

DRAFT

Technical Memorandum

Whitney Road Drainage & Safety Enhancements
Phase III – Hydraulic Update



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October 2012

I. INTRODUCTION

A. Background and Scope

Lockwood, Andrews & Newnam, Inc. (LAN) developed a Preliminary Design Memorandum (PDM) for Phase I of the Whitney Road Drainage and Safety Enhancements project dated March 2012. The purpose of the PDM was to outline the plan for improving two approximately 250 foot sections of roadside drainage ditch to eliminate erosion. Phase II of this project is a PDM describing the results of an evaluation of the intersection of Whitney and Wolford Roads, and sidewalks to and through that intersection from U.S. Highway 19 N. This technical memorandum (TM) identified as Phase III of this assignment, is an extension of Phase I. In the Phase III assignment, Pinellas County contracted with LAN to evaluate an alternative stormwater outfall configuration that would convey stormwater runoff from the existing drainage system to a new outfall downstream from the Whitney Road crossing of Long Branch Creek in order to maximize reduction in head loss and flood control for potential future changes in conditions upstream.

The Phase I PDM evaluated different options for add culverts to the two sections of roadside drainage ditch while maintaining the hydraulic condition of the channel in order to improve safety along this section of Whitney Road. The analysis looked at the Whitney Road ditch on its own as there was limited data available on the outfall channel Long Branch Creek. The results included the use of a box culvert to maintain flood storage, and the Hydraulic Grade Line (HGL) through the system. In Phase III, LAN was asked to evaluate other options to relocate a proposed outfall downstream of the existing 3-10 foot x 8foot box culverts at the intersection of Whitney Road and Long Branch Creek. For this analysis, additional survey data was requested and provided by Pinellas County. This information included cross sections of Long Branch Creek to better evaluate the tailwater elevations in the creek and quantify impacts downstream of the proposed outfall.

Pinellas County requested that only round or elliptical pipe be considered since box culverts are considered to require more maintenance to remove sediment resulting from soil deposition from runoff. In addition, LAN was asked to evaluate the impacts of increasing conveyance downstream so that areas upstream of the project could benefit if future development required additional stormwater conveyance capacity.

B. Existing Conditions

An XP-SWMM model of the project area was created to represent current conditions and also look at proposed improvement options. Runoff for the model was developed using the Southwest Florida Water Management District's (SWFWMD) 24-hr rainfall data from their Environmental Resource Permitting Information Manual dated July 1996. The SCS hydrograph methods within XP-SWMM were used to develop runoff hydrographs. Flows in Long Branch Creek upstream of the existing 3-10-foot x 8-foot box culverts at Whitney Road were taken

from previous Advanced Interconnected Pond Routing Model (adICPR) models of the Long Branch Creek system developed by others and provided by Pinellas County. The hydrograph used in XP-SWMM was the sum of the combined hydrographs upstream of the culvert crossing. The peak flows in cubic feet per second (cfs) determined for this channel are as follows:

Long Branch Creek – Storm Frequency	Peak Flow
100 yr/24 hr	1,092 cfs
25 yr/24 hr	733 cfs
10 yr/24 hr	532 cfs

This XP-SWMM model as shown on Exhibits 5, 6 and 7 is limited to representing the areas surveyed along Whitney Road within the project limits and Long Branch Creek upstream and downstream of Whitney Road where cross-sections are available. The primary modeling nodes consist of existing 48-inch culverts and roadside ditches and portions of Long Branch Creek. A storage node with the stage area relationship was determined from existing contour data of the contributing drainage areas upstream of the project. This storage was approximated from the existing flowline upstream of the project to a depth of 10-feet. A total storage volume of 27 ac-ft was estimated from this GIS topographic data within the drainage area limits. This node is used to accept the total flows determined from this 108-acre area upstream as shown in Table 1 below (Total Flow).

Tailwater conditions were based on a mean high water elevation of 0.70 feet taken from the LABINS Mean High Water Interactive Map, using point 669 (NTDE 83-01 – NAVD 88) as it is located just south of the mouth of Long Branch Creek. With surveyed cross-sections downstream of the Whitney Road crossing, and a review of previous models, a channel Manning’s n-value of 0.085 was used to represent the heavily wooded areas within the channel downstream of the project. A normal depth condition was used to represent tailwater conditions downstream of the project which were higher than the mean high water elevation above. Therefore the water elevations at the Whitney Road outfall are driven by riverine conditions rather than tidal factors. Results from the existing conditions analysis are as follows.

