



# Village of Estero Stormwater Master Plan

October, 2018



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ENGINEERING





**Figure 4-3: Country Creek Drive, Looking North  
(August 28, 2017)**



**Figure 4-4: Estero River, North Branch  
(August 28, 2017)**

#### **4.3. Improvement Projects Evaluated with Model Scenarios**

The following report sections detail the ICPR4 modeling that was completed for the studied projects.

##### **4.3.1. Project One - Villages of Country Creek Bypass Swale Improvements**

The intent for Project One is to re-establish the conveyance ability of the Villages at Country Creek Bypass Swale that runs along the north side of the Villages at Country Creek property, to the west and along the west boundary until it reaches the Estero River Main Branch. Based on the existing conditions hydraulic analysis, this bypass swale provides little relief to the North Branch prior to entering the Villages at Country Creek property. Re-establishing the bypass connection should provide a better distribution of flows within the North Branch as it enters the Villages at Country Creek property.

##### **Project One: Phase One**

Improvements considered for The Villages at Country Creek Bypass Swale, includes the addition of two inline structures and channel modifications to increase the flow capacity. The proposed improvements considered during this evaluation are described as follows:

- Improvements to the main channel sections considers modifications to the existing channel cross sections from the most downstream confluence of The Villages at Country Creek Bypass Swale with the Estero River North Branch Diversion 1 (ERNBD1) to the most upstream connection of the Bypass Swale with the Estero River North Branch (ERNB). The proposed trapezoidal cross sections at the Bypass Swale are considered to have side slopes of 3H:1V with variable top and bottom widths. Trapezoidal cross sections channel top width ranges from approximately 45 feet to 50 feet, while the bottom width varies from 4 feet to 20 feet. It should be noted, that bottom widths of 20 feet were used near the existing culvert structures to consider the full width of the culvert openings, since these two (2) structures are considered to stay. It should be noted, that a berm may be required at some locations to optimize the design through the entire Bypass Swale.
- The most downstream invert along the Bypass Swale is considered to be 1.3 feet-NAVD (same found at Estero River North Branch Diversion 1) and the most upstream invert is considered at 8.5 feet-NAVD (near the Bypass Swale connection with the Estero River). An adequate tie-in of all connections to the Bypass Swale should be warranted.
- Installation of an inline structure (weir) at the most upstream swale with an elevation equivalent or similar to the existing swale bottom (ranging from approximately 8.9 feet to 10.5 feet-NAVD).
- Installation of an inline structure (weir) some feet upstream of the confluence of The Villages of Country Creek Bypass and the Estero River North Branch Diversion 1 (Node Name: ERNBD1). Such structure should allow flows associated to less severe rainfall events.
- Proposed improvements consider a routine maintenance that will keep the Bypass Swale free of: obstructions, undesired vegetation, and sedimentation /scour.

## Project One: Phase Two

Improvements considered for the Ditch Between Cascades and Rookery Point Alignment Improvement: Diversion to the Villages at Country Creek Bypass System, includes the addition of a supplemental channel to connect with the improved Villages at Country Creek Bypass Swale (as described in Phase 1) and immediately upstream channel cross section modification. Such ditch is named as ERNB4 in the ICPR4 Model. The proposed improvements are intended to divert some of the flows from the Ditch (ERNB4) while keeping the ultimate discharge point (Estero River, North Branch). The proposed improvements considered during this evaluation are described as follows:

- Creation of a diversion channel approximately 500 feet long, generally following a north to south alignment with a geometry similar to the one found at the existing downstream segment. A trapezoidal section with side slopes of 3H:1V, top width of 45 feet and bottom width of 23 feet was considered. The most downstream invert was established considering The Villages at Country Creek Bypass swale proposed sections (invert elevation of 8.25 feet-NAVD), while the upstream invert elevation was set to 11.7 feet -NAVD (consistent with the existing most downstream segment at the ditch).
- Improvements to the ditch cross section at the diversion point include: modifications to the channel section generally conforming the same geometry as the existing cross section, but warranting a well-defined, free of: obstructions, undesired vegetation at the channel, debris and sediment/erosion (as part of a continuous maintenance program). Approximate dimensions considered are: top width of 45 feet, bottom width of 19 feet, approximate side slopes of 3H:1V. It is proposed to keep the same invert as the existing conditions (11.61 feet-NAVD, based on the available LiDAR topographic information).
- Removal of undesired debris and vegetation from the most downstream ditch channel segment (to the confluence with the Estero River North Branch) as part of a continuous maintenance program.

Once the modifications were conducted in the ICPR4 model, the 25-Year, 3-Day design storm simulation was executed, and peak stage results were compared with the pre-project stages. The modeling results indicate a significant decrease in peak water surface elevations along the Estero River North Branch channel from the confluence with the Main/South Branches up through the Three Oaks Parkway crossing. The maximum decrease in water surface elevation within the North Branch is 0.57 feet or 6.8 inches. Decreases in peak stages were also shown in the development areas adjacent to the North Branch, such as the Villages of Country Creek. Within the Bypass swale (ERNB6) itself, the decrease in peak water surface stages were also significant, with the maximum difference of 0.89 feet. This is attributed to the additional capacity of the Bypass swale system with the improved cross-section and maintained conditions. The results also indicate a slight increase (maximum of 0.15 feet) in the peak water stages of the North Branch Diversion 1 (ERNBD1) due to the increased flow from the improved Bypass swale. Provided below is a comparison table for the surrounding nodes for the Project One Peak Stage results. Also, reference Figure 4-7 for an exhibit of the project area.



**Table 4-1: Project One Node Comparison Results**

Project One Node Comparison Results				
Node	Existing 25-Year Stage	Project_1 25-Year Stage	Run Difference	Notes
ER-N1	0.48	0.49	0.01	
ER-N10	1.65	1.66	0.01	
ER-N11	1.83	1.84	0.01	
ER-N12	2.28	2.29	0.01	
ER-N13	2.61	2.62	0.01	
ER-N14	3.01	3.03	0.02	
ER-N15	3.10	3.12	0.02	
ER-N16	3.34	3.36	0.02	
ER-N17	3.38	3.40	0.02	
ER-N18	3.42	3.45	0.03	
ER-N19	3.56	3.58	0.02	
ER-N2	0.52	0.52	0.00	
ER-N20	3.74	3.76	0.02	
ER-N204	2.22	2.24	0.02	
ER-N21	3.91	3.94	0.03	
ER-N22	3.92	3.95	0.03	
ER-N23	4.63	4.66	0.03	
ER-N24	4.64	4.67	0.03	
ER-N24.5	5.41	5.44	0.03	
ER-N25	6.00	6.03	0.03	
ER-N26	6.01	6.04	0.03	
ER-N27	6.58	6.62	0.04	
ER-N28	6.69	6.72	0.03	
ER-N28.6	6.96	6.97	0.01	
ER-N29	7.08	7.09	0.01	
ER-N3	0.92	0.92	0.00	
ER-N4	1.24	1.24	0.00	
ER-N5	1.28	1.29	0.01	
ER-N6	1.43	1.43	0.00	
ER-N7	1.46	1.47	0.01	
ER-N8	1.48	1.49	0.01	
ER-N81	1.44	1.45	0.01	
ER-N9	1.50	1.51	0.01	

Project One Node Comparison Results				
Node	Existing 25-Year Stage	Project_1 25-Year Stage	Run Difference	Notes
ER-N901	6.80	6.80	0.00	
ERNB6-N1	9.11	8.40	-0.71	
ERNB6-N10	10.94	10.57	-0.37	
ERNB6-N11	11.05	10.84	-0.21	
ERNB6-N12	11.62	11.12	-0.50	
ERNB6-N13	11.78	11.20	-0.58	
ERNB6-N14	11.85	11.65	-0.20	
ERNB6-N15	12.33	12.33	0.00	
ERNB6-N2	9.34	8.66	-0.68	
ERNB6-N3	9.35	8.78	-0.57	
ERNB6-N4	10.19	9.30	-0.89	
ERNB6-N5	10.55	9.79	-0.76	
ERNB6-N6	10.59	9.95	-0.64	
ERNB6-N7	10.59	10.03	-0.56	
ERNB6-N8	10.78	10.17	-0.61	
ERNB6-N9	10.92	10.41	-0.51	
ERNBD1-N1	6.67	6.72	0.05	
ERNBD1-N2	6.67	6.73	0.06	
ERNBD1-N3	6.86	6.95	0.09	
ERNBD1-N4	7.28	7.43	0.15	
ERNB-N1	7.83	7.76	-0.07	
ERNB-N10	10.84	10.33	-0.51	
ERNB-N11	10.84	10.33	-0.51	
ERNB-N12	11.30	10.76	-0.54	
ERNB-N13	11.63	11.08	-0.55	
ERNB-N15	11.75	11.19	-0.56	
ERNB-N16	11.80	11.23	-0.57	
ERNB-N17	12.44	11.97	-0.47	
ERNB-N18	14.08	14.00	-0.08	
ERNB-N19	14.66	14.62	-0.04	
ERNB-N2	8.61	8.36	-0.25	
ERNB-N20	14.66	14.62	-0.04	
ERNB-N21	14.72	14.69	-0.03	
ERNB-N22	14.77	14.73	-0.04	

Project One Node Comparison Results				
Node	Existing 25-Year Stage	Project_1 25-Year Stage	Run Difference	Notes
ERNB-N23	14.78	14.75	-0.03	
ERNB-N24	14.79	14.76	-0.03	
ERNB-N26	14.80	14.77	-0.03	
ERNB-N27	14.83	14.79	-0.04	
ERNB-N3	9.41	9.04	-0.37	
ERNB-N30	14.83	14.80	-0.03	
ERNB-N31	14.88	14.85	-0.03	
ERNB-N31.5	14.89	14.86	-0.03	
ERNB-N34	15.28	15.27	-0.01	
ERNB-N35	15.32	15.31	-0.01	
ERNB-N35.5	15.34	15.33	-0.01	
ERNB-N36	15.34	15.33	-0.01	
ERNB-N37	15.43	15.42	-0.01	
ERNB-N39	15.81	15.81	0.00	
ERNB-N4	9.92	9.48	-0.44	
ERNB-N40	15.86	15.86	0.00	
ERNB-N41	15.86	15.86	0.00	
ERNB-N45	15.32	15.31	-0.01	
ERNB-N6	9.98	9.53	-0.45	
ERNB-N7	10.15	9.68	-0.47	
ERNB-N8	10.26	9.78	-0.48	
ERNB-NC014	12.96	12.89	-0.07	
ERNB-NC05	10.28	10.04	-0.24	Villages of Country Creek Basin 3
ERNB-NC09	11.19	11.01	-0.18	Villages of Country Creek Basin 1
ERNB-NC14	12.95	12.87	-0.08	Villages of Country Creek Basin 4
ERNB-NC25	16.16	16.16	0.00	Rookery Basin 2

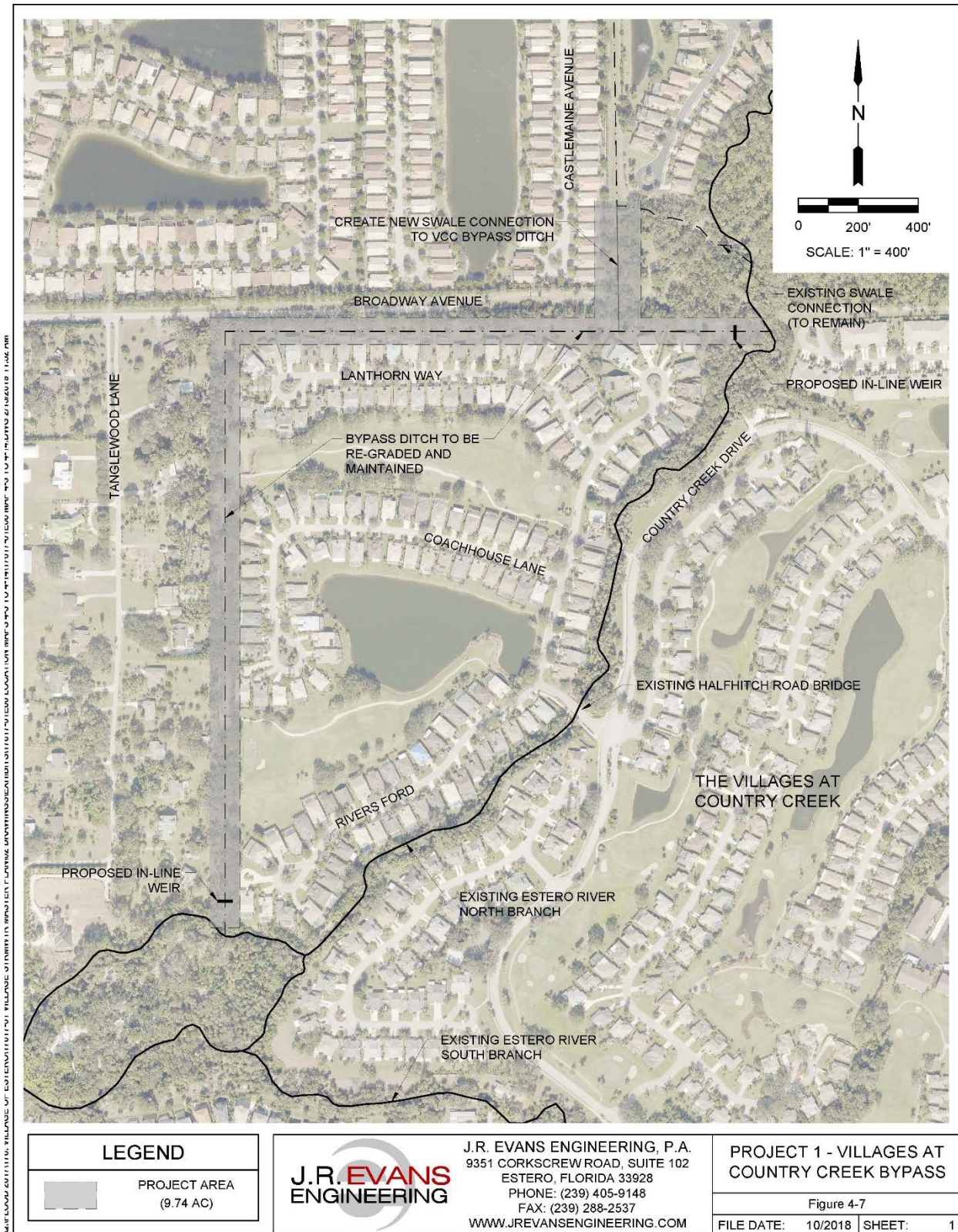


Figure 4-7: Project One - Villages at Country Creek Bypass

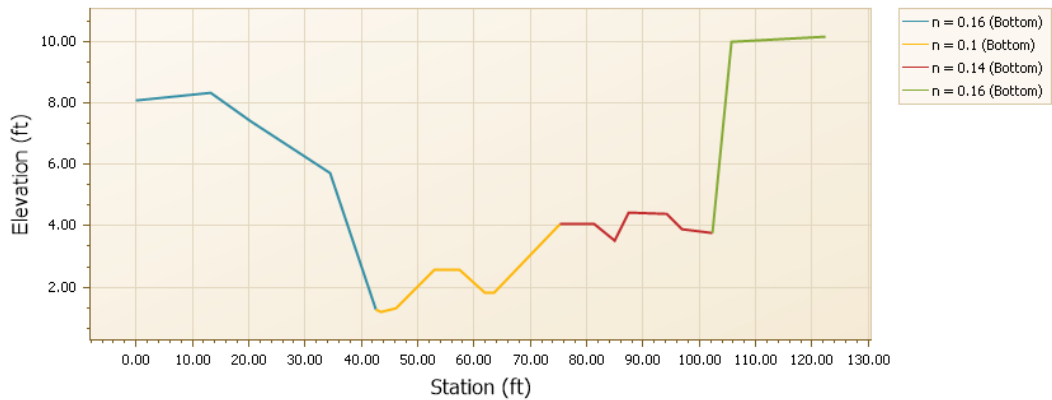


### 4.3.6. Project Six - Dry Creek Bed Sediment Removal

Improvements considered for the Bamboo Island bypass between the North Branch and South Branch of the Estero River include the dredging, reshaping and removal of vegetation within the bypass channel to increase the flow capacity and better distribute the flow between the north diversion and the subject bypass channel. The proposed improvements to the bypass channel are shown in the below cross-sections:

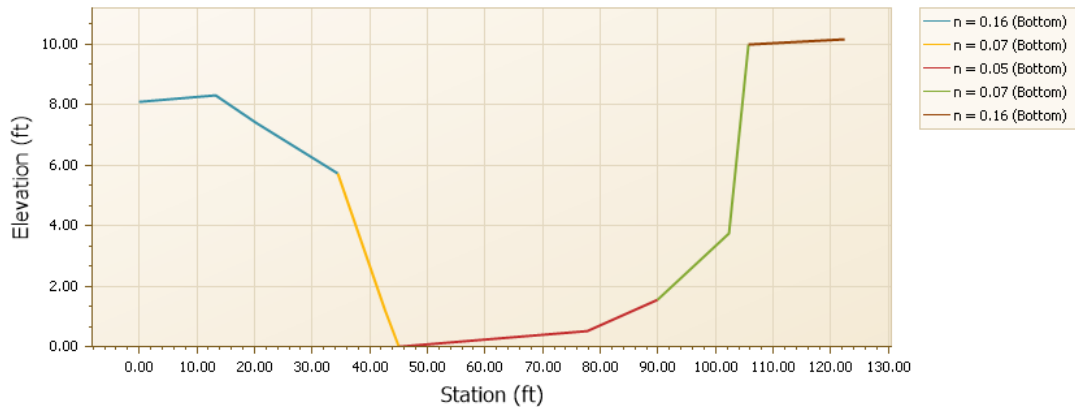
#### EXISTING CHANNEL CROSS-SECTION ERNB-XS01

##### ERNB-XS01



#### PROPOSED CHANNEL CROSS-SECTION ERNB-XS01

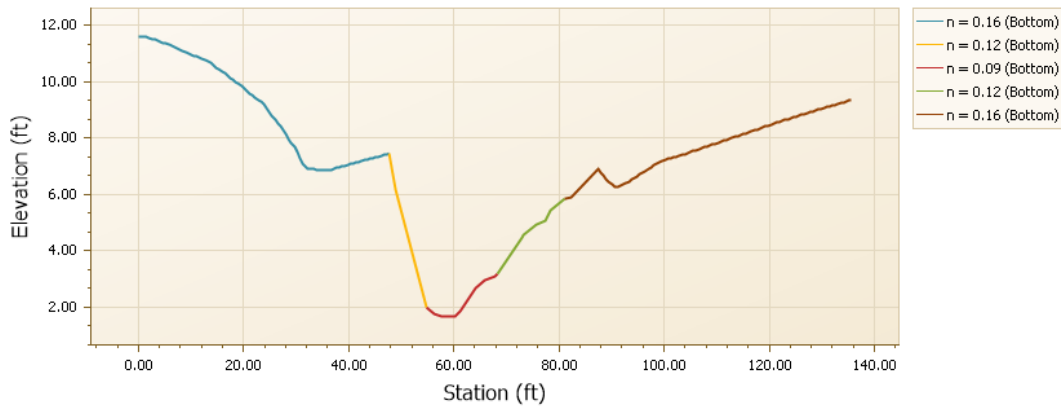
##### ERNB-XS01



**Figure 4-12: Channel Cross-section ERNB-XS01 Comparison**

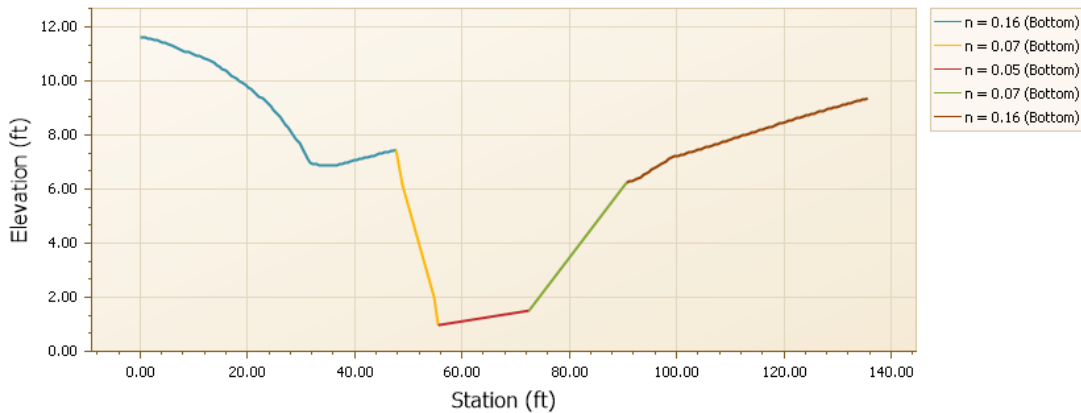
### EXISTING CHANNEL CROSS-SECTION ERNB-XS02

#### ERNB-XS02



### PROPOSED CHANNEL CROSS-SECTION ERNB-XS02

#### ERNB-XS02



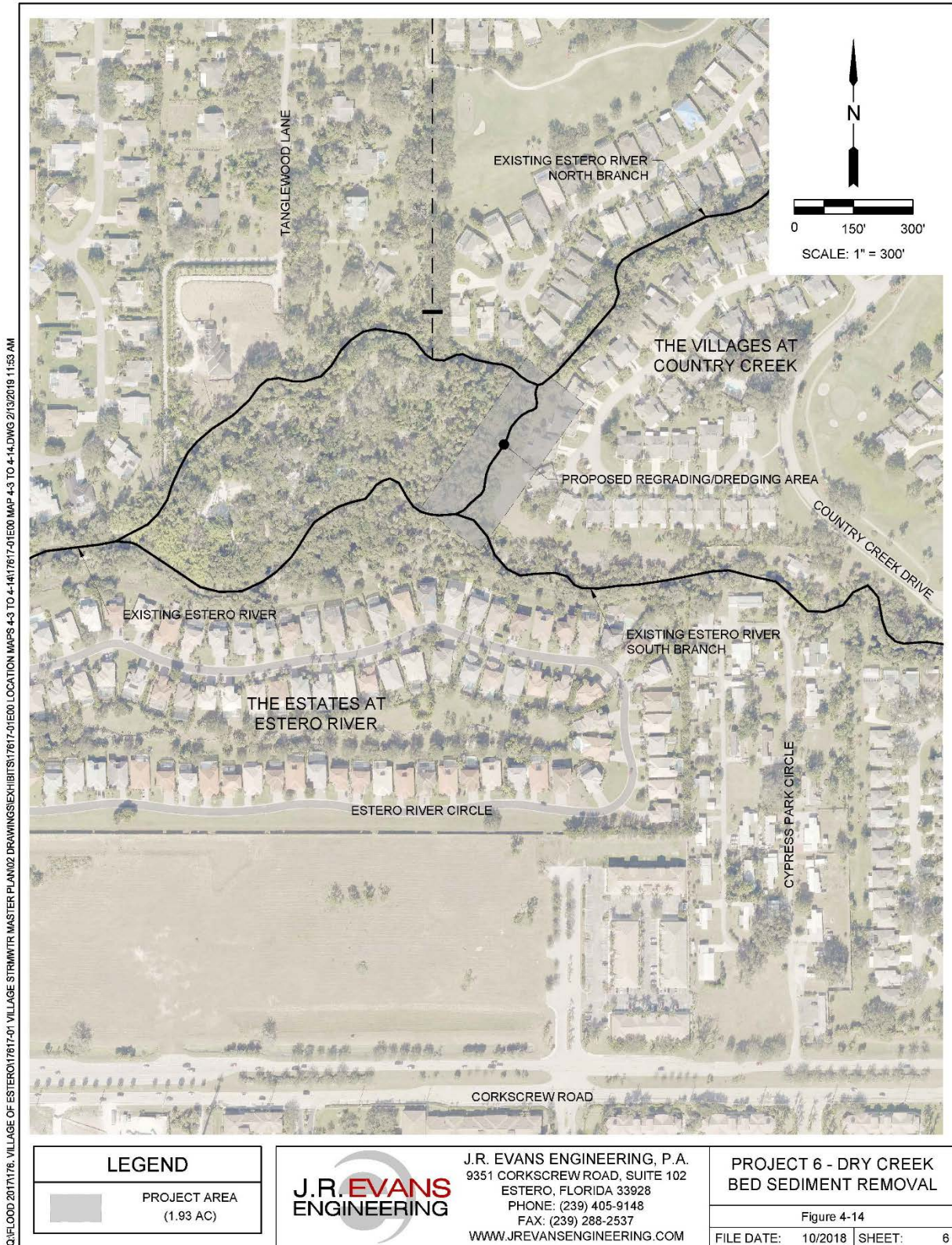
**Figure 4-13: Channel Cross-section ERNB-XS02 Comparison**

Once the modifications were conducted in the ICPR4 model, the 25-Year, 3-Day design storm simulation was executed, and peak stage results were compared with the pre-project stages. The modeling results indicate that the modification proposed to the bypass channel would decrease peak stages upstream and within several of the Country Creek basins. Provided below is a comparison table for the surrounding nodes for the Project Six Peak Stage results. Also, reference Figure 4-14 for an exhibit of the project area.

**Table 4-7: Project Six Node Comparison Results**

Node	Existing 25-Year Stage	Project_6 25-Year Stage	Run Difference	Location
ER-N22	3.92	3.92	0	Downstream of Modified Cross Section
ER-N24	4.64	4.64	0	Downstream of Modified Cross Section
ER-N26	6.01	6.01	0	Downstream of Modified Cross Section
ER-N27	6.58	6.58	0	Downstream of Modified Cross Section
ER-N29	7.08	7.09	<b>0.01</b>	Downstream of Modified Cross Section
ERNB-N1	7.83	7.73	<b>-0.1</b>	Upstream of Modified Cross Sections
ERNB-N10	10.84	10.81	<b>-0.03</b>	Upstream of Modified Cross Sections
ERNB-N13	11.63	11.62	<b>-0.01</b>	Upstream of Modified Cross Sections
ERNB-N15	11.75	11.74	<b>-0.01</b>	Upstream of Modified Cross Sections
ERNB-N17	12.44	12.44	0	Upstream of Modified Cross Sections
ERNB-N3	9.41	9.36	<b>-0.05</b>	Upstream of Modified Cross Sections
ERNB-N4	9.92	9.88	<b>-0.04</b>	Upstream of Modified Cross Sections
ERNB-N8	10.26	10.23	<b>-0.03</b>	Upstream of Modified Cross Sections
ERNB-NC14	12.95	12.95	0	Downstream of Modified Cross Section
ERNB-NC5	10.27	10.26	<b>-0.01</b>	Downstream of Modified Cross Section





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**Figure 4-14: Project Six – Dry Creek Bed Sediment Removal**

## Confirmation of Positive Outfall for Surface Water Management System

Issue to be Addressed: There are some developments within the Village that discharge to secondary conveyances, which lead to an ultimate main waterway such as the Estero River or Halfway Creek. However, the secondary conveyance receiving the discharge is typically not under the public ownership and the maintenance conditions are unknown. This recommended rule will require an in-depth review of the discharge route for the project's surface water discharge to identify and address potential issues in the beginning, which will aid in avoiding further problems after construction.

Recommended Rule:

*At time of development order submittal, new private and public development projects must demonstrate and provide sufficient information on the proposed route of the projects' surface water discharge to the ultimate receiving water body, i.e. Estero River. This will ensure that there is a clear understanding of the outfall route and potential impedance issues that can be addressed with Village staff during the development order review process.*

Potential Issues Created by Rule:

This rule may require maintenance agreements and responsibilities to be established either with the developer, secondary conveyance land owner or both.

## **Additional Recommended Activities**

Another activity that the Village can pursue to address flood mitigation is install additional water data (stage and flow) loggers within the main waterways. The additional water data loggers can be set-up to record continuous data which can be downloaded and evaluated. There are also loggers with telemetry which provide real-time data, which is beneficial during the wet season where the potential for large rainfall events is greater. The recommended locations for the water data loggers are as follows:

- Estero River/North Branch : U.S. 41 Bridge, Rookery Circle Crossing, Three Oaks Parkway Culverts, and the I-75 Bridge
- Estero River South Branch: I-75 Bridge
- Halfway Creek: FPL Easement Crossing, U.S. 41 Crossing, and I-75 Culverts

Having more stations will do the following:

- Provide real-time data during major storm events which can be used by the Village to effectively monitor potential flooding issues and act efficiently; and
- Provide more data which can be used to continuously calibrate the Local-Scale ICPR model.