CITY OF CAPE CORAL STORMWATER MASTER PLAN PHASE II - PART 1 BASINS 4, 10, & 14 SUB-BASIN DRAINAGE IMPROVEMENTS HYDRAULIC ANALYSIS SUMMARY

Cape Coral, FL

Prepared for:

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Introduction

As a portion of the City of Cape Coral Stormwater Master Plan Phase 2 Project, the Design Team integrated city-wide modeling results into collaboration efforts with Public Works Staff to identify sub-basin areas where localized flooding is known to occur. The city-wide modeling results suggest that flooding in these areas is a result of local swales, inlets, pipes, or topography, and not caused by the primary City canal and weir system. Therefore, flooding of this nature is referred to herein as secondary flooding. Due to the city-wide MIKE SHE model grid size, it was decided under Task 9 to develop local Ad-ICPR hydraulic models for the sub-basin areas subject to flooding. These local models would be used to evaluate the existing drainage system performance in a design storm event, and to evaluate improvements to reduce localized flooding. From collaboration with Public Works Staff, AIM focused on sub-basin areas within City Basins 4, 10, and 14.

Within each sub-basin mentioned above, AIM concentrated on a closed stormwater system located in the descriptions and figures below:

- Basin 4 - Along NW 2nd Ave. northeast of the Roger Dean Chevrolet dealership.
- Basin 10 – North of Tropicana Pkwy, between NW 26th Ct & NW 24th Place
- Basin 14 – Areas along Hancock Bridge Pkwy, south of the Kia Dealership, west to Cultural Park Blvd.

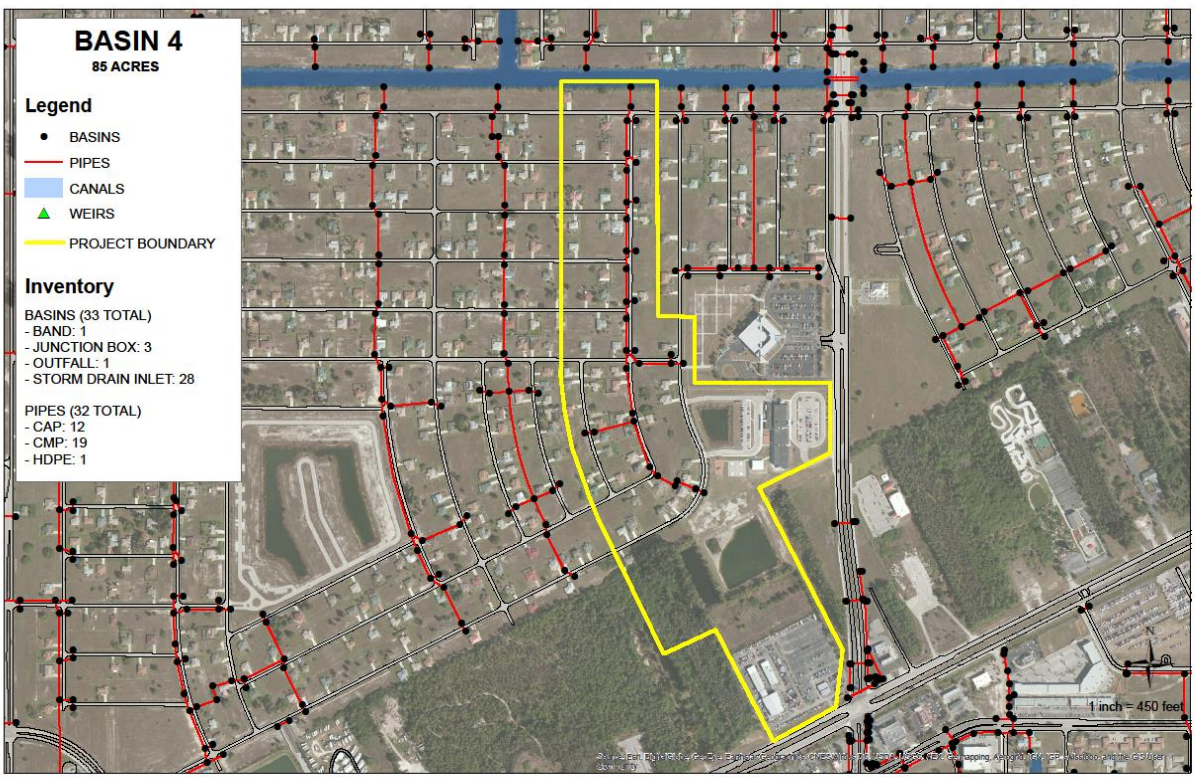

Figure 1 - Basin 4 Stormwater System Location, Boundary, and Existing Conditions.

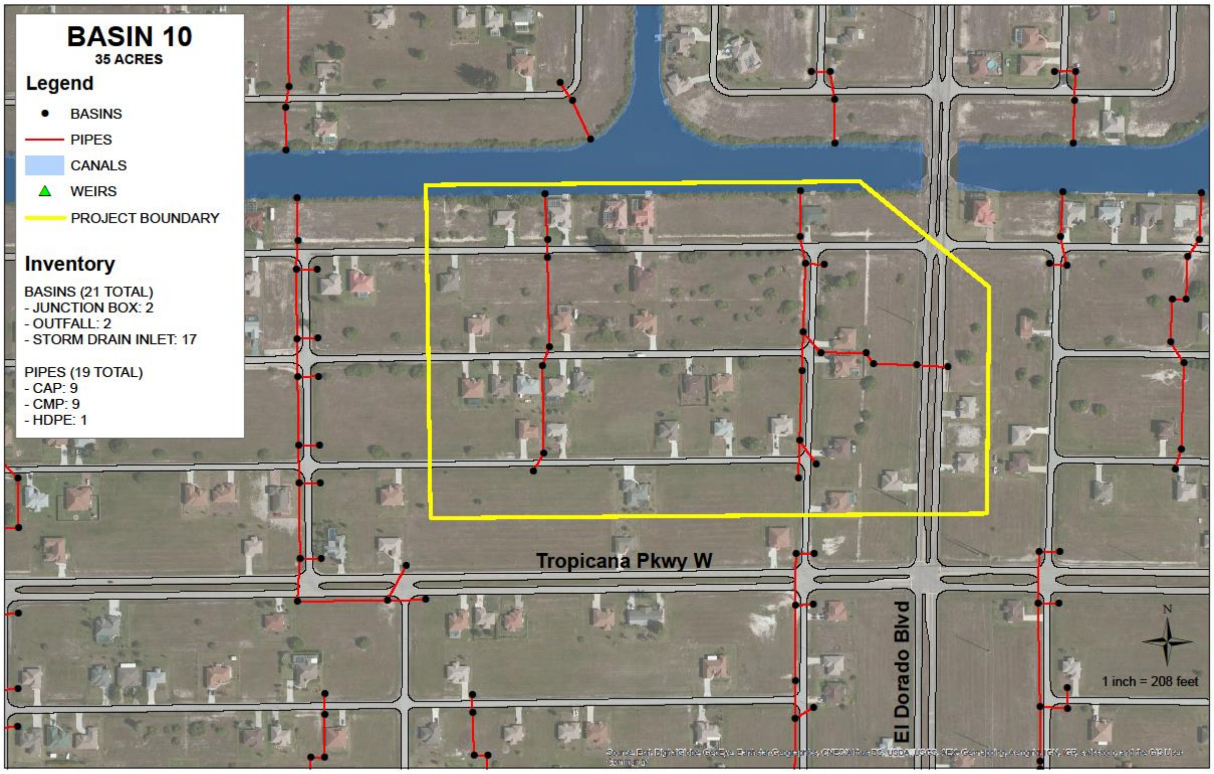

Figure 2 - Basin 10 Stormwater System Location, Boundary, and Existing Conditions.

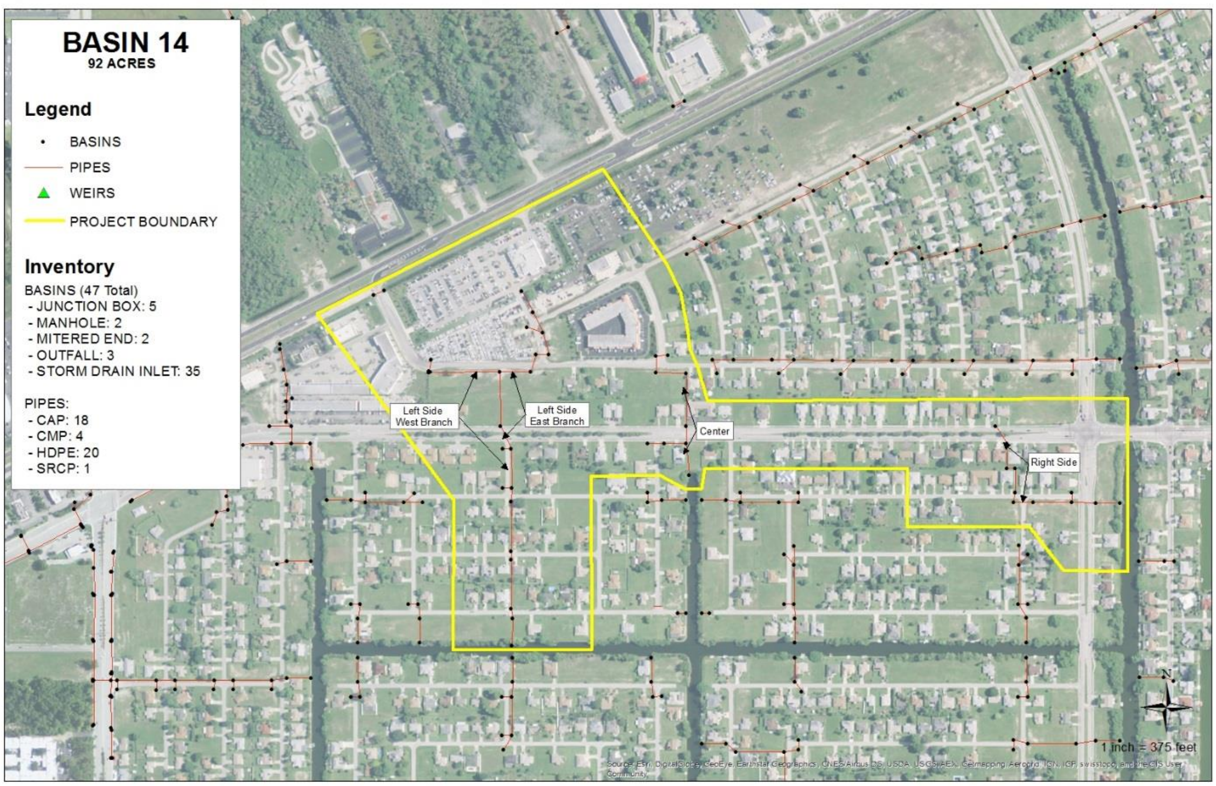

Figure 3 - Basin 14 Stormwater System Location, Boundary, and Existing Conditions.

Based on the hydraulic analysis of the basins in question, AIM can make recommendations for additional improvements to further reduce flooding within each basin during intense storm events.

Existing Conditions

The area analyzed within Basin 4 is located within Section 11, Township 44-S, Range 23-E. Currently, there are 29 water control structures within the basin, which consist of a variety of FDOT Type C, curb and gutter, and GAC inlets that receive stormwater runoff from Basin 4.

The area analyzed within Basin 10 is located within Section 5, Township 44-S, Range 23-E. Currently, there are 17 water control structures within the basin, which consist of a variety of FDOT Type C and GAC inlets that receive stormwater runoff from Basin 10.

The area analyzed within Basin 14 is located within Sections 12 & 13, Township 44-S, Range 23-E. Currently, there are 17 water control structures within the basin, which consist of a variety of FDOT Type C and GAC inlets that receive stormwater runoff from Basin 10.

Stormwater runoff from each sub-basin sheet flows into very shallow roadside swales, and eventually collects and flows into the network of inlets around each basin. The system serving the sub basin discharges into a separate canal systems within the city. Canals receiving discharge per Basin studied: Basin 4 – Vermont Canal, Basin 10 – Hermosa Canal, & Basin 14 – Adam (Node 84), Mackinac (Node 97), and Moro Canals (Node 77).

From initial inspection, there appears to be insufficient storage or conveyance to the inlet network along with constrictions within the pipe network of the storm sewer system for the area. There are also roadway segments that have been constructed substantially lower than adjacent ground elevation which increases road flooding.

Methodology

Data Collection

To begin the evaluation of the City of Cape Coral Drainage Improvements, AIM first had to obtain data from multiple resources. The City of Cape Coral Public Works Department initially provided AIM with electronic GIS Maps and Basin Map hard copies. These maps and electronic drawings provided AIM with much of the physical data for the storm sewer system serving the project, including many of the pipes, inlets, inverts, etc.

After reviewing the available storm sewer plans and data, AIM dispatched a survey field crew to collect topographic information on the existing inlets, pipes, and other system information for the storm sewer network serving the different basin project areas. AIM collected detailed field data that included inlet type, inlet size, weep hole invert elevations, rim invert elevations, discharge pipe material, upstream & downstream invert elevations, edge of pavement elevations, centerline of road elevations, & surrounding lot elevations. The survey information was utilized to complete the development of the hydraulic models for the stormwater system serving the three project areas.

AIM also utilized the SFWMD LIDAR within GIS software to determine surrounding land elevations within the contributing watershed sub-basins. Our understanding of existing conditions was also enhanced through discussions with local residents and City staff to obtain a general recollection of historical drainage patterns & peak stages within the analysis area.

Watershed Basin Delineation

To determine the contributing watershed sub-basin areas for Basins 4, 10, & 14, AIM first utilized SFWMD LIDAR in GIS, to compare "break-point" elevations between the roadways of the residential area. AIM also conducted field exploration of the Project area and compared with the obtained survey and LIDAR information. Upon extensive investigation and review, AIM determined that the total contributing area for each Watershed Basin mentioned above. The following figures demonstrate watershed basin delineation for each focused stormwater system area.

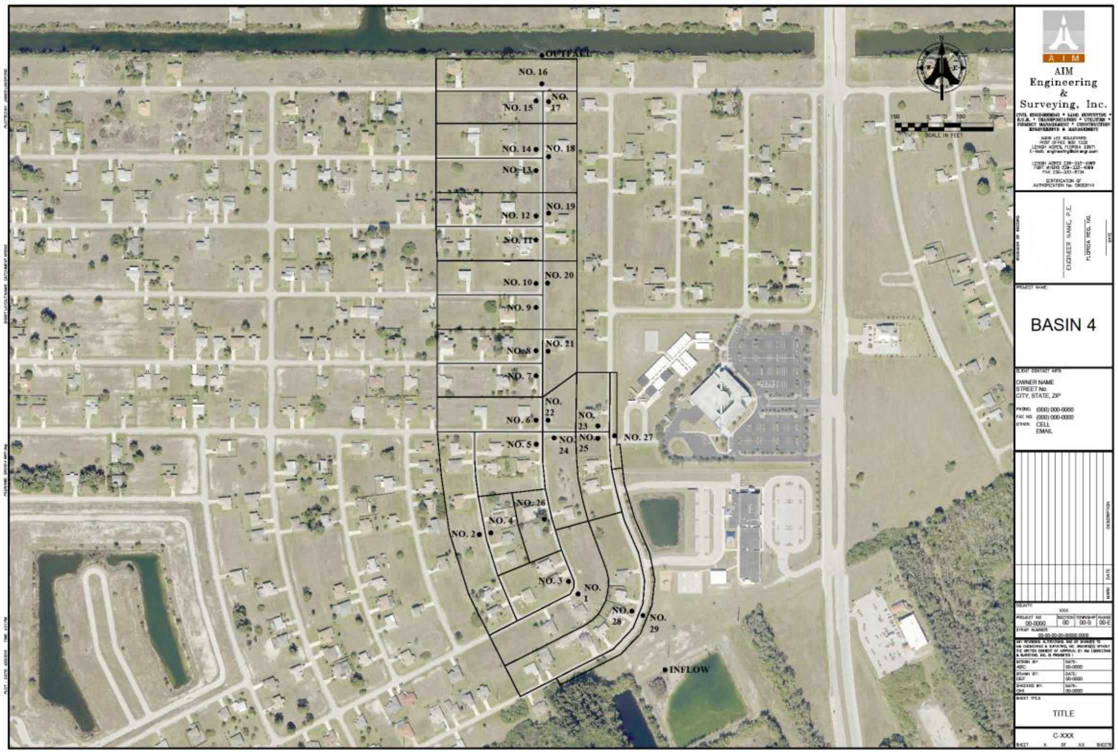

Figure 4- Basin 4 Watershed Basin Delineation.

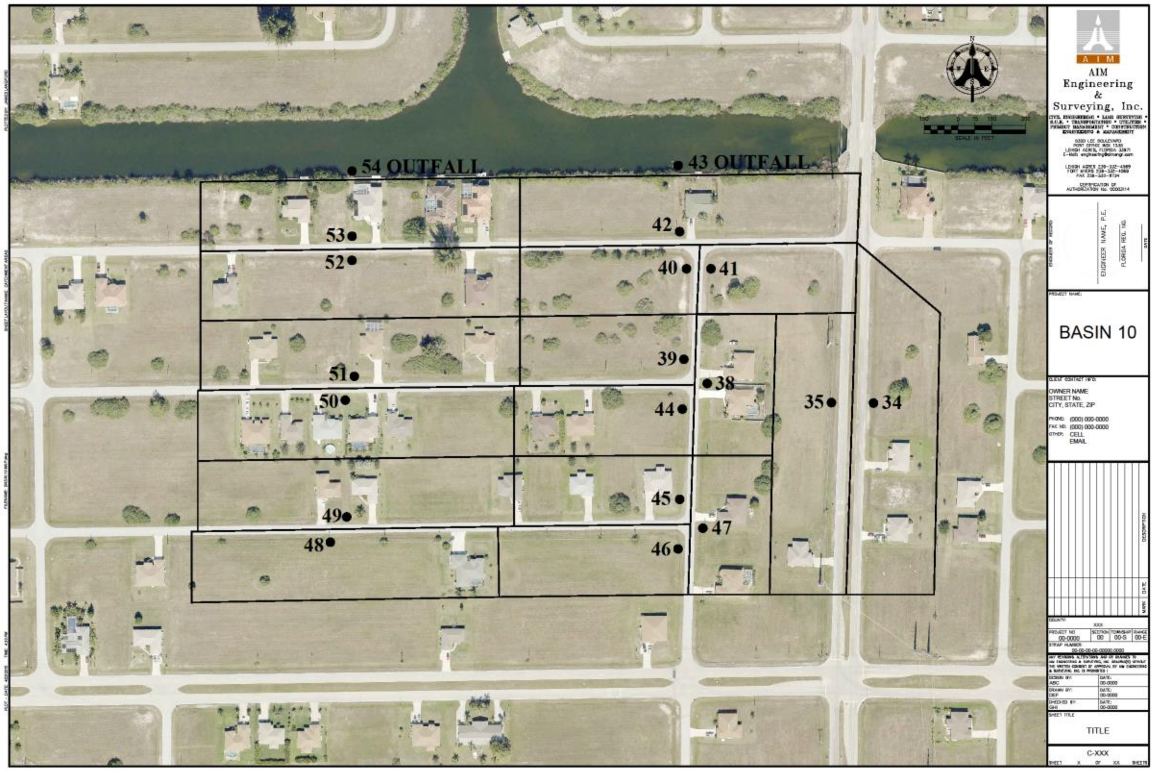

Figure 5 - Basin 10 Watershed Basin Delineation.

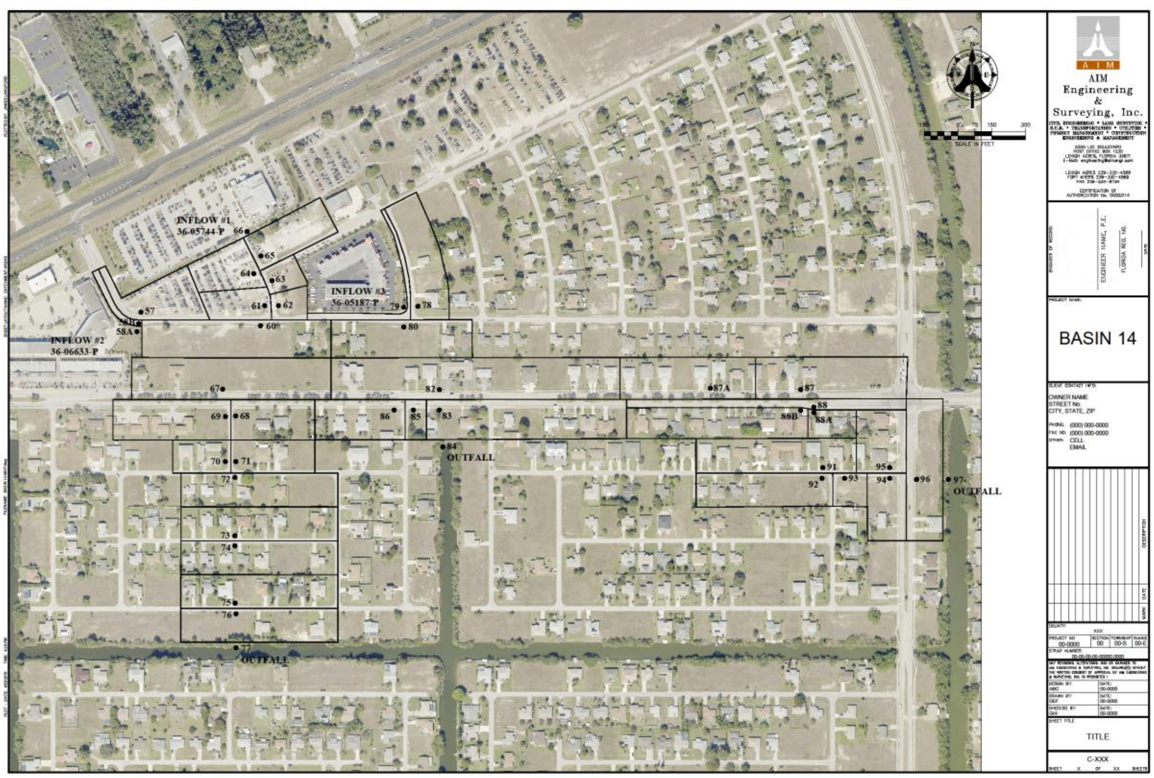

Figure 6 - Basin 14 Watershed Basin Delineation.

Node Stage vs. Area

From the topographic data obtained, as mentioned above, each sub-basin was assigned to a node (based on stage vs. area) within the ICPR model to account for stormwater storage within the basin. Each existing water control structure was assigned to a "Link" to depict said structures physical appearance. Given the hydraulic model "Node" – "Link"-"Node" structure, the downstream node (past the link, or structure) is representative as a "Ghost" Node or node with a small storage capability, i.e. – storage within the inlet structure itself.

Manning's n Roughness Coefficient

AIM Engineering utilized the resources Chow, 1959 and the TR-55 Manual, "Urban Hydrology for Small Watersheds" to determine appropriate Manning's roughness coefficients (n values) for the different pipe materials within the system (corrugated metal & HDPE). Below are the proposed roughness coefficients as referenced within Chow, 1959 & the TR-55 Manual:

Table 1 - Manning's n Values: Chow, 1959.

Type of Conduit and Description	Manning's n
a. High-density polyethylene (HDPE) and Reinforced Concrete Pipe (RCP)	
1. Smooth Interior	0.012
b. Corrugated Metal	
1. Annular 2.67 x 1/2 in (all diameters)	0.024

Time of Concentration

The time of concentration is calculated as the time required for a generated volume of water to travel from the most hydraulically-distant point within the sub-basin to the point of discharge. The NRCS TR-55 method for Time of Concentration was utilized to determine TC's for each associated sub-basin within the study area. The TR-55 method subdivides the water flow path in three distinct regimes: sheet flow, shallow concentrated flow, and channel flow. Sheet flow occurs at the most upstream reach of each sub-basin, and can occur for a maximum distance of 300 ft. Below is the Manning's kinematic solution utilized to compute the TC for sheet flow.

$$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$$

Where:

n = Manning's roughness coefficient
L = flow length (ft)
P_2 = 2-year 24-hour rainfall (in)
s = land slope (ft/ft)

For calculation purposes, shallow concentrated flow occurs after 300 ft of sheet flow. At this moment preferential flow paths begin to form and stormwater is no longer considered sheet flow over a plane surface. The water velocity for shallow concentrated flow over unpaved surfaces is calculated from the following TR-55 method equation:

$$V = 16.1345(s)^{0.5}$$

Where:

V = velocity (fps)

s = watercourse slope (ft/ft)

Once the stormwater flow reaches a swale, canal or open channel, TC is calculated using the Manning's flow equation. However for this application open channel flow is not applicable, therefore the value for this calculation is considered to be zero.

Curve Number

The ICPR curve number for each sub-basin within the analysis area were calculated based on the TR-55 manual, Table 2-2a, Runoff Curve Numbers for Urban Areas. The Residential District (1/4 acre) was assumed for the CN determination. Based on general soil properties within this region, it was assumed that the hydrological soil group is considered to be a C. Therefore, the assumed curve number for most sub-basins is 83. There also some sub-basins within the watershed which flow to a curb and gutter system. For these sub-basins a CN of 98 was utilized since the majority of sub-basin is impervious.

Rainfall Distribution

In the ICPR model, a rainfall distribution file was chosen to simulate a 10-yr, 3 day storm event, which has a duration and total rainfall amount similar to the real events that cause problematic flooding within the basin areas. In the ICPR input routing files, this distribution is called "SFWMD-72".

Boundary Conditions

The peak tailwater stage for each basin area analyzed, was provided by ADA Engineering, Inc. These said peak stages were provided 10 yr – 3 day peak canal stages within their MIKE SHE/MIKE11 hydraulic model for the appropriate canals receiving the stormwater discharge. The peak canal stages for each Basin are as follow:

- Basin 4 – 6.43 NAVD (Vermont Canal)
- Basin 10- 2.92 NAVD (Hermosa Canal)
- Basin 14 – 6.45 NAVD (Adam, Mackinac, & Moro Canals)

Boundary conditions for each basin delineation are demonstrated below.

Existing Conditions Modeling Results

The hydraulic modeling evaluation of existing conditions began with 10-yr- 3 day routings utilizing the input parameters calculated as described above. Upon inspection of the result files, the ICPR model suggested flooding areas within each Basin mentioned above during the selected storm event. In Basin 4, the areas along NW 2nd Avenue from NW 1st Street to NW 3rd Lane experience flooding above the existing edge of pavement. In Basin 10, the western end of NW 8th Terrace experiences minor flooding above the existing edge of pavement. In Basin 14, the ICPR model shows an extensive amount of flooding within the entire basin during the 10-year, 3-day design storm event. Please refer to the figures below that depict flood stage comparisons along the main trunk of the stormwater conveyance system within each basin. The x variable in the chart is representative of the distance from the outfall to each inlet structure in series. The outfall represents 0 in the chart, therefore the higher the number, the further upstream the data.

Basin 4

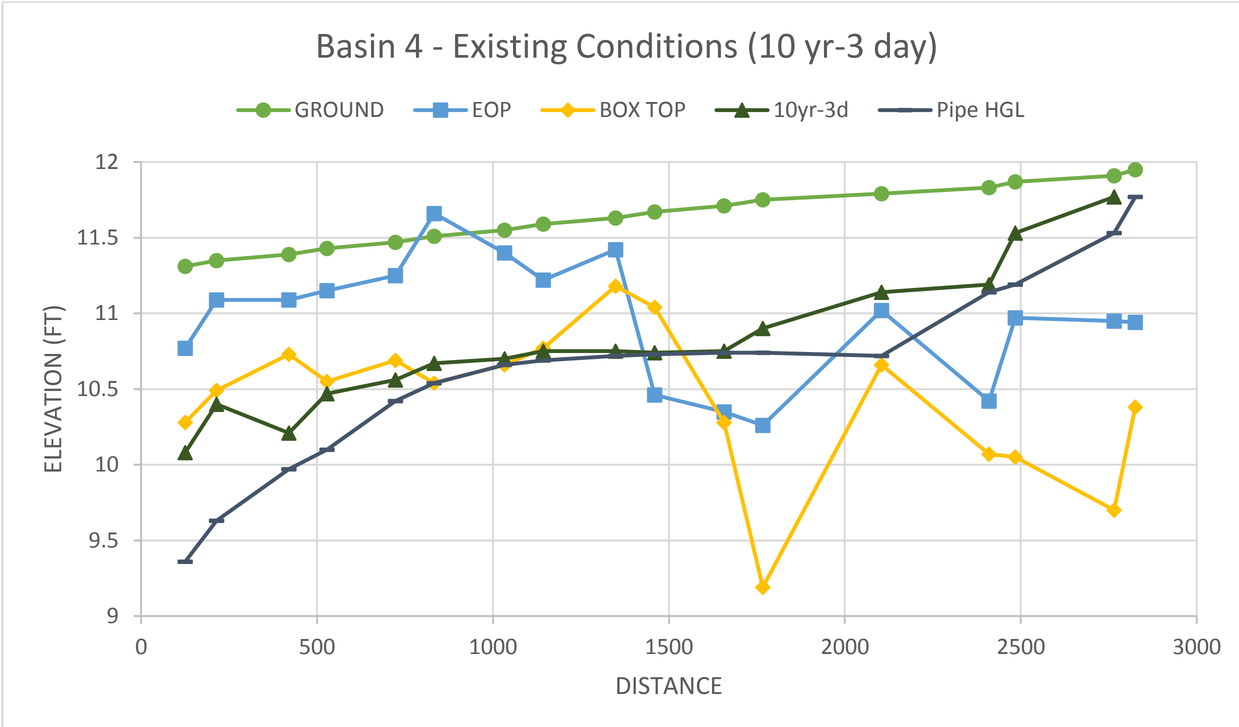

Figure 7 - Basin 4 Existing Conditions.

Basin 10

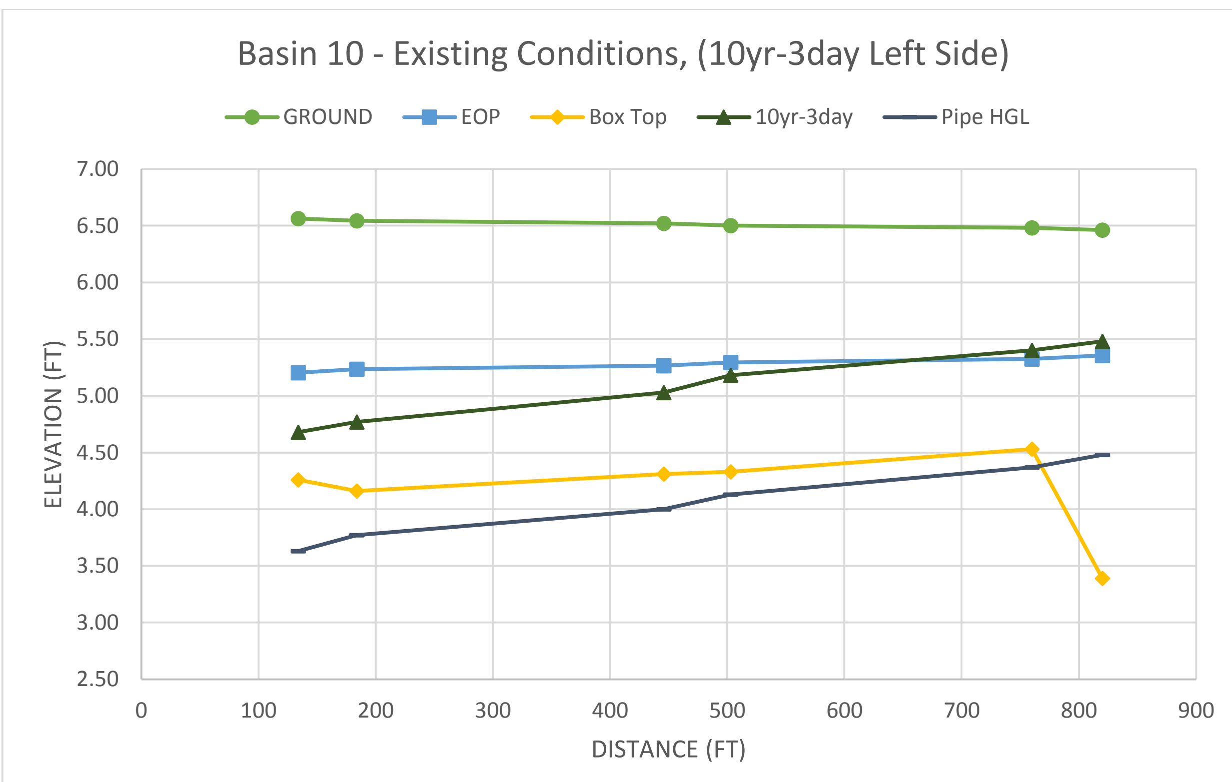

Figure 8 - Basin 10 Existing Conditions.

Basin 14

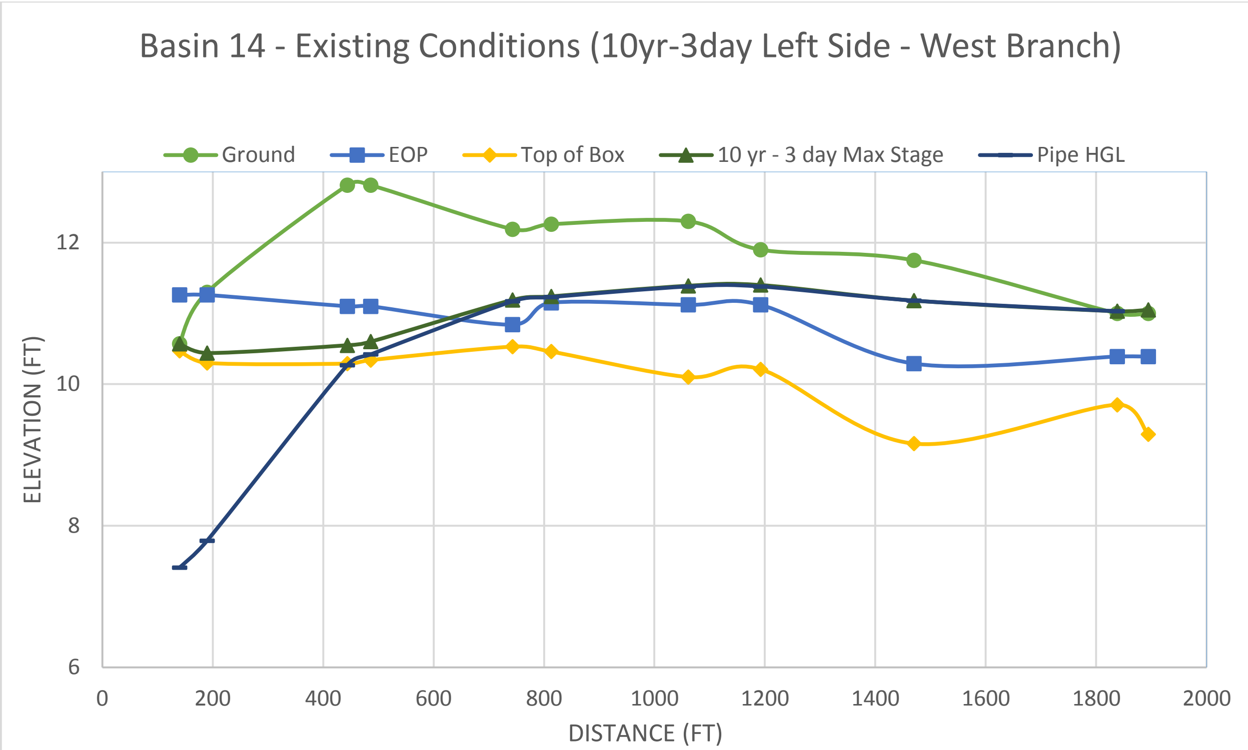

Figure 9 - Basin 14 Existing Conditions (Left Side – West Branch).

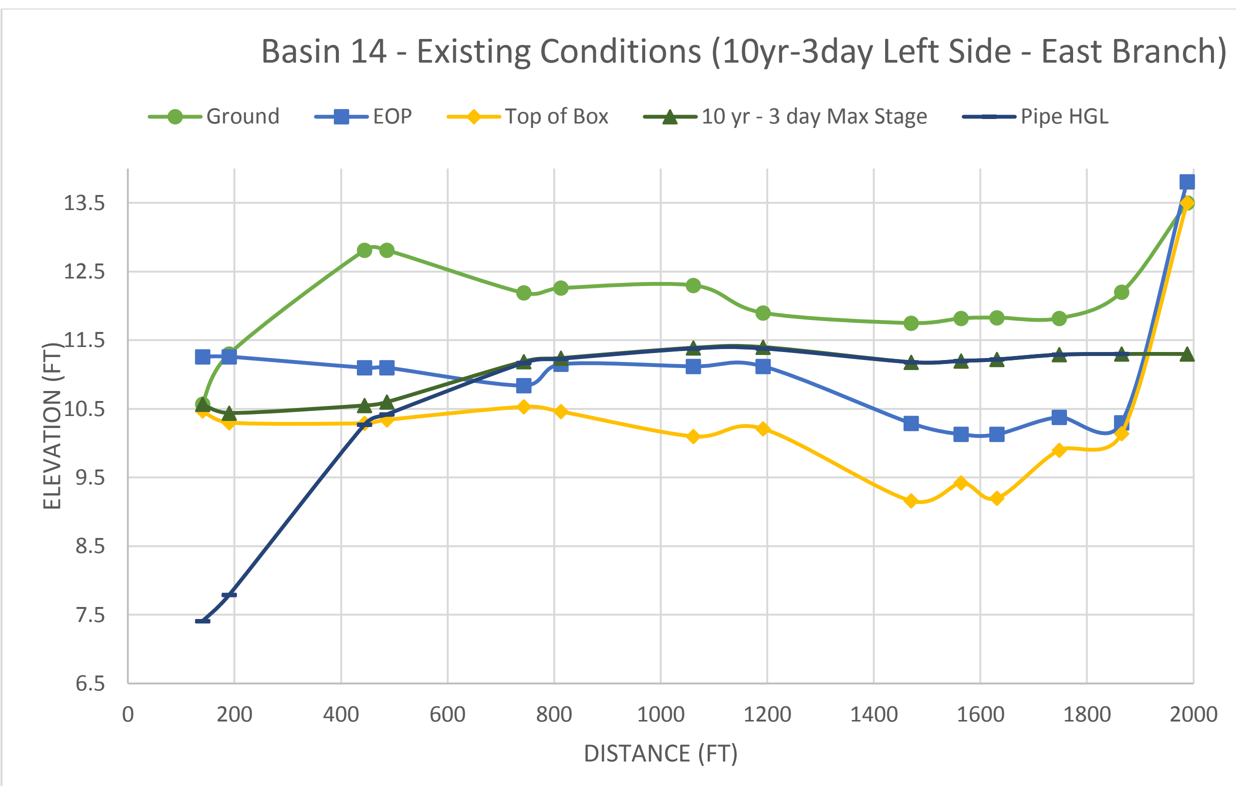

Figure 10 - Basin 14 Existing Conditions (Left Side – East Branch).

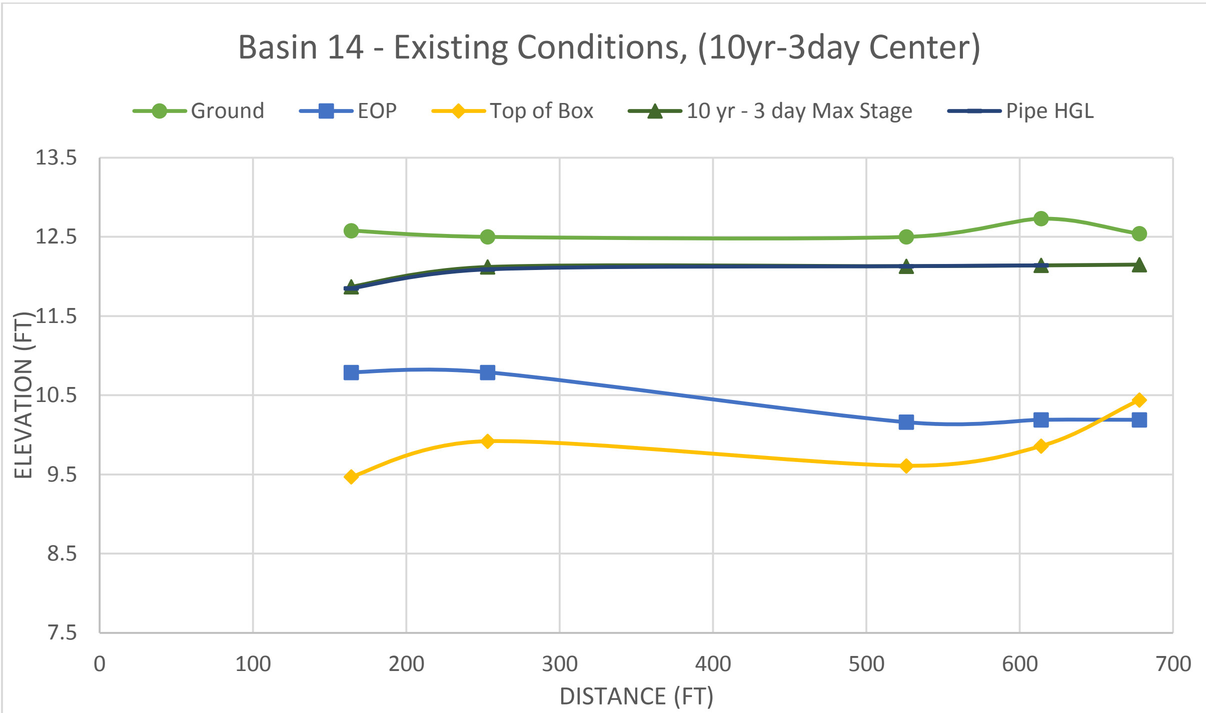

Figure 11 - Basin 14 Existing Conditions (Center).

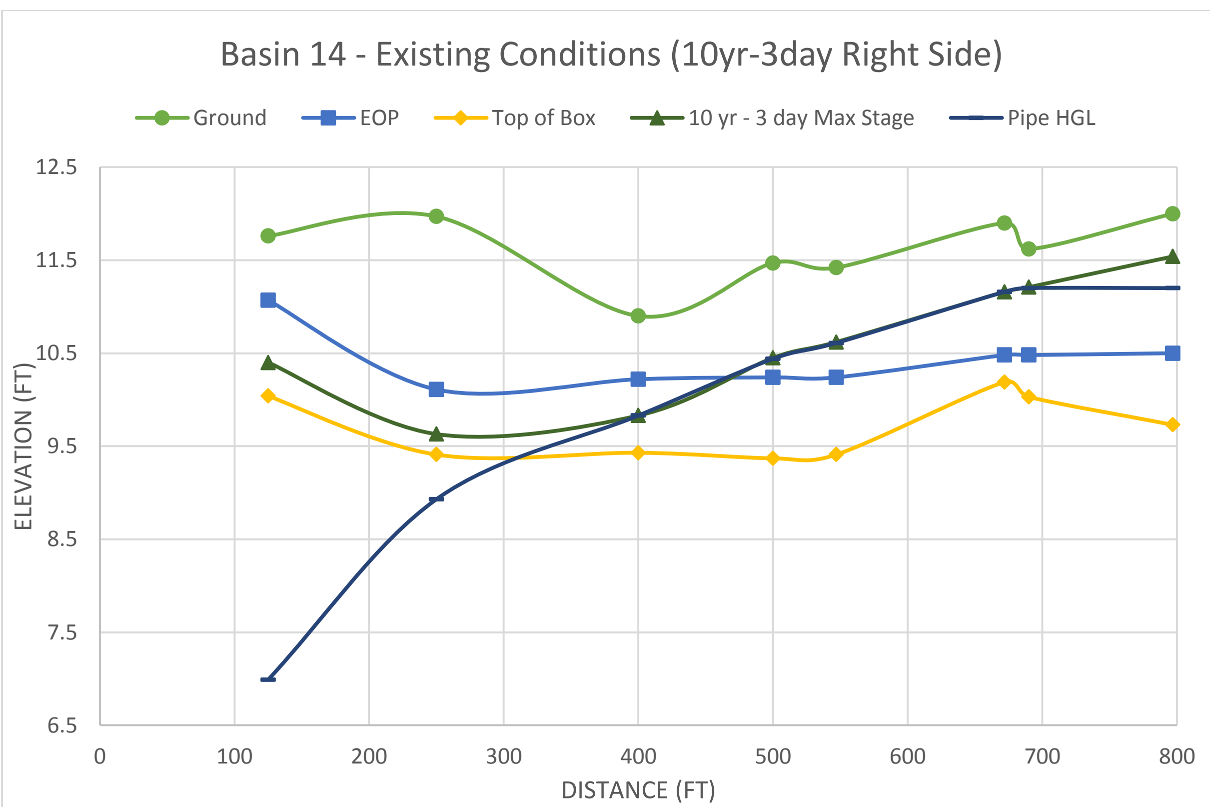

Figure 12 - Basin 14 Existing Conditions (Right Side).

Proposed Conditions

From inspection of the peak stage results, hydraulic grade line, edge of pavement, and ground elevations under existing conditions, certain problem areas within each basin were identified. In an effort to reduce flood stages, AIM developed several model scenarios that revised different input parameters (drainage system components). Optimized scenarios, structure modifications, pipe modifications, maps of modifications, cost opinions, and proposed conditions tables demonstrating flooding reduction are described in the following tables and figures:

Basin 4

Table 2 - Basin 4 Structure Modifications.

Structure Modifications - Basin 4					
Name		Existing		Proposed	
GIS ID	ICPR ID	Type	Weir Elevation	Type	Top of Box Elevation
7352	1	CURB INLET	*	CURB INLET	*
7341	2	GAC	*	TYPE C	*
7331	3	JUNCTION	*	JUNCTION	*
7339	4	JUNCTION	*	JUNCTION	*
7318	5	GAC	*	TYPE C	*
7315	6	GAC	*	TYPE C	*
7256	7	TYPE C	*	TYPE C	*
29553	8	GAC	*	TYPE C	*

** Unless specified, maintain current control elevations*

Table 3 - Basin 4 Pipe Modifications.

Pipe Modifications - Basin 4									
Name		Existing				Proposed			
GIS ID	ICPR ID	Type	Size (IN)	US Invert (FT)	DS Invert (FT)	Type	Size (IN)	US Invert (FT)	DS Invert (FT)
6784	1-2	CMP	15	*	*	HDPE	24	*	*
6774	2-3	CMP	15	*	*	HDPE	24	*	*
6771	3-4	CMP	15	*	*	HDPE	24	*	*
6772	4-5	CMP	15x24	*	*	HDPE	24	*	*
6754	5-6	CMP	18	*	*	HDPE	24	*	*
17928	6-7	CMP	17x13	*	*	HDPE	24	*	*
24201, 24200, 29575 (band)	7-8	CMP	21x15	*	*	HDPE	24	*	*

** Unless specified, maintain current upstream/downstream pipe inverts*

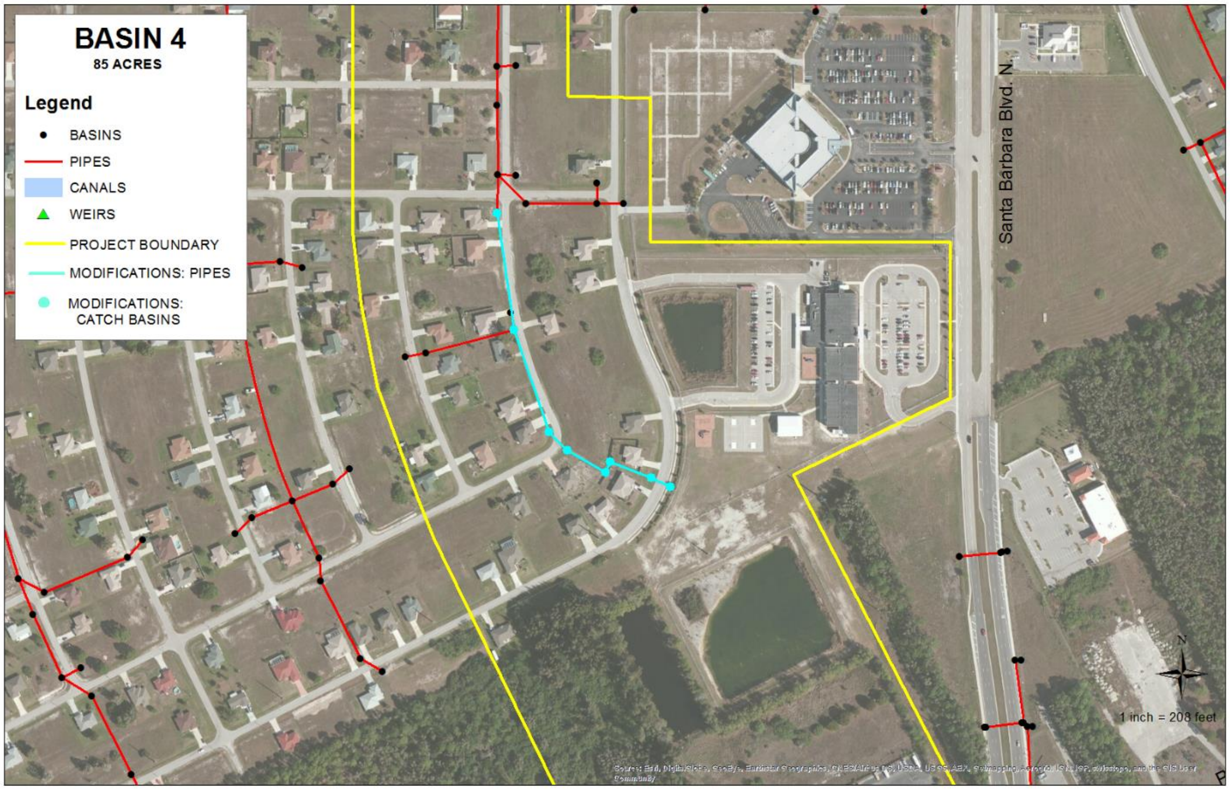

Figure 13 - Basin 4 Modifications Map.

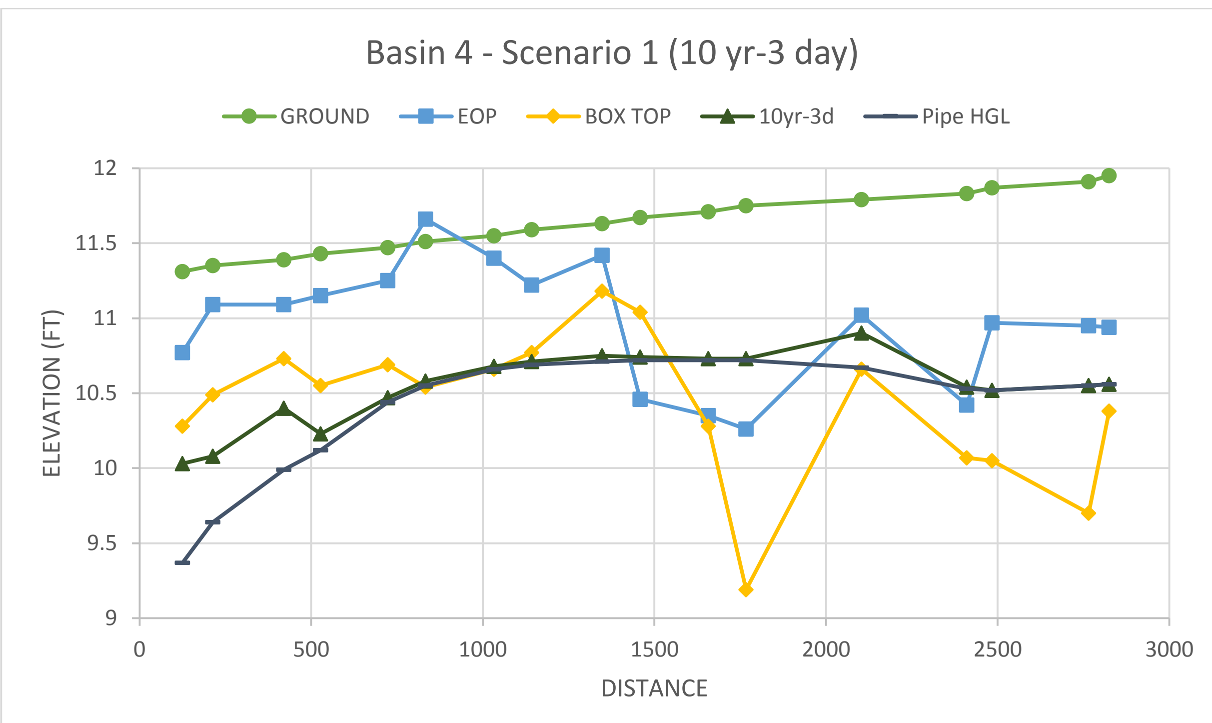

Figure 14 - Basin 4 Proposed Conditions.

Table 4 – Basin 4 Engineer's Opinion of Probable Cost.

AIM ENGINEERING & SURVEYING, INC.
5300 Lee Boulevard
Lehigh Acres, FL 33971
239.332.4569 - Phone
239.332.8734 Fax
Engineer's Opinion of Probable Cost

CLIENT: City of Cape Coral **DATE: 05-15**
PROJECT: Cape Coral Stormwater Master Plan **PERSONNEL: JDL/BLF**
PROJECT NUMBER: 15-0337 **COMMENTS:**
FDOT Standard Specifications for Road & Bridge Construction (2015 Version)

Basin 4

Item Number	DOT Ref. No.	Item Description	Measurement Units	Estimated Quantity	Unit Cost	Item Cost
1	101	Mobilization/Demobilization	LS	1.00	$ 15,000.00	$ 15,000.00
2	100	General Requirements	LS	1.00	$ 5,000.00	$ 5,000.00
3	102-1	Maintenance of Traffic	LS	1.00	$ 5,000.00	$ 5,000.00
4	104	Temporary Erosion Control	LS	1.00	$ 3,000.00	$ 3,000.00
5	120	Excavation (Rock)	LS	1.00	$ 5,000.00	$ 5,000.00
6	120-4	Swale Grading	LF	500.00	$ 20.00	$ 10,000.00
7	121-70	Flowable Fill	CY	60.00	$ 150.00	$ 9,000.00
8	232	FDOT Type C Inlet	EA	5.00	$ 4,000.00	$ 20,000.00
9	211	Curb Inlet	EA	1.00	$ 6,000.00	$ 6,000.00
10	201	Junction Box	EA	2.00	$ 3,000.00	$ 6,000.00
11	430	24" HDPE (including removal of existing pipe)	LF	1060.00	$ 80.00	$ 84,800.00
12	570	Restoration Sodding (Bahia)	SY	950.00	$ 2.50	$ 2,375.00
13	125	Backfill (Replacement)	CY	1,260.00	$ 15.00	$ 18,900.00
14	339	Miscellaneous Asphalt	TN	22.00	$ 120.00	$ 2,640.00
15	160	Limerock Base	CY	22.00	$ 50.00	$ 1,100.00
16	516	Driveway Repair	EA	6.00	$ 1,750.00	$ 10,500.00
17	307	Utility Adjustments	EA	1.00	$ 5,000.00	$ 5,000.00
18	500	Clearing	EA	1.00	$ 5,000.00	$ 5,000.00
19	544	Landscaping Replacement	EA	1.00	$ 2,500.00	$ 2,500.00
TOTAL CONSTRUCTION COST				**$**		**216,815.00**

Basin 10

Table 5- Basin 10 Structure Modifications.

Structure Modifications - Basin 10					
Name		Existing		Proposed	
GIS ID	ICPR ID	Type	Weir Elevation	Type	Top of Box Elevation
6131	48	GAC	*	TYPE C	*
24474	49	GAC	*	TYPE C	*
24475	50	GAC	*	TYPE C	*
24476	51	GAC	*	TYPE C	*

** Unless specified, maintain current control elevations*

Table 6 - Basin 10 Pipe Modifications.

Pipe Modifications - Basin 10									
Name		Existing				Proposed			
GIS ID	ICPR ID	Type	Size (IN)	US Invert (FT)	DS Invert (FT)	Type	Size (IN)	US Invert (FT)	DS Invert (FT)
19060	48-49	CMP	15	*	*	HDPE	18	*	*
19061	49-50	CMP	18	*	*	HDPE	24	*	*
19062	50-51	CMP	18	*	*	HDPE	24	*	*

** Unless specified, maintain current upstream/downstream pipe inverts*

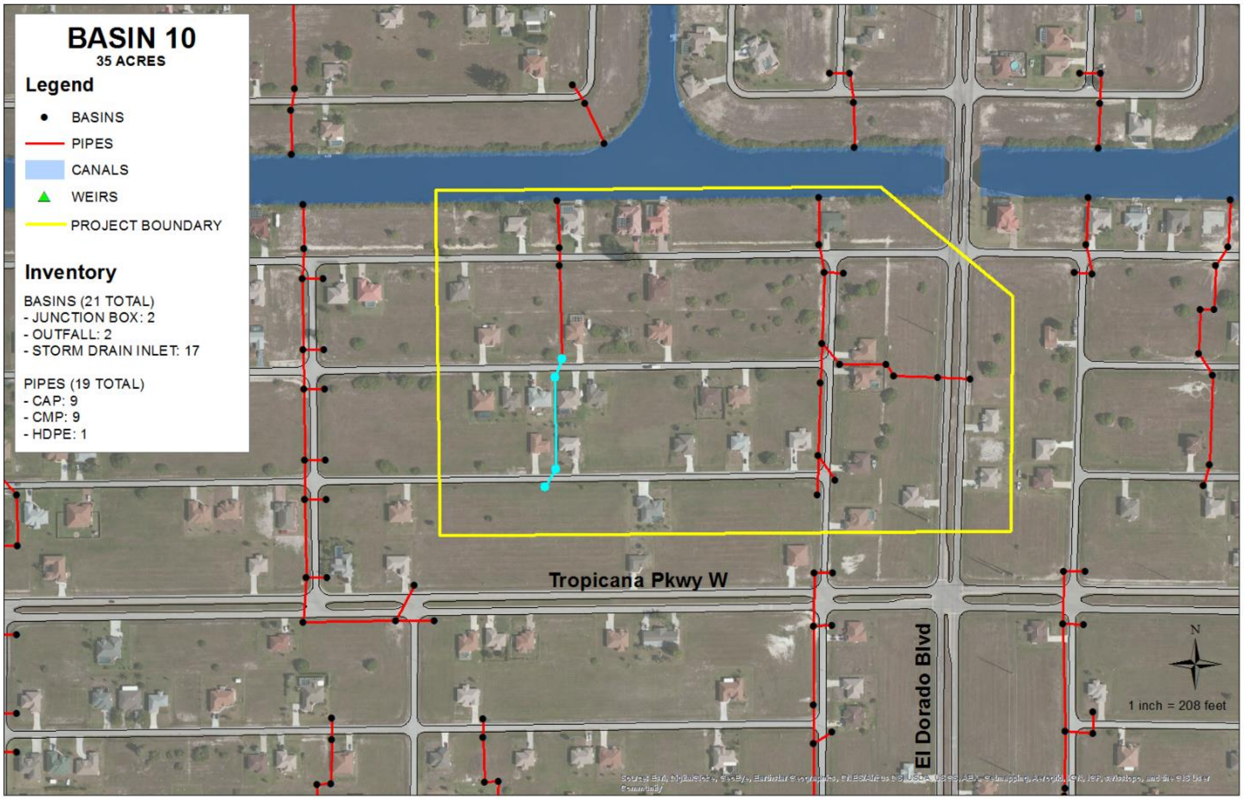

Figure 15 - Basin 10 Modifications Map.

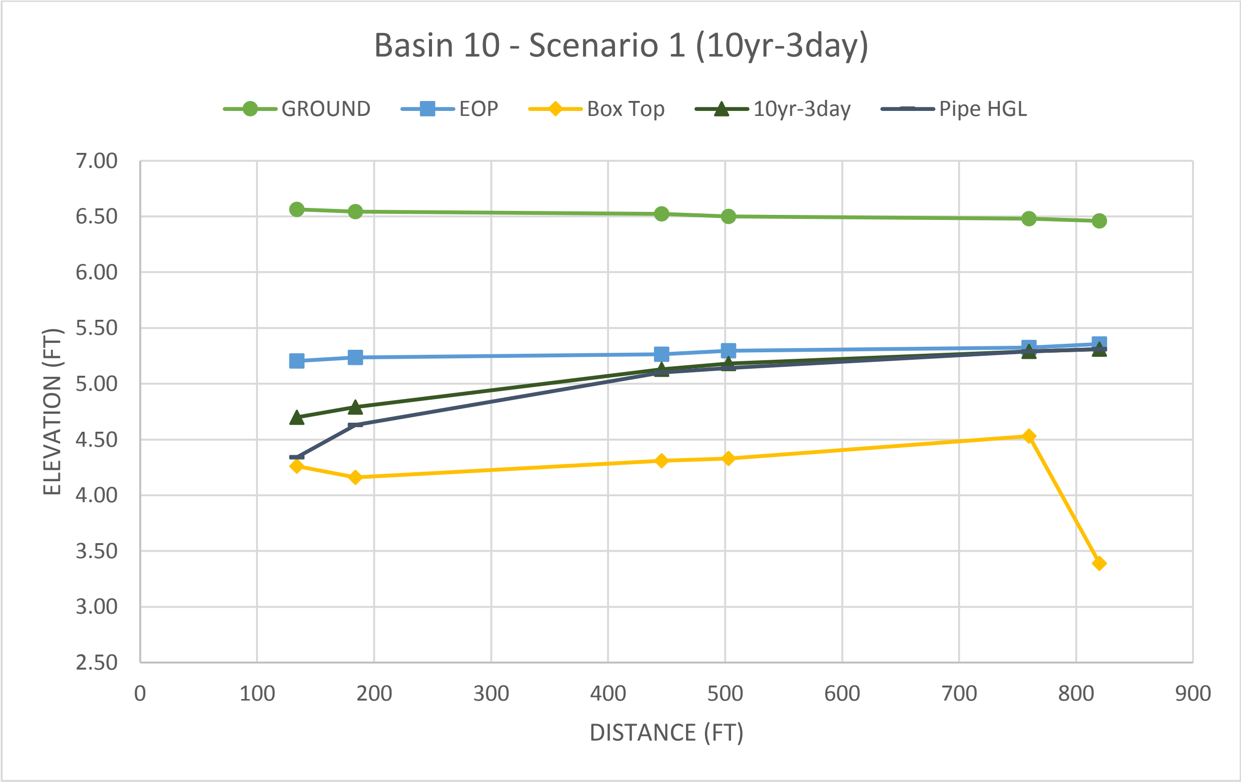

Figure 16 - Basin 10 Proposed Conditions.

Table 7 - Basin 10 Engineer's Opinion of Probable Cost.

AIM ENGINEERING & SURVEYING, INC.
5300 Lee Boulevard
Lehigh Acres, FL 33971
239.332.4569 - Phone
239.332.8734 Fax
Engineer's Opinion of Probable Cost

CLIENT: City of Cape Coral **DATE: 05-15**
PROJECT:Cape Coral Stormwater Master Plan **PERSONNEL: JDL/BLF**
PROJECT NUMBER: 15-0337 **COMMENTS:**
FDOT Standard Specifications for Road & Bridge Construction (2015 Version)

Basin 10

Item Number	DOT Ref. No.	Item Description	Measurement Units	Estimated Quantity	Unit Cost	Item Cost
1	101	Mobilization/Demobilization	LS	1.00	$ 7,500.00	$ 7,500.00
2	100	General Requirements	LS	1.00	$ 5,000.00	$ 5,000.00
3	102-1	Maintenance of Traffic	LS	1.00	$ 5,000.00	$ 5,000.00
4	104	Temporary Erosion Control	LS	1.00	$ 3,000.00	$ 3,000.00
5	120	Excavation (Rock	LS	1.00	$ 3,000.00	$ 3,000.00
6	120-4	Swale Grading	LF	200.00	$ 20.00	$ 4,000.00
7	121-70	Flowable Fill	CY	43.00	$ 150.00	$ 6,450.00
8	232	FDOT Type C Inlet	EA	4.00	$ 4,000.00	$ 16,000.00
9	430	18" HDPE (including removal of existing pipe)	LF	60.00	$ 70.00	$ 4,200.00
10	430	24" HDPE (including removal of existing pipe)	LF	315.00	$ 80.00	$ 25,200.00
11	570	Restoration Sodding (Bahia)	SY	350.00	$ 2.50	$ 875.00
12	125	Backfill (Replacement)	CY	450.00	$ 15.00	$ 6,750.00
13	339	Miscellaneous Asphalt	TN	10.00	$ 120.00	$ 1,200.00
14	160	Limerock Base	CY	11.00	$ 50.00	$ 550.00
15	500	Clearing	EA	1.00	$ 5,000.00	$ 5,000.00
16	544	Landscaping Replacement	EA	1.00	$ 5,000.00	$ 5,000.00
17	307	Utility Adjustment	EA	1.00	$ 5,000.00	$ 5,000.00
TOTAL CONSTRUCTION COST						**$ 103,725.00**

Basin 14

Table 8 - Basin 14 Structure Modifications.

Structure Modifications - Basin 14						
	Name		Existing		Proposed	
	GIS ID	ICPR ID	Type	Top of Box Elevation	Type	Top of Box Elevation
LEFT SIDE - WEST BRANCH						
	8014	76	TYPE C	*	TYPE D	*
	8008	75	TYPE C	*	TYPE D	*
	24442	74	TYPE C	*	TYPE D	*
	24441	73	TYPE C	*	TYPE D	*
	24440	72	TYPE C	*	TYPE D	*
	24438	71	TYPE C	*	TYPE D	*
	24437	68	TYPE C	*	TYPE D	*
	24435	67	TYPE C	*	TYPE D	*
	24444	65	JUNCTION	*	JUNCTION	*
LEFT SIDE - EAST BRANCH						
	24434	60	TYPE C	9.16	TYPE D	8.5
	7632	61	TYPE C	9.42	TYPE D	8.77
	7633	62	TYPE C	9.2	TYPE D	8.87
	7609	63	TYPE C	9.9	TYPE D	9.31
	14906	65	TYPE C	10.14	TYPE D	9.5
	26674	66	TYPE C	*	TYPE D	*
CENTER						
	7758	83	TYPE C	9.47	TYPE D	8.84
	7732	82	TYPE C	*	TYPE D	*
	7673	81	JUNCTION	*	JUNCTION	*
	7672	80	TYPE C	*	TYPE D	*
	7634	79	TYPE C	*	TYPE D	*
	7635	78	TYPE C	*	TYPE D	*
RIGHT SIDE						
	7850	96	TYPE C	*	TYPE D	*
	7791	89	JUNCTION	*	JUNCTION	*
	N/A	88A	TYPE C	10.19	TYPE D	9.9
	7733	87	TYPE C	8.73	TYPE D	8.73
	**N/A	87A	N/A	N/A	TYPE D	8.73

Note: GAC type top of box elevation indicates existing weir elevation

** Unless specified, maintain current control elevations*

**Scenario 2

Table 9 - Basin 14 Pipe Modifications.

Pipe Modifications - Basin 14									
Name		**Existing**				**Proposed**			
GIS ID	**ICPR ID**	**Type**	**Size (IN)**	**US Invert (FT)**	**DS Invert (FT)**	**Type**	**Size (IN)**	**US Invert (FT)**	**DS Invert (FT)**
LEFT SIDE - WEST BRANCH									
19025	72-73	CMP	30	*	*	HDPE	36	*	*
19030	58B-59	ECPM	15 X 21	*	*	HDPE	36	*	*
N/A	57	ERCP	15 X 21	*	*	HDPE	36	*	*
19028	76-77	CMP	36	5.15	4.13	HDPE	42	2.5	2.0
7834	75-76	CMP	36	5.67	4.97	HDPE	42	3.0	2.5
19027	74-75	RCP	36	5.33	5.55	HDPE	42	3.5	3.0
19020	67-68	CMP	30	*	*	HDPE	36	*	*
19029	59-67	RCP	24	*	*	HDPE	36	*	*
19022	68-71	CMP	30	*	*	HDPE	36	*	*
LEFT SIDE - EAST BRANCH									
19019	60-59	ECMP	15 X 21	*	*	HDPE	36	*	*
13904	65-63	ECMP	15 X 21	*	*	HDPE	36	*	*
14346	63-62	CMP	18	*	*	HDPE	36	*	*
7599	62-61	RCP	18	*	*	HDPE	36	*	*
19018	61-60	RCP	24	*	*	HDPE	36	*	*
CENTER									
819	83-OUT	CMP	24	*	*	HDPE	36	*	*
7688	82-83	CMP	24	*	*	HDPE	36	*	*
7668	81-82	CMP	24	*	*	HDPE	36	*	*
7630	80-81	ECMP	15 X 21	*	*	HDPE	36	*	*
7629	79-80	CMP	8	*	*	HDPE	36	*	*
7600	78-79	CMP	18	*	*	HDPE	30	*	*
N/A	79	CMP	8	*	*	HDPE	36	*	*
RIGHT SIDE									
7551	96-97	CMP	36	4.74	*	HDPE	36	3	*
15931	88A-91A	CMP	18	*	*	HDPE	36	*	*
15931	88-88A	CMP	18	*	*	HDPE	36	*	*
**N/A	87A-87AA	N/A	N/A	N/A	N/A	HDPE	36	6.5	6.03
N/A	87	N/A	N/A	N/A	N/A	HDPE	36	*	*

** Unless specified, maintain current upstream/downstream pipe inverts*

**Scenario 2

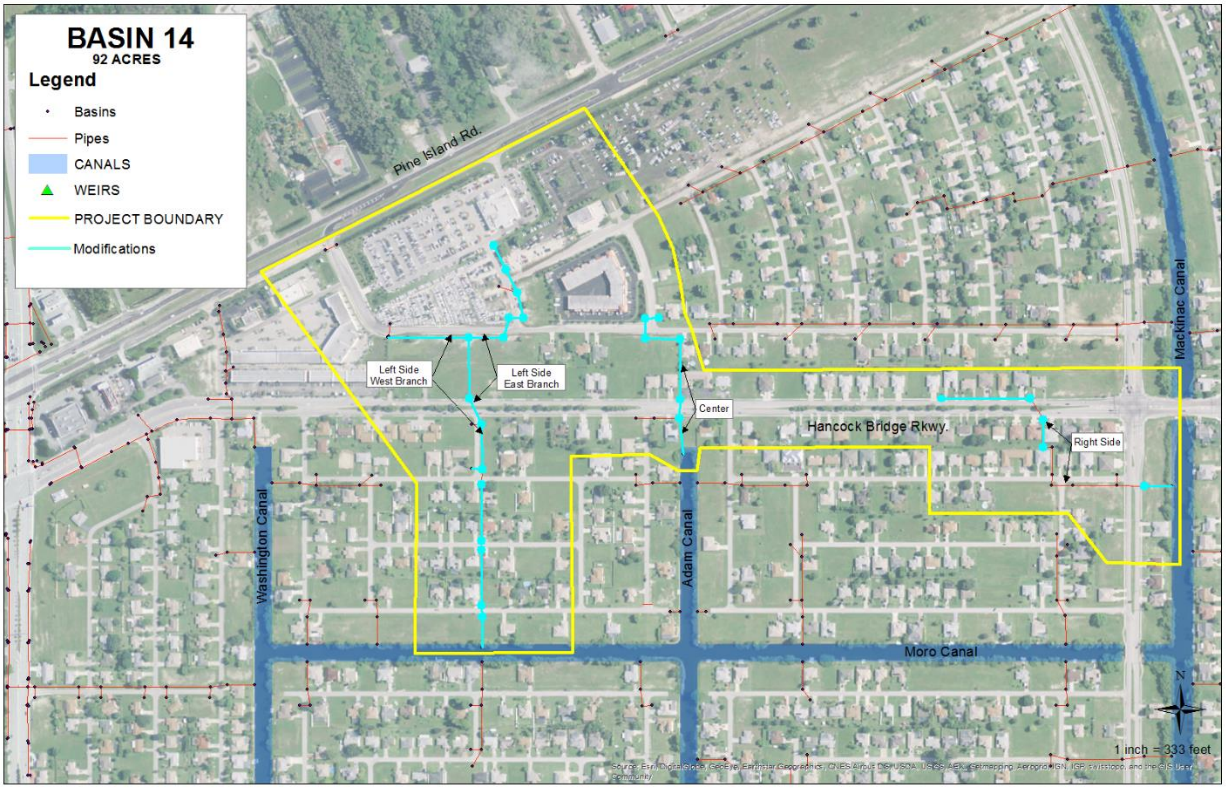

Figure 17 - Basin 14 Modifications Map.

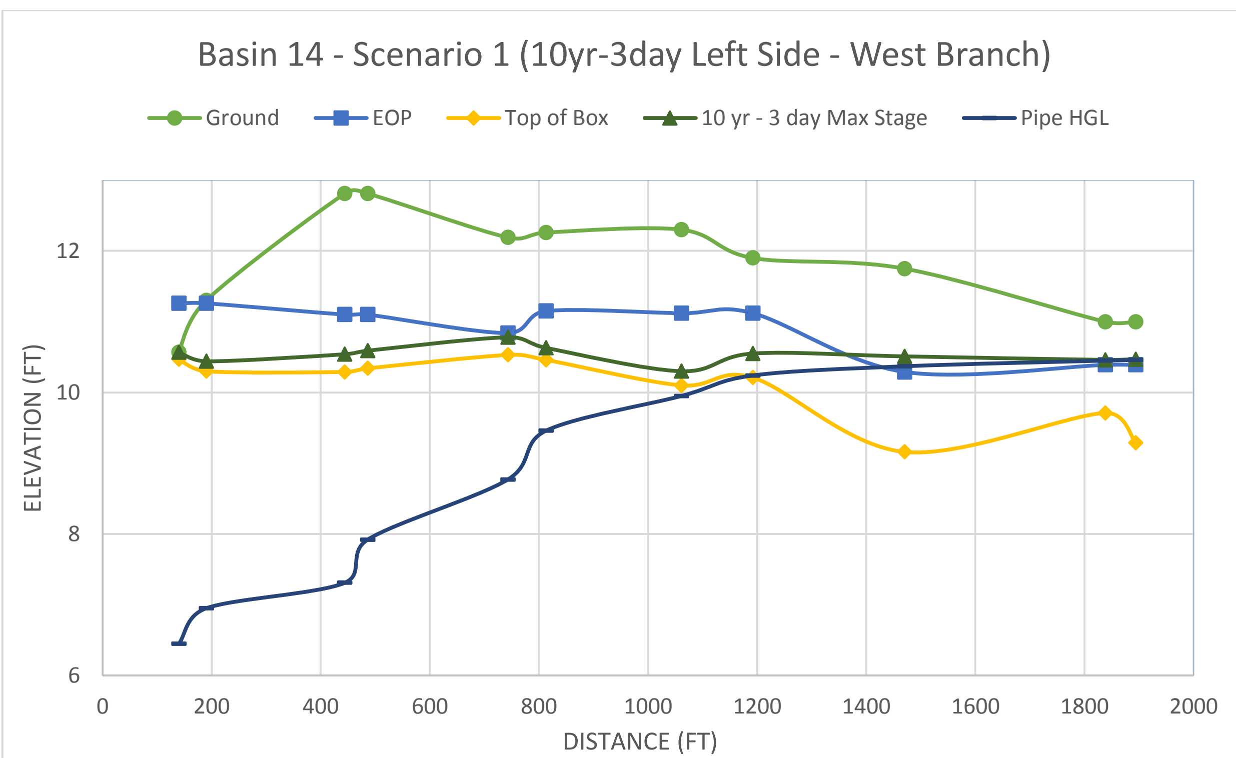

Figure 18 - Basin 14 Proposed Conditions (Left Side –West Branch).

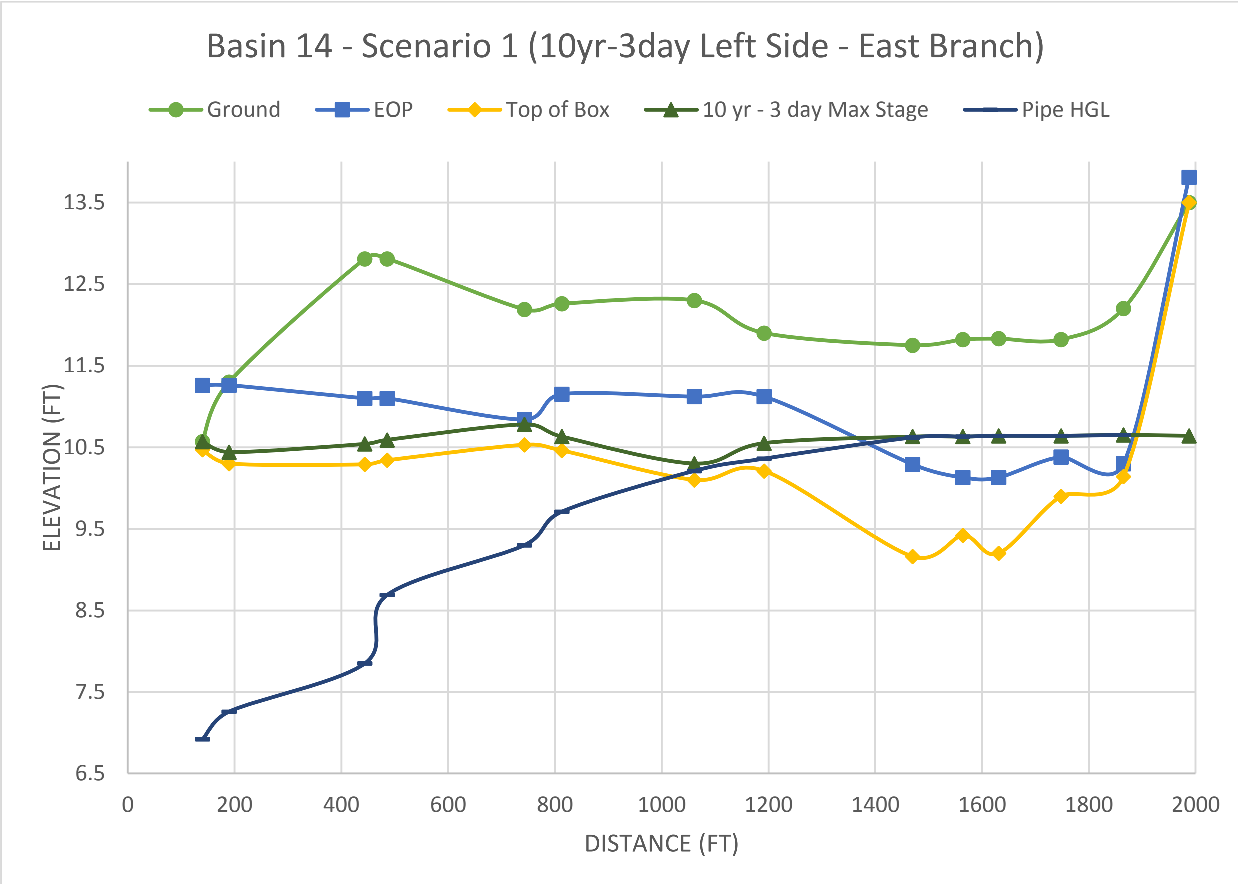

Figure 19 - Basin 14 Proposed Conditions (Left Side – East Branch).

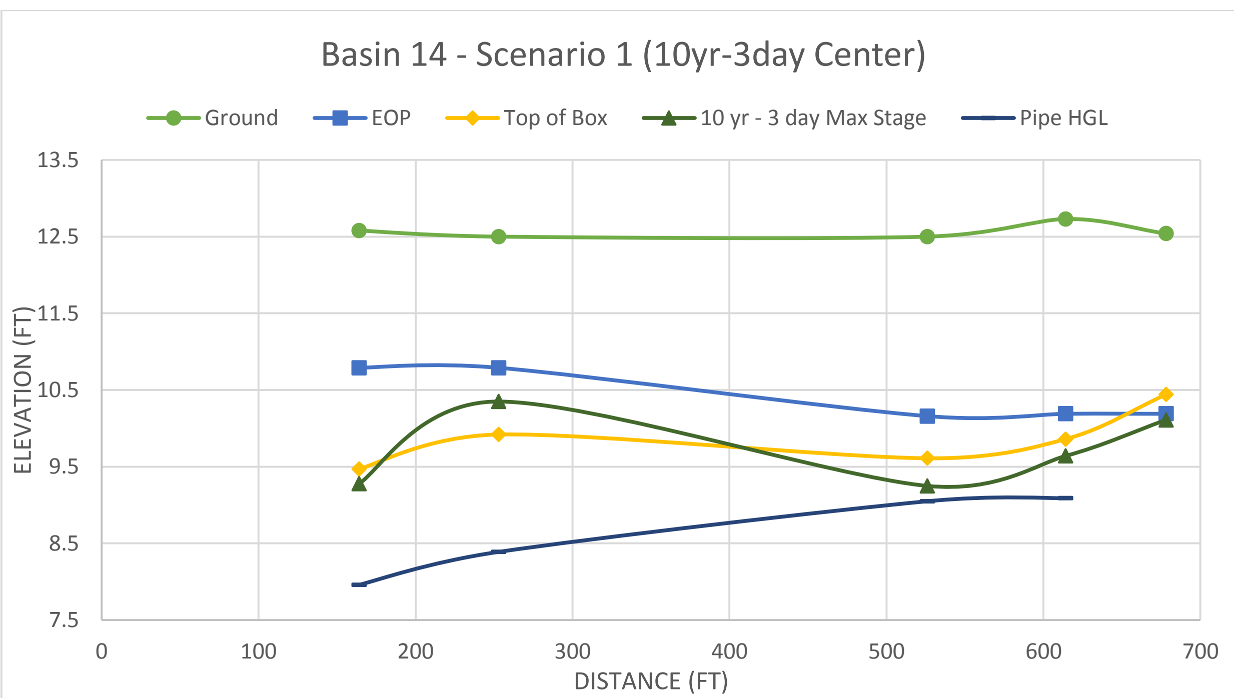

Figure 20 - Basin 14 Proposed Conditions (Center).

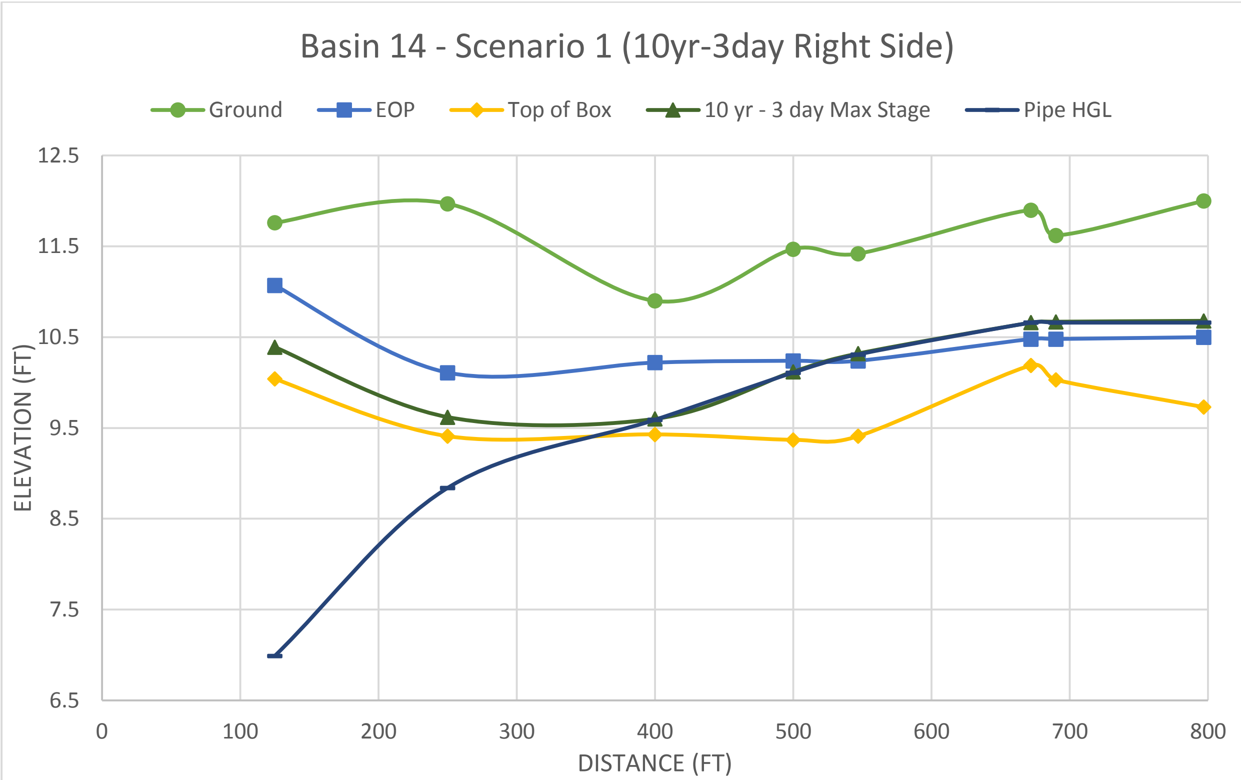

Figure 21 - Basin 14 Proposed Conditions (Right Side).

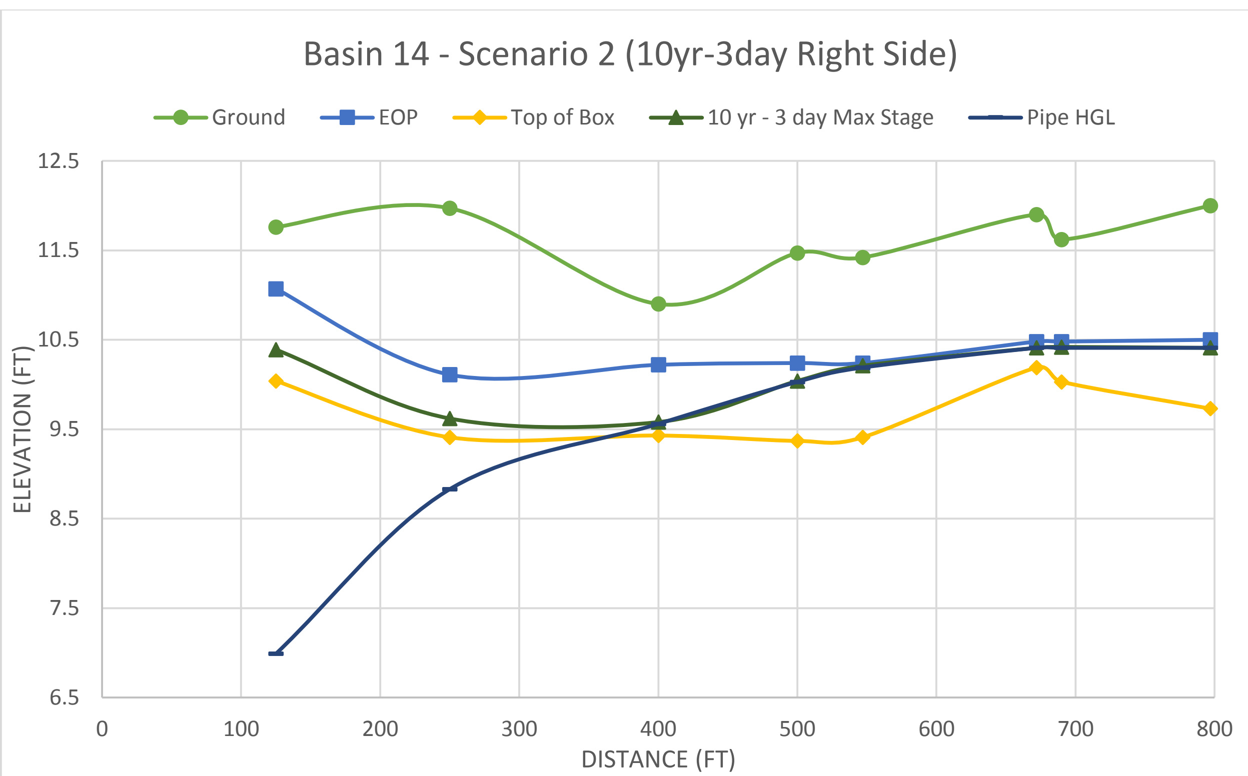

Figure 22 - Basin 14 Proposed Conditions Scenario 2 (Right Side).

Table 10 - Basin 14 Engineer's Opinion of Probable Cost.

AIM ENGINEERING & SURVEYING, INC.
5300 Lee Boulevard
Lehigh Acres, FL 33971
239.332.4569 - Phone
239.332.8734 Fax
Engineer's Opinion of Probable Cost

CLIENT: City of Cape Coral **DATE: 05-15**
PROJECT:Cape Coral Stormwater Master Plan **PERSONNEL: JDL/BLF**
PROJECT NUMBER: 15-0337 **COMMENTS:**
FDOT Standard Specifications for Road & Bridge Construction (2015 Version)

Basin 14

Item Number	DOT Ref. No.	Item Description	Measurement Units	Estimated Quantity	Unit Cost	Item Cost
1	101	Mobilization/Demobilization	LS	1.00	$ 15,000.00	$ 15,000.00
2	100	General Requirements	LS	1.00	$ 15,000.00	$ 15,000.00
3	121	Maintenance of Traffic	LS	1.00	$ 17,000.00	$ 17,000.00
4	104	Temporary Erosion Control	LS	1.00	$ 4,500.00	$ 4,500.00
5	120	Excavation (Rock)	LS	1.00	$ 9,000.00	$ 9,000.00
6	120-4	Swale Grading	LF	4900.00	$ 20.00	$ 98,000.00
7	121	Flowable Fill	CY	236.15	$ 130.00	$ 30,699.26
8	232	FDOT Type D Inlet	EA	23.00	$ 5,000.00	$ 115,000.00
9	201	Junction Box	EA	3.00	$ 3,000.00	$ 9,000.00
10	430	36" HDPE (including removal of existing pipe)	LF	3557.00	$ 135.00	$ 480,195.00
11	430	42" HDPE (including removal of existing pipe)	LF	444.00	$ 160.00	$ 71,040.00
12	570	Restoration Sodding (Bahia)	SY	1,778.22	$ 2.50	$ 4,445.56
13	125	Backfill (Replacement)	CY	888.89	$ 15.00	$ 13,333.33
14	339	Miscellaneous Asphalt	TN	55.00	$ 120.00	$ 6,600.00
15	160	Limerock Bass	CY	55.56	$ 50.00	$ 2,777.78
TOTAL CONSTRUCTION COST					**$**	**891,590.93**

Conclusion

By inspection of the modeling results, proposed modifications to the secondary stormwater system for each sub-basin study area are shown to achieve a reduction of peak flood stages in the 10-year, 3-dy storm event. Due to budget constraints, it is anticipated that all modifications proposed herein will not be performed at one time. However, it was shown in the hydraulic analysis that by simply increasing the final few outfall pipe diameters just upstream of the outfall of each sub-basin, there was a reduction of roadway flooding to a certain degree.

Recommendations

AIM created the ICPR hydraulic models for each sub basin area based on available data, collected survey, and using engineering judgement for assumptions made. Prior to final design and construction of the proposed secondary drainage improvements as described herein, AIM recommends that the peak stage suggested results be verified to the greatest extent possible through collaboration with field staff and possible local residents who have witnessed flooding in these areas. This will provide additional verification of the model, or suggest which model input parameters can be adjusted (within reason) to improve calibration.