Table 1 - Existing Conditions SWMM Summary

Location	Existing *100-yr Elevation (ft)	Existing 25-yr Elevation (ft)	Existing 10-yr Elevation (ft)	Existing 100-yr Flow (cfs)	Existing 25-yr Flow (cfs)	Existing 10-yr Flow (cfs)
Total Flow (Upstream of Project)				350.4	255.0	207.0
Upstream of 48-inch – (P- 01)	12.21	10.57	9.71			
Ditch flow (Channel1)				160.2	132.2	114.8
Upstream of Outfall 48-inch (Ditch 4)	7.39	6.97	6.57			
Pipe Flow 48- inch outfall (48CL3)				83.42 / with driveway overflow of 80.4	100.93 / with driveway overflow of 31.5	106.85 / with driveway overflow of 7.76
Estimated Tailwater (DS-BOX)	6.40	5.61	5.08			
Long Branch Flow				1091.6	732.5	531.6

*X-yr/24-hr Recurring Storm Event

The existing storage and roadside culvert restrictions upstream of the project tend to reduce the peak flows that flow to the study portion of this ditch. The estimated flows are shown to be above the capacity of the existing 48-inch pipes in the ditch with velocities up to near 12 ft/s; however these flows are likely reduced by the succession of driveway culverts upstream of the project area which were not modeled in detail as part of this analysis. The upstream water surface elevation of 12.3 feet is below the road elevation of Whitney Road. The tailwater in the area is high due to low flow velocities downstream at less than 2 ft/s creates a backwater effect through the heavy vegetation. Due to the water levels there appears to be existing overflows at the existing driveway just west of the Whitney Road Bridge. These overflows occur at an approximate elevation 6-ft. Overflows occur for all storm frequencies as shown in Table 1 above.

C. Proposed Conditions

Different options were considered to approximate the existing headloss through the study area for the purposes of maintaining flood storage and to meet SWFWMD criteria for permitting. Based on discussions with Pinellas County a box culvert option was considered undesirable due to maintenance concerns. Therefore, pipe options of 2-48-inch or 2-54-inch pipes were considered based on the available depth in the area. When looking at elliptical pipes it was determined that a single 91-inch W x 58-inch H elliptical reinforced concrete elliptical pipe (ERCP) is approximately equivalent to 2-54-inch RCPs and has a flow area of 29.5 sf, vs. 31.8 sf for a 2-54-inch RCPs. This elliptical option would have less fill over the top of the culvert, however there is some room to lower the flow line due to outfall elevations. See the proposed Cross Section Exhibit.

The proposed outfall of the enclosed system is downstream of the Whitney Road culvert. Currently this area is heavily overgrown and silted in. Some clearing and channel improvements would be necessary to construct an outfall at the required flow line elevations. Existing utilities include a 24-inch sanitary sewer (City of Largo), 16-inch reclaimed water (City of Largo), 8-inch water (Pinellas County) and 2-inch natural gas (City of Clearwater) pipelines. Pinellas County indicated that these issues would be addressed in final design should the County determine to design the alternative proposed outfall.

Replacing the existing ditch and culvert system with a 91-inch x 58-inch ERCP is considered to be the best long term option, and based on modeling results there are no increases in discharge flow elevations downstream when compared to the existing conditions. The mitigation of flow impacts can be attributed to a high tailwater that acts to slow runoff and limit the additional flow downstream. The proposed storm sewer improvements lessen the HGL through the project limits. The results of this analysis are reasonably consistent with the previous study of Long Branch Creek. See Table 2 below for a summary of existing and proposed results.

The proposed storm sewer analysis does include keeping the existing 48-inch pipe connection to the 3-10-foot x 8-foot box culverts. Plugging this connection would not have a significant impact on hydraulics, but may reduce the current silting issue within this existing westerly box culvert. Other options for reducing sedimentation should be considered in subsequent phases. Removal of this existing silt is recommended pending permitting requirements.

Table 2 - Proposed Conditions SWMM Summary (Hydraulic Grade Line Elevations)

Description	Node	Existing Conditions			Prop 2-54"			Elliptical 91" x 58"		
		10-yr	25-yr	100-yr	10-yr	25-yr	100-yr	10-yr	25-yr	100-yr
		ft	ft	ft	ft	ft	ft	ft	ft	ft
Downstream section	DS-BOX	5.08	5.61	6.40	5.08	5.54	6.12	5.08	5.61	6.42
Existing 3-10x8 box	48CON	5.27	5.83	6.70	5.13	5.64	6.33	5.14	5.7	6.62
	DITCH-4	6.57	6.97	7.39	5.25	5.68	6.36	5.17	5.74	6.65
	DITCH-3	6.60	6.99	7.41	5.45	6.07	6.93	5.44	5.98	7.18
	DITCH-2	7.22	7.86	8.69	5.55	6.15	7.06	5.59	6.05	7.46
	DITCH-1	7.40	7.97	8.76	5.85	6.48	7.54	5.84	6.26	7.94
EXIST 48"	DITCH-1	7.40	7.97	8.76	5.85	6.48	7.54	5.84	6.26	7.94
Exist INLET/JB	P-01	9.71	10.57	12.21	9.71	10.57	12.21	9.71	10.57	12.2
Flow out ds of bridge (cfs)	LB-CHAN2	644.8	863.11	1,250.75	644.9	862.58	1,250.4	862.56	862.56	1,250.4

Future storm sewer improvements upstream of the project were also evaluated. For this analysis, the current restriction on the flows upstream of the project was lessened by doubling of the current 48-inch pipe upstream of the project. This improvement allows additional water to flow into the proposed 91-inch x 58-inch storm sewer within the project area. The result of this analysis shows that existing HGL's can be maintained and lