, S-354 and S-369 with FDOT Type P1 (or equivalent) inlets.
BEAUCHAMP AVE
GOLDENROD CT
17TH ST
15TH ST
BAKER AVE
OAK CT
CARTER AVE
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey.
Explanation of Features
Proposed New Structures
Proposed New Pipes
Existing Structures
Existing Pipes
Channels
N
0 75 150 300 450
Feet
amec
Figure 10-3
Basin 1W, Area 1A
Proposed Oak Court C.I.P. "Phase 2"
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345


Enlarge Existing Ponds
BEAUCHAMP AVE
GOLDENROD CT
17TH ST
15TH ST
BAKER AVE
OAK CT
CARTER AVE
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey.
Explanation of Features
Proposed Beauchamp Pond Expansion
N
0 75 150 300
Feet
amec
Figure 10-3A
Basin 1W, Area 1A
Proposed Beauchamp Pond Expansion
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345


HUTCHINSON ST
15TH ST
AUTUMN DR
CLINTON ST
Contributing Area
Approx. 3.48 acres
17TH ST
Proposed Control Structure
BOWMAN ST
MOCERI AVE
ACORN LP
DADE ST
STATE ST
Total Area of Ponds
at Top of Berm
Approx. 0.37 acres
MARSHALL DR
VALERA AVE
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey
Prepared by: SJK
Checked by: TJK
N
Explanation of Features
Proposed Structures
Existing Structures
Proposed Pipes
Existing Pipes
Contributing_Area
Proposed Ponds
0
75
150
300
Feet
amec
Figure 10-4
Basin 1W, Area 1C
Proposed Moceri Avenue Pond System
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345


STATE ST
NORTH AVE
15TH ST
OSCEOLA ST
COUNTRY LN
Clean and Reshape Ditch; Install Ditch Pavement on Bottom
Upgrade Pipe to 24" X 38" (30" Equivalent)
Upgrade Pipe to 24" X 38" (30" Equivalent)
DAVIS AVE
Upgrade Pipe to 24" X 38" (30" Equivalent)
14TH ST
Clean and Reshape Ditch; Install Ditch Pavement on Bottom
13TH ST
MAIN AVE
GRAHAM ST
LAWRENCE ST
MARTIN LU KING BLVD
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey
Prepared by: SJK
Checked by: TJK
Explanation of Features
Proposed Structures
Existing Structures
Proposed Pipes
Existing Pipes
Contributing Area
Proposed Ponds
N
0 75 150 300 Feet
amec
Figure 10-5
Basin 1W, Area 1B
Proposed Osceola Street Ditch Improvements
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345


US HIGHWAY 98 BYP
Replace Existing 12" PVC Pipe with 24" Pipe
POND AVE
5TH ST
Construct earthen berm.
6TH ST
7TH ST
HALL ST
Notes:
1- Project No.: 19545
2- Data Source - SWFWMD Aerial Imagery (2011); Dade City Stormwater Geodatabase
3- This map is intended to be used for planning purposes only. It is not a survey
Prepared by: SJK
Checked by: TJK
Explanation of Features
N
0 40 80 160
Feet
Figure 10-6
Basin 1E, Area 1E
Proposed 6th Street/Pond Avenue
Church of God in Christ Improvements
amec
AMEC Environment & Infrastructure, Inc.
2000 E. Edgewood Drive Ste #215 - Lakeland, FL 33803 - CA-5392 - (863) 667-2345

10.2 Downtown Problem Area

Summary of Existing Conditions

The downtown area of Dade City experiences frequent street flooding from "routine" rainfall events that often occur during the summer months. During these storms, runoff flows uncontrolled down the city streets, and can reach depths and velocities that are hazardous to pedestrian traffic and have resulted in flooding of parking lots at businesses located in the downtown area. The primary causes of this flooding have been identified to a number of factors that are briefly described below.

- The downtown area lies along the base of a sandy ridge area with lands located to the south and east draining toward downtown. Over the years, as the city has grown, these areas have been developed with buildings, parking areas, streets and other paved areas that do not allow stormwater to percolate down into the ground. In addition, the downtown area itself is almost completely covered with impermeable surfaces. This results in very large volumes of excess stormwater runoff that reaches appreciable velocities as it moves through the downtown area.

- Most of the construction in the downtown area predates environmental resource permitting which was implemented by the Southwest Florida Water Management District (SWFWMD) in the 1980"s. Environmental resource permitting imposes requirements for new development to include stormwater ponds to manage excess runoff. Since most of the construction in the Dade City downtown area was completed before these requirements were implemented, there are almost no constructed facilities that would help to attenuate the volume of stormwater runoff entering the downtown area.

- The existing storm sewer system in the downtown area was constructed when the area was considerably less built out than it is at present. In fact, for the most part, the City infrastructure was laid out with reliance for stormwater to drain via shallow roadway gutters. The natural topography with slopes of 1.5 to 3% was sufficient for stormwater to drain downhill by gravity. However, the increased runoff volumes and rates of flow from development have surpassed the capacity of shallow gutter systems. As a result, the system is now undersized for the current volume of stormwater runoff flowing to the downtown area during rainfall events. This causes inlets and pipes in the area to surcharge, creating street flooding.

The entire contributing area for the downtown area is approximately 198 acres. Under current conditions, runoff from this area flows in a generally northerly and easterly direction, toward the right-of-way for State Road 533 (US Highway 98/301 Bypass), via predominantly overland flow. Once the stormwater enters the State Road 533 right-of-way, it flows through roadside ditches to a 48" concrete culvert located approximately 430 feet north of the intersection of State Road 533 and Meridian Avenue (State Road 52). This culvert conveys runoff under State Road 533 to a

48" metal culvert that runs under the alignment for the CSX Transportation railroad located east of State Road 533. From this culvert, runoff flows southward through a man made channel to an approximately 7-acre pond located in the City-owned parcel referred to as "Irvin Park." This pond was originally used as an impoundment for treated effluent from the City"s wastewater treatment plant located at Irwin Avenue and Canal Street. The plant no longer discharges to the pond. From the pond, water flows through a 48" metal pipe that conveys it under Canal Street and to a man-made ditch, which leads to the Duck Lake system and eventually to the Withlacoochee River floodplain.

Please refer to **Exhibits 6, 6A, 6B, 7, 7A, and 7B** for additional information on conditions in the downtown area and on the modeling setup used.

Analysis of Downtown Dade City Flooding

The downtown flooding problems were analyzed as part of AMEC"s update to the City"s current Stormwater Master Plan, and for the design of the Downtown Drainage Capital Improvement Project. The area was modeled in ICPR, using available topographic data, plan sets and other information provided by the City, environmental resource permit data from SWFWMD for the few constructed stormwater management systems within the project area, and observations made during field visits and discussions with City Public Works personnel. Permit applications for the Downtown Drainage Capital Improvement Project are currently under review by SWFWMD and the Florida Department of Transportation (FDOT).

The modeling results confirmed the primary causes for downtown street flooding discussed above, and also identified another issue which affects the final design of the capital improvements project. The 48" culverts under the rights-of-way for State Road 533 and the CSX railroad serve as significant bottlenecks on the entire downtown contributing drainage area, even under existing conditions. This potentially limits the overall level of service to which any project to improve downtown drainage can be designed since drainage problems in one area cannot simply be transferred to down gradient areas. Additionally, the permitting process to upgrade the existing FDOT and CSX culverts would be costly and protracted for the City, with no guarantee of finally securing the required permits.

Downtown Stormwater Capital Improvements Project

The Downtown Stormwater Capital Improvements Project consists of two primary goals.

1. Construction of a storm sewer system along Pasco Avenue between 7th Street and 3rd Street. This storm sewer will serve to intercept stormwater runoff flowing down the hill to the south of the downtown area and more efficiently convey it toward the State Road 533 right-of-way. This will result in considerably less runoff reaching the overloaded existing downtown drainage system, and should reduce the frequency and magnitude of street flooding, at least for smaller, more frequent rainfall events.

2. Improvements to the receiving pond at Irvin Park. Under this project, the pond will be enlarged to provide additional volume for incoming stormwater runoff, and several improvements to enhance the treatment of this runoff will be made, resulting in an improvement to the quality of runoff being discharged to the Duck Lake receiving system.

These above goals are discussed in more detail below.

Pasco Avenue Storm Sewer

The proposed storm sewer for Pasco Avenue will begin with new inlets installed south of Pasco Avenue on 7th Street and at the intersection of Pasco Avenue and 7th Street. These inlets will carry stormwater runoff to a 30" concrete pipe installed on the south side of Pasco Avenue. Additional inlets will be installed at the intersections of Pasco Avenue and 6th, 5th, 4th and 3rd Streets, with the main line increasing in size to a maximum of 42" diameter just east of 5th Street. Once this pipe reaches 3rd Street, it turns north and runs along the east side of 3rd Street, crossing Meridian Avenue and continuing to run north until it reaches Live Oak Avenue, where it turns to the east again and discharges to the FDOT roadside ditch for State Road 533 at a point east of the east end of Live Oak Avenue. The total length of installed pipe is approximately 2,400 linear feet. Construction of the proposed storm sewer system will involve replacement of curbs and sidewalks along Pasco Avenue, as well as potential relocation of existing sanitary sewer and potable water services in the area.

Irvin Pond Improvements

The proposed improvements to the existing pond at Irvin Park include excavation at the southwest corner to enlarge the pond to approximately 9.5 acres in size at a design top-of-bank elevation of 72.0 ft. NAVD and construction of a deep sump area at the northwest corner where the existing channel enters the pond, to allow for better capture of entrained sediments in the stormwater runoff entering the pond. Improvements also include construction of two long, narrow berms with a top elevation of 71.5 ft NAVD, which will force stormwater entering the pond to take a long, circuitous route through the facility, further enhancing the pond's stormwater treatment capacity. In addition, the existing outfall from the pond which conveys water under Canal Street will be replaced with a new 48" concrete pipe, and will be fitted with a concrete control structure to regulate the water level at the seasonal high water elevation of 68.3 ft NAVD.

The preliminary peak estimated stages in the pond for the storm events modeled are compared for existing and proposed conditions in **Table 10.9** below.

TABLE 10.9
Peak Estimated Stages at Irvin pond
Existing and Proposed Conditions
(Preliminary – Subject to Agency Permitting)

STORM	RAINFALL AMOUNT (IN.)	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)
		EXISTING	PROPOSED	
2.33 Yr, 24 Hr.	4.75	69.88	69.76	-1.4
5 Yr., 24 Hr.	5.75	70.17	70.01	-1.9
10 Yr., 24 Hr.	7.0	70.49	70.35	-1.7
25 Yr., 24 Hr.	8.5	70.89	70.88	-0.1
50 Yr., 24 Hr.	9.5	71.15	71.25	1.2
100 Yr. 24 Hr.	12.0	71.75	71.92	2.0

While peak stages decrease for the smaller magnitude events, they slightly increase for the larger magnitude events, however in no case exceed the design top of bank elevation of 72.0 ft. NAVD. The pond modifications should not exacerbate any existing flooding issues in the Irvin Park area, and should result in improvements during larger magnitude storm events.

Please refer to **Appendix D** (attached) for additional information on the proposed downtown drainage and pond improvements.

Summary of Improvements to Downtown Flooding with Construction of Capital Improvement Project

The predicted peak stages at key locations of the downtown area are summarized in **Tables 10.10 through 10.15** for the 2.33, 5, 10, 25, 50 and 100-24 year design storm events. Additionally, **Tables 10.16 and 10.17** have similar information for the 2Yr/1Hr and 10Yr/2Hr design storm events. The most significant improvements occur at 7th Street and on Meridian Avenue between 6th and 7th Streets. For smaller, "routine" events up to the 5-year, 24-hour storm (5.75 inches of rainfall) street flooding is eliminated in these areas, and conditions near the State Road 533 right-of-way are not significantly worsened. The FDOT drainage connection permit application (currently under review) demonstrated that conditions worsened at the area near the proposed downtown outfall, but slightly improved at locations to the south along the State Road 533 alignment (intersection of Pasco Avenue and areas north of the intersection).

During larger rainfall events (in excess of 7 inches), street flooding will continue to occur in the downtown area, and further attempts to alleviate this are likely to become cost prohibitive for the City. Such alternatives would involve constructing stormwater impoundments to capture and attenuate and/or slow down runoff before it reaches the FDOT right-of-way. This would involve considerable cost for the City in acquiring properties for the construction of these facilities, as well as the associated permitting and design costs. The current design, in our opinion, provides the City with the best possible cost-to-benefit ratio. The estimated construction cost for this alternative is approximately $1.8 million. Please refer to the attached engineer‟s opinion of probable cost (**Table 10.18**) for this alternative.

TABLE 10.10
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
2.33-YEAR (MEAN ANNUAL), 24 HOUR STORM EVENT, RAINFALL AMOUNT 4.75 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	97.93	93.78	-49.8	97.66
Meridian Avenue & 7th Street	94.80	93.53	-15.2	96.03
6th Street Between Pasco Ave & Meridian Ave.	92.62	91.07	-18.6	92.76
Meridian Ave. Between 6th Street & 7th Street	92.28	88.46	-45.8	92.54
Meridian Avenue at 5th Street	92.66	92.37	-3.5	92.09
Live Oak Avenue at 6th Street	87.63	86.39	-14.9	87.00
Live Oak Avenue at 5th Street	86.13	85.75	-4.6	86.00
Live Oak Avenue at 3rd Street	74.98	73.23	-21.0	74.30
Pineapple Avenue at 6th Street	81.20	81.14	-0.7	81.12
7th Street & Madill Avenue	77.53	76.48	-12.6	79.00
US Hwy. 98 Bypass at Meridian Avenue	73.44	73.24	-2.4	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.11
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
5-YEAR, 24 HOUR STORM EVENT; RAINFALL AMOUNT 5.75 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	97.95	95.32	-31.6	97.66
Meridian Avenue & 7th Street	95.06	93.60	-17.5	96.03
6th Street Between Pasco Ave & Meridian Ave.	92.76	91.36	-16.8	92.76
Meridian Ave. Between 6th Street & 7th Street	92.76	89.82	-35.3	92.54
Meridian Avenue at 5th Street	92.70	92.38	-3.8	92.09
Live Oak Avenue at 6th Street	87.71	86.95	-9.1	87.00
Live Oak Avenue at 5th Street	86.18	85.77	-4.9	86.00
Live Oak Avenue at 3rd Street	75.22	73.92	-15.6	74.30
Pineapple Avenue at 6th Street	81.32	81.25	-0.8	81.12
7th Street & Madill Avenue	78.89	76.79	-25.2	79.00
US Hwy. 98 Bypass at Meridian Avenue	73.98	73.93	-0.6	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.12
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
10-YEAR, 24 HOUR STORM EVENT; RAINFALL AMOUNT 7.0 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	97.98	97.19	-9.5	97.66
Meridian Avenue & 7th Street	95.16	93.90	-15.1	96.03
6th Street Between Pasco Ave & Meridian Ave.	93.10	92.31	-9.5	92.76
Meridian Ave. Between 6th Street & 7th Street	93.10	90.83	-27.2	92.54
Meridian Avenue at 5th Street	92.75	92.40	-4.2	92.09
Live Oak Avenue at 6th Street	87.77	87.60	-2.0	87.00
Live Oak Avenue at 5th Street	86.23	85.80	-5.2	86.00
Live Oak Avenue at 3rd Street	75.54	74.63	-10.9	74.30
Pineapple Avenue at 6th Street	81.42	81.36	-0.7	81.12
7th Street & Madill Avenue	79.61	78.31	-15.6	79.00
US Hwy. 98 Bypass at Meridian Avenue	74.76	74.64	-1.4	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.13
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
25-YEAR, 24 HOUR STORM EVENT; RAINFALL AMOUNT 8.5 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	98.01	97.46	-6.6	97.66
Meridian Avenue & 7th Street	95.24	94.55	-8.3	96.03
6th Street Between Pasco Ave & Meridian Ave.	93.44	92.59	-10.2	92.76
Meridian Ave. Between 6th Street & 7th Street	93.44	91.93	-18.0	92.54
Meridian Avenue at 5th Street	92.81	92.41	-4.8	92.09
Live Oak Avenue at 6th Street	87.83	87.78	-0.6	87.00
Live Oak Avenue at 5th Street	86.28	85.83	-5.4	86.00
Live Oak Avenue at 3rd Street	75.94	75.46	-5.8	74.30
Pineapple Avenue at 6th Street	81.50	81.46	-0.5	81.12
7th Street & Madill Avenue	79.87	79.70	-2.0	79.00
US Hwy. 98 Bypass at Meridian Avenue	75.14	75.44	3.6	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.14
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
50-YEAR, 24 HOUR STORM EVENT; RAINFALL AMOUNT 9.5 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	98.03	97.76	-3.2	97.66
Meridian Avenue & 7th Street	95.28	95.08	-2.4	96.03
6th Street Between Pasco Ave & Meridian Ave.	93.64	92.63	-0.1	92.76
Meridian Ave. Between 6th Street & 7th Street	93.64	92.39	-15.0	92.54
Meridian Avenue at 5th Street	92.85	92.42	-5.2	92.09
Live Oak Avenue at 6th Street	87.87	87.83	-0.5	87.00
Live Oak Avenue at 5th Street	86.32	85.85	-5.6	86.00
Live Oak Avenue at 3rd Street	76.37	75.91	-4.8	74.30
Pineapple Avenue at 6th Street	81.54	81.52	-0.2	81.12
7th Street & Madill Avenue	79.93	79.90	-0.4	79.00
US Hwy. 98 Bypass at Meridian Avenue	75.57	75.85	3.4	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.15
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
100-YEAR, 24 HOUR STORM EVENT; RAINFALL AMOUNT 12.0 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	98.07	98.11	0.5	97.66
Meridian Avenue & 7th Street	95.37	95.24	-1.6	96.03
6th Street Between Pasco Ave & Meridian Ave.	94.11	92.85	-15.1	92.76
Meridian Ave. Between 6th Street & 7th Street	94.11	92.85	-15.1	92.54
Meridian Avenue at 5th Street	92.95	92.43	-6.2	92.09
Live Oak Avenue at 6th Street	87.94	87.91	-0.2	87.00
Live Oak Avenue at 5th Street	86.40	85.89	-6.1	86.00
Live Oak Avenue at 3rd Street	77.57	76.53	-12.5	74.30
Pineapple Avenue at 6th Street	81.61	81.60	-0.1	81.12
7th Street & Madill Avenue	79.80	80.21	4.9	79.00
US Hwy. 98 Bypass at Meridian Avenue	76.16	76.64	5.8	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.16
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
2-YEAR, 1 HOUR FDOT STORM EVENT; RAINFALL AMOUNT 2.3 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	97.96	95.74	-26.6	97.66
Meridian Avenue & 7th Street	95.08	93.63	-17.4	96.03
6th Street Between Pasco Ave & Meridian Ave.	92.72	91.83	-10.7	92.76
Meridian Ave. Between 6th Street & 7th Street	92.72	90.38	-28.1	92.54
Meridian Avenue at 5th Street	92.72	92.39	-5.2	92.09
Live Oak Avenue at 6th Street	87.64	87.15	-5.9	87.00
Live Oak Avenue at 5th Street	86.20	85.78	-5.0	86.00
Live Oak Avenue at 3rd Street	75.38	73.22	-25.9	74.30
Pineapple Avenue at 6th Street	81.34	81.27	-0.8	81.12
7th Street & Madill Avenue	79.27	77.04	-26.8	79.00
US Hwy. 98 Bypass at Meridian Avenue	74.16	73.06	-13.2	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.17
COMPARISON OF PEAK FLOOD STAGES FOR EXISTING AND PROPOSED CONDITIONS IN DADE CITY DOWNTOWN AREA
10-YEAR, 1 HOUR FDOT STORM EVENT; RAINFALL AMOUNT 4.2 INCHES

LOCATION	PEAK PREDICTED STAGE, FT. NAVD		DIFFERENCE (IN.)	SURFACE FLOODING ELEVATION, FT. NAVD
	EXISTING CONDITIONS	PROPOSED CONDITIONS		
Pasco Avenue & 7th Street	98.00	97.41	-7.1	97.66
Meridian Avenue & 7th Street	95.21	94.26	-11.4	96.03
6th Street Between Pasco Ave & Meridian Ave.	93.13	92.56	-6.8	92.76
Meridian Ave. Between 6th Street & 7th Street	93.10	91.66	-17.3	92.54
Meridian Avenue at 5th Street	92.80	92.41	-4.7	92.09
Live Oak Avenue at 6th Street	87.75	87.68	-0.08	87.00
Live Oak Avenue at 5th Street	86.27	85.83	-5.3	86.00
Live Oak Avenue at 3rd Street	75.90	73.51	-28.7	74.30
Pineapple Avenue at 6th Street	81.44	81.41	-0.4	81.12
7th Street & Madill Avenue	79.80	79.57	-2.8	79.00
US Hwy. 98 Bypass at Meridian Avenue	74.96	73.81	-13.8	76.54

Note: Surface flooding elevation is the estimated roadway centerline elevation using, in most cases, the aerial digital elevation model which has a potential error of 0.3' ±. Only in locations of the topographic survey for the downtown area was the roadway centerline obtained to topographic survey standards.

TABLE 10.18
ENGINEER'S OPINION OF PROBABLE COST
DOWNTOWN STORMWATER CAPITAL IMPROVEMENT PROJECT

Description	Unit	Unit Cost	Quantity	Total Cost
Mobilization	LS	$120,000.00	1	$120,000.00
Video	LS	$2,000.00	1	$2,000.00
Maintenance of Traffic	LS	$55,000.00	1	$55,000.00
Staked Silt Fence	LF	$2.00	1,500	$3,000.00
Floating Turbidity Barrier	LF	$10.00	50	$500.00
Sediment Barrier	LF	$10.00	300	$3,000.00
Clear & Grub	AC	$7,500.00	5	$37,500.00
Pavement Removal	SY	$15.00	2,844	$42,666.67
Project Signage	EA	$700.00	1	$700.00
Excavation	CY	$12.00	23,000	$276,000.00
Sub base	SY	$3.00	2,844	$8,533.33
Optional Base Material - Group 11	SY	$20.00	2,844	$56,888.89
Asphalt (1.5")	TN	$125.00	235	$29,333.33
Type 5 Curb Inlet	EA	$4,200.00	8	$33,600.00
Type V Ditch Bottom Inlet	EA	$2,700.00	2	$5,400.00
Ditch Bottom Inlet - Type E w/J Btm	EA	$5,200.00	2	$10,400.00
Type 8 Manhole (<10')	EA	$3,000.00	2	$6,000.00
Type J-7 Manhole w/J Btm	EA	$6,000.00	4	$24,000.00
Type 5 Curb Inlet w/ J Btm	EA	$5,000.00	4	$20,000.00
Type 10 Curb Inlet (<10')	EA	$3,800.00	1	$3,800.00
Type H	EA	$14,000.00	1	$14,000.00
Endwall (48")	CY	$1,000.00	8	$8,200.00
Reinforced Concrete Pipe (RCP) (24")	LF	$120.00	437	$52,440.00
Reinforced Concrete Pipe (RCP) (30")	LF	$135.00	288	$38,880.00
Reinforced Concrete Pipe (RCP) (48")	LF	$170.00	59	$10,030.00
Reinforced Concrete Pipe (RCP) (18")	LF	$60.00	67	$4,020.00
Reinforced Concrete Pipe (RCP) (42")	LF	$160.00	1,277	$204,320.00
Reinforced Concrete Pipe (RCP) (36")	LF	$155.00	264	$40,920.00
Curb - Type D	LF	$22.00	301	$6,622.00
Curbing (Type F and Transition)	LF	$22.00	834	$18,348.00
Rubble Riprap	TN	$275.00	5	$1,375.00
Sidewalk	SY	$45.00	221	$9,945.00
Fabriform	SY	$100.00	786	$78,566.67
Sod - Bahia	SY	$3.00	17,107	$51,320.00
Landscaping	LS	$10,000.00	0	$0.00
Construction Survey & As-Builts	LS	$40,000.00	1	$40,000.00
Surface Water Management	LS	$65,000.00	1	$65,000.00
Utility Adjustments	LS	$30,000.00	1	$30,000.00
			Subtotal	**$1,412,308.89**
			Contingency (25%)	**$353,077.22**
			Total	**$1,765,386.11**

10.3 Howard Avenue Street Problem Area

Summary of Existing Conditions

The section of Howard Avenue between 12th Street and the crossing for the former Seaboard Air Line railroad right-of-way near 9th Street (converted to a multipurpose pedestrian and bicycling trail in 2007) has long been identified as a problem area for the City, requiring frequent road closures after routine rainfall events due to street flooding on Howard Avenue. The location of the flooding is centered on a vertical low point in the Howard Avenue alignment, which has a minimum edge of pavement elevation of approximately 107 ft. NAVD at a location 600± feet west of the trail crossing at Howard Avenue.

The City attempted to alleviate the flooding in this area by constructing improvements to Howard Avenue in 2007 and 2008. The original proposed improvements included upgrades to stormwater, potable water and sanitary sewer services, but due to budget constraints the City was forced to reduce the scope of the project. However, a review of the as-built plans indicates that the cuts were made to the proposed sanitary sewer and potable water improvements, and that the stormwater improvements were constructed as proposed. The constructed stormwater improvements included replacement of two existing curb inlets located at the low point of the above noted location, construction of a 0.25-acre surge pond located at the southwest corner of the trail crossing at Howard Avenue, and construction of a new 30" RCP storm sewer connecting the new inlets to the pond.

The surge pond was constructed in line with an existing 24" storm sewer line that originates at the intersection of 8th Street and Pineapple Avenue, runs southward and crosses State Road 52 (Meridian Avenue), and then continues to run in a roughly north-to-south alignment to the pond. This line picks up stormwater runoff from inlets located on Church Avenue and McMinn Avenue along the way. The total contributing area from this existing line north of the pond is approximately 18 acres. Additionally, a 2.3 acre area located directly west of the trail crossing at Howard Avenue also contributes by means of a series of small inlets connected to the main storm sewer line by a 15" pipe. The contributing area of the newly constructed storm sewer along Howard Avenue is approximately 48 acres.

Stormwater runoff entering the surge pond leaves the facility by means of a 30" RCP. This stormwater pipe terminates at a City-owned lift station located at the Florida Avenue crossing of the multipurpose trail, where it is joined with runoff from a 25 ± acre area centered on Florida Avenue between 14th Street and the trail crossing. The stormwater from Florida Avenue flows to the lift station by means of a 30" pipe running parallel with the line from the Howard Avenue surge pond. According to the as-built plans for the Howard Avenue improvements project, the 30" pipe from the surge pond enters the lift station wet well at an elevation of 100.14 ft. NAVD, and the floor elevation of the lift station enclosure housing the pump motor is 114.3 ft. NAVD. The specifications for the pump, as provided by the City, are detailed in **Table 10.19** below. No control elevations (cut-on stage, cut-off stage) for the lift station were provided.

Table 10.19
Florida Avenue Stormwater Lift Station Pump Specifications

Model	NW310X12 (No Manufacturer Data Supplied)
Serial No.	7198
Size	12
Type	Axial Flow
Gallons per Minute	2,700 (6.02 CFS)
Total Dynamic Head	15.0 ft.
Impeller Diameter	10 inches
RPM	1,770
Motor Size	20 HP

Stormwater from the lift station is conveyed under Florida Avenue by means of a 1 ft. by 7 ft. rectangular concrete culvert with an invert elevation of approximately 111.7 ft. NAVD, and is discharged to a ditch which runs southward along the multipurpose trail alignment, and eventually to the Tank Lake portion of the Duck Lake watershed system. Tank Lake is a Basin of Special Concern and any proposed improvements to this problem area must be carefully analyzed relative to the special basin criteria. For the purposes of this Stormwater Master Plan, the standard design storm events and level of services have been used for assessing improvements for the problem area. Modeling of the Tank Lake area was not included and is considered beyond the scope of the Master Plan.

Analysis of Howard Avenue Flooding

The flooding problems on Howard Avenue were analyzed as part of AMEC‟s update to the City‟s current Stormwater Master Plan. The area was modeled in ICPR, using available topographic data, plan sets and other information provided by the City, as well as observations made during field visits and discussions with City Public Works personnel. Based on this information, the main cause of the Howard Avenue flooding was identified as the lift station on Florida Avenue at the trail crossing being inadequately sized for the expected flows of stormwater runoff from the 93-acre total contributing area. Because the lift station is inadequately sized, the constructed surge pond on Howard Avenue is unable to lower the flood elevation at Howard Avenue experienced during most rainfall events. This creates a localized tailwater condition that prevents the inlets on Howard Avenue at the roadway‟s low point from discharging, resulting in inlet surcharging and flooding of the street. The problem area slowly recovers after rainfall has ceased and as the lift station is able to discharge flood waters offsite to the south.

Since the lift station is such a significant bottleneck on the storm sewer system in this area, other alternatives, such as enlarging the Howard Avenue surge pond, and/or adding more inlets along Howard Avenue, would be ineffective at relieving the street flooding in the area. Therefore, the focus of this alternative analysis was concentrated on ways to increase the flow capacity of the Florida Avenue stormwater lift station.

Florida Avenue Stormwater Lift Station Improvements

Based on visual examination of the existing pump house, it appears that there is sufficient room inside the structure to place a second axial pump motor identical to the existing one without the necessity of modifying the pump house structure. There also appears to be sufficient room inside the pump house to place the necessary controls for proper duplex operation. Given the location of the pump house next to a major City thoroughfare, supplying electrical power for the second motor should be relatively cost effective to accomplish.

To estimate the effects of placing a second pump motor in the existing lift station, the ICPR model was modified to place two identical pumps at the lift station and was run again. The results of this modeling are summarized in **Table 10.20** below. Predicted peak stages which indicate flooding of Howard Avenue are listed in red text.

Table 10.20
Maximum Predicted Stages at Howard Avenue Trail Crossing

STORM EVENT	RAINFALL AMOUNT (IN.)	MAXIMUM STAGE EXISTING CONDITIONS	MAXIMUM STAGE PROPOSED CONDITIONS	CHANGE IN PEAK STAGE (IN.)
5 Year, 24 Hour	5.75	107.59	107.32	-3.2
10 Year, 24 Hour	7.0	108.12	107.72	-4.8
25 Year, 24 Hour	8.5	108.67	108.18	-5.9
50 Year, 24 Hour	9.5	108.97	108.53	-5.5
100 Year, 24 Hour	12.0	109.60	109.18	-5.0

(NOTE: Howard Avenue drainage inlets have throat elevations of 106.47 ft. NAVD '88 (south side) and 107± Ft. NAVD '88 (north side). Street flooding occurs above elevation 106.50 ±.)

The results indicate that for all rainfall events studied, inlet surcharging and street flooding along Howard Avenue is reduced, but is not eliminated. The most significant reduction occurs with the 25-year storm event. This alternative would not allow the system to meet any of the City"s level of service criteria. A cursory review of historical rainfall records for the Dade City area suggests that in excess of 90 percent of rainfall events by frequency have a magnitude of less than the 5.75 inches provided by the 5-year, 24-hour storm event. Implementation of this alternative should reduce the frequency and duration of street closures on Howard Avenue due to roadway flooding.

To implement this alternative, it will be necessary to conduct a thorough engineering analysis of the current lift station, to confirm the feasibility of the proposed improvements and to validate the assumptions made in this conceptual alternative. These assumptions include; relative ease of supplying sufficient electrical power to the proposed lift station, suitability of the current pump house and wet well/vault configuration for the proposed improvements, and the capacity of the existing culvert conveying lift station discharge under Florida Avenue being sufficient to handle the increased flow. The stability of the existing downstream ditch cross section under the increased flow velocities would also need to be assessed. The estimated cost for implementing this alternative is $82,000± and an engineer"s opinion of probable cost for this alternative is given below (see **Table 10.21**).

Additional conceptual level modeling was performed to examine the feasibility of meeting the 25-year level of service (LOS) standard for the Howard Avenue storm sewer system. To meet this LOS, street flooding on Howard Avenue cannot exceed a maximum depth of six inches at the low point during the 25-year, 24-hour storm event - this corresponds to a peak stage of 107 ± ft. NAVD on Howard Avenue for this storm. Peak stages at Howard Avenue can be reduced to within 0.35 feet of the peak required to meet the 25-year level of service by increasing the maximum flow capacity of the Florida Avenue stormwater lift station by another factor of three over the alternative discussed above. This would represent a six fold increase in capacity over the existing lift station, corresponding to a flow rate of approximately 36 cfs when the pumps are working at the design operating points on their performance curves.

To implement this alternative, it will be necessary for the City to design and construct a completely new stormwater lift station to replace the existing lift station. It will also be necessary to upgrade the existing culvert connection under Florida Avenue that conveys discharge from the lift station to the multipurpose trail ditch south of Florida Avenue, and a detailed engineering study of the receiving system will be required to ensure that the increased discharge volume does not cause flooding problems for property owners south of Florida Avenue in the vicinity of the receiving ditch. Also, obtaining sufficient electrical power to support an upgrade of this magnitude may be more difficult and therefore costly.

The estimated cost for implementing an alternative that approaches a 25-year level of service is approximately $2.8 million (see engineer"s opinion of probable cost, **Table 10.22**). This cost assumes that no additional right-of-way or easement rights will need to be acquired by the City to construct the new lift station facility; if it is necessary to acquire right-of-way, the final cost could increase significantly. Additionally, due to the major increase in peak flow rates to the receiving system to meet the 25-year level of service on Howard Avenue, it is probable that significant improvements will need to be constructed at the receiving system south of Florida Avenue to mitigate problems with flooding, erosion and sedimentation downstream. Identifying the improvements to be made is not possible without a detailed engineering study that is beyond the scope of this project, so any costs associated with designing or constructing needed improvements at the receiving system are not included in this cost estimate.

It should be pointed out that the costs of receiving system improvements have the potential to equal a significant proportion of the costs estimated to construct the new lift station. Finally, given the magnitude of the increase of peak flows, it may be difficult or even impossible to secure the required permits from SWFWMD and other regulatory agencies to authorize construction.

A third alternative for this problem area includes installation of a gravity storm sewer line that would begin at the wet well for the Florida Avenue lift station and be routed southward under Florida Avenue and along the east side of the Trail right-of-way. This storm sewer would extend southerly until the topography of the area allows the invert of the pipe to discharge to daylight (at grade). Pipe end protection and scour protection would be installed.

This third alternative was modeled in ICPR to determine its feasibility. The minimum pipe size required to approach the 25-year level of service criteria for the Howard Avenue storm sewer system is 42 inches. To maintain self cleansing velocities within the pipe, the downstream elevation would be required to be 98.5± ft. NAVD. This would require approximately 2,150 linear feet of pipe, with the pipe day lighting on the east side of the trail near Dixie Avenue. Due to the length of the pipe, a minimum of six manhole structures would need to be installed to permit access to the pipe for routine inspection and maintenance.

Implementation of Concept Option 3 would result in a peak predicted stage on Howard Avenue of 107.86 ft. NAVD, 0.86 ft above the maximum stage for meeting the City‟s 25-year level of service criteria. Implementation of Option 3 in conjunction with the lift station upgrade discussed in Option 1 results in only a very slight (0.03 ft) additional decrease in maximum stage at Howard Avenue for the 25-year storm event and would not be cost effective.

It should be pointed out that due to the significantly increased flows that will be experienced at the outfall discharge point as a result of this alternative, the concerns noted in Alternative 2 above apply in this case as well. A comprehensive engineering study of the area, as well as a study of the current lift station, will also be required. The estimated cost of Option 3 is $595,000, and an engineer‟s opinion of probable cost is provided in **Table 10.23** below.

It is our opinion that Option 1 provides the City with the best cost-to-benefit ratio. While it does not meet the 25-year level of service desired by the City for Howard Avenue, it will reduce the need for road closures on Howard Avenue for a majority of storm events experienced in the area. The costs and uncertainties associated with approaching the 25-year level of service make the excessive cost unacceptable in our opinion. Any improvements proposed for the Howard Avenue system should be assessed using the Tank Lake special basin criteria prior to implementation.

TABLE 10.21
ENGINEER'S OPINION OF PROBABLE COST
FLORIDA AVENUE STORMWATER LIFT STATION IMPROVEMENTS
UPGRADE EXISTING LIFT STATION WITH SECOND PUMP MOTOR

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1.0	Mobilization	$ 5,000.00	$ 5,000.00
LS	1.0	Maintenance of Traffic	$ 1,000.00	$ 1,000.00
LS	1.0	Axial Pump, 20 HP, 10" Imp., 2700 GPM @ 15' TDH, F & I	$ 30,000.00	$ 30,000.00
LS	1.0	Pump Station Duplex Control & Remote Alarm, F & I	$ 7,500.00	$ 7,500.00
LS	1.0	Electrical Service for Pump	$ 5,000.00	$ 5,000.00
LS	1.0	Engineering & Permitting	$ 17,000.00	$ 17,000.00
			Subtotal	$ 65,500.00
			Contingency 25%	$ 16,375.00
			TOTAL	**$ 81,875.00**

TABLE 10.22
ENGINEER'S OPINION OF PROBABLE COST
FLORIDA AVENUE STORMWATER LIFT STATION IMPROVEMENTS
REPLACE EXISTING LIFT STATION TO MEET 25-YEAR LEVEL OF SERVICE STANDARD

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1.0	Mobilization	$ 25,000.00	$ 25,000.00
LS	1.0	Maintenance of Traffic	$ 7,500.00	$ 7,500.00
LS	1.0	Demolish and Remove Existing Lift Station	$ 10,000.00	$ 10,000.00
LS	1.0	Lift Station, Complete, 36 CFS Peak Capacity, F & I	$ 2,000,000.00	$ 2,000,000.00
LF	35.0	Culvert Upgrade at Florida Avenue (36" RCP equiv.)	$ 200.00	$ 7,000.00
LS	1.0	Electrical Service for Lift Station	$ 25,000.00	$ 25,000.00
LS	1.0	Engineering & Permitting	$ 240,000.00	$ 240,000.00
			Subtotal	$ 2,314,500.00
			Contingency 25%	$ 578,625.00
			TOTAL	**$ 2,893,125.00**

TABLE 10.23
ENGINEER'S OPINION OF PROBABLE COST
FLORIDA AVENUE STORMWATER LIFT STATION IMPROVEMENTS
CONSTRUCT GRAVITY STORM SEWER BETWEEN LIFT STATION AND DIXIE AVENUE

Unit	Approx Qty	Item	Unit Cost	Total Cost
LS	1.0	Mobilization	$ 15,000.00	$ 15,000.00
LS	1.0	Maintenance of Traffic	$ 1,000.00	$ 5,000.00
LF	4,500	Staked Silt Fence	$ 2.00	$ 9,000.00
LS	1.0	Clear & Grub	$ 5,000.00	$ 5,000.00
LF	2,150	Storm Sewer Installation (42" RCP, F & I))	$ 160.00	$ 344,000.00
EA	6.0	Manhole Structure (Type J, F & I)	$ 6,000.00	$ 36,000.00
SY	28	Sub base	$ 3.00	$ 84.00
SY	28	Optional Base Material - Group 11	$ 20.00	$ 560.00
TN	3.0	Asphalt (1.5")	$ 125.00	$ 375.00
EA	1.0	Mitered End Section (42” RCP)	$ 2,500.00	$ 5,000.00
TN	6.5	Rubble Riprap	$ 275.00	$ 1,788.00
LS	1.0	Engineering & Permitting	$ 60,000.00	$ 60,000.00
			Subtotal	$ 481,807.00
			Contingency 25%	$ 130,952.00
			TOTAL	**$ 594,759.00**

11.0 RECOMMENDATIONS AND POTENTIAL FUNDING SOURCES

Areas within the City that have experienced persistent flooding problems were previously identified and conceptual capital improvement projects (CIPs) were presented and discussed in Chapter 10. This section provides the recommended capital improvement projects to the City and the estimated costs of those improvements. The City does not currently have a dedicated funding source for stormwater improvements and potential funding sources are also discussed in this section.

Please reference **Table 11.1** below for a summary of the recommended CIPs for the stormwater flooding problem areas of the town. This list includes the location of the major CIP projects that have been brought to AMEC‟s attention during the course of this project. It has not been the emphasis of this report to include water quality-based BMPs as it is anticipated the City will add these in the future as needed to support the City‟s SWMP. A specific water quality CIP was mentioned for the Outfall #1 discharge due to the potential benefits it may provide in securing cooperative funding.

Table 11.1
Summary of the Recommended CIPs

Problem Area	CIP Description	PRIMARY PURPOSE/ Secondary Benefits	Estimated Benefits	Estimated Implementation Costs
1	Whitehouse Ave/10th St.- Pond Construction (Phase 1- Initial Pond Expansion only)	-FLOOD REDUCTION (REGIONAL) -Water Quality -Natural System Enhancement -Preservation of Water Resource - Public Education	Property[1] flooding reduced from 35± to 12± units (25 YR storm) & 25± to isolated yard flooding (5 YR Storm) (after Phase 2 Implementation)	$110,000±
1	Whitehouse Ave/10th St.- Pond Construction (Phase 2- Expanded Pond Construction)	"	"	$500,000±
1	Moseri Avenue Pond Construction	-FLOOD REDUCTION (REGIONAL)	Flood reduction not modeled separately however flood prone Dade Oaks Apartments will benefit.	$58,000±
1	Osceola Street at Davis Avenue Ditch Improvements	-FLOOD REDUCTION (LOCAL)	Flood reduction not modeled separately however hydraulic capacity will improve and existing flow "bottleneck" will be eliminated.	$106,000±
1	Oak Court Ditch Improvements (Pave ditch)	-FLOOD REDUCTION (LOCAL)	Improved flow capacity of ditch will reduce ditch overflows onto private properties. Reduced routine maintenance.	$48,000±
1	Pipe part of conveyance ditch along 17th Street, and under Oak Court	-FLOOD REDUCTION (LOCAL)	Reduction in instances of hazardous flows on 17th Street near Oak Court during intense storm events, improved conveyance to pond system at Beauchamp Avenue, reduction in maintenance costs.	$25,000±
1	17th Street Storm sewer from Meridian Ave. to Oak Court to Beauchamp Pond	-EROSION REDUCTION (LOCAL)	Reduction in erosion of private property at outfall location and controlled conveyance of stormwater to pond.	$219,000±
1	Beauchamp Pond Expansion	-FLOOD REDUCTION (REGIONAL)	Flood reduction not modeled separately however the severity of the	$115,000±

Problem Area	CIP Description	PRIMARY PURPOSE/ Secondary Benefits	Estimated Benefits	Estimated Implementation Costs
			infrequent flooding of adjacent properties will be reduced.	
1	St. Joe Road Ditch Erosion Repair	-EROSION REPAIR (LOCAL)	Reduction in erosion of private property at outfall location.	$31,000±
2	Downtown Storm sewer & Irvin pond Modifications	-FLOOD REDUCTION (REGIONAL) -Water Quality -Preservation of Water Resource -Public Education - Passive Recreation	Street and parking area[5] flooding reduced from 6-12" down to none (5 YR Storm) and 3-6" down to none (Mean Annual Storm[4])	$1,800,000±
1	6th Street/ Pond Avenue Berm Construction	-FLOOD REDUCTION (LOCAL)	Flood reduction not modeled separately however improvements may reduce frequency and severity of flooding at church property.	$25,000±
2	Howard Avenue Storm Lift Station Upgrade	-FLOOD REDUCTION (LOCAL)	Street flooding reduced from 3-6" down to none (5 YR Storm)[6]	$82,000±
4	Ferguson Avenue Canal Improvements	-NUISANCE STAGNANT WATER COMPLAINTS (LOCAL)	Stagnant pools will be graded to reduce the frequency and depth of standing water behind homes.	$40,000±

Notes

[1] Property Flooding may be limited to yard and parcel flooding and not actual structure flooding. Obtaining floor elevations of low structures was not included in the scope of this project.

[2] 25 YR- 25 Year Design storm of 8.5 inches in 1 Day.

[3] 5 YR- 5 Year Design storm of 5.75 inches in 1 Day

[4] Mean Annual Storm (4.75 inches in 1 Day) typically occurs once a year.

[5] Assigning the benefits of the reduced flooding to downtown is difficult. Safety for pedestrian and vehicular traffic is improved and parking space usage along the previously flooded roads would be improved for the duration of the storm events. The limits of the primary improvements are on 7th, 6th and 5th streets generally from Pasco Avenue north to Pineapple Avenue.

[6] The frequency of public works or emergency personnel having to shut the road to through traffic will be reduced significantly and the associated inconvenience to the motoring public reduced as well.

Table 11.2 summarizes the CIP costs and potential outside funding mechanisms for those projects.

Table 11.2
Concept CIP Cost Summary & Potential Funding Sources

Project	Potential Partnering Agencies/Reasons	Estimated Cost Range to City
Whitehouse Ave/10th St.- Phase 1- Pond Construction	FDOT/Contribution at Outfall PCHA/Contribution of Stormwater PCSB/Property Owner State of Florida (CDBG)	$36,000-$110,000
Phase 2 – Expanded Pond Construction	PCSB/Property Owner PCHA/Contribution of Stormwater State of Florida (CDBG)	$250,000 - $500,000
Moseri Avenue Pond Construction	PCHA/Benefits from Project	$29,000 - $58,000
Osceola St. at Davis Ave. Ditch Improvements	None	$95,000 - $106,000
Oak Court Ditch Capacity Improvements	None	$40,000-$50,000
Pipe part of conveyance Ditch along 17th Street, and under Oak Ct. (&17th Street Existing Storm Sewer Upgrade)	None	$80,000-$95,000
17th Street Storm sewer from SR 52 to Oak Ct.	FDOT	$125,000-$150,000
Beauchamp Pond Expansion	State of Florida (CDBG)	$65,000-$130,000
St. Joe Road Ditch Erosion Improvements	Pasco County	$26,000-$31,000
Irvin pond Modifications	SWFWMD/Cooperative Funding FDOT/Meridian Ave. Drainage Improvements FDEP[1]	$450,000-$1.8M
6th Street/Pond Avenue Berm Construction	None	$22,000 - $25,000
Howard Avenue Storm Lift Station Upgrade	None	$80,000-$90,000
Ferguson Avenue Canal Improvements	None	$25,000 - $40,000
Total		**$1.31M-$3.19M**

[1] **FDEP grant funding could potentially be pursued for some types of water quality projects however, FDEP would require that the City have a dedicated source of funding such as a stormwater utility**.

It is anticipated that the ongoing requirements of the City‟s NPDES MS4 permit and periodic infrastructure replacement will absorb a large part of any stormwater-related budget adjustments the City can make using General Funds. One dedicated source of funding which could be used is a municipal service benefit unit which provides benefits to specific areas of the municipality. Therefore it would work on a more project/problem area specific basis. A special assessment could also be considered for specific problem areas however this is typically used for local road improvements and it could be cost prohibitive for stormwater improvements. Another alternative would be a city-wide stormwater utility. This type of dedicated funding could provide services city-wide and could be applied to the problem areas in a systematic manner. An added benefit of a stormwater utility would be its ability to address the costs associated with the demands from the NPDES and TMDL programs.

In the event a stormwater utility is adopted within the City, the approximate duration for funding the above concept projects would vary depending on the adopted utility rate. **Table 11.3** presents several potential scenarios of CIP project completion based on various levels of funding. The most rapid path for implementation of the CIPs would be cooperative funding assistance from other agencies and a higher level of utility income and could potentially result in sufficient funding being available within 5± years. On the other end of the spectrum, if no cooperative funding is secured and annual utility revenues for CIP projects is at a lower level of $125,000, the time period for fully funding the concept CIP projects is ±25 years.

Table 11.3
Hypothetical CIP Funding Scenarios

Annual Stormwater Utility Revenues Dedicated to CIP Projects	Approximate Time Period to Fund City's Share Assumed Maximum Cooperative Funding (Years)	Approximate Time Period to Fund City's Share with No Cooperative Funding (Years)
$125,000	10.5	25.5
$250,000	5+	13±

Notes:
1. **CIP Costs of $1.31M to City based on assumptions associated with concept improvements shown in Table 11.2 and described in report.**
2. **CIP Costs of $3.19M to City based on assumptions associated with concept improvements shown in Table 11.2 and described in report.**
3. **The conceptual level of funding of the Stormwater Utility shown in Table 11.3 would be dedicated to the CIP projects. Additional Utility revenue would be required for administration, maintenance and operations, regulatory (NPDES, TMDL) and any other costs that the City desires to absorb under the Utility program, if adopted in the future.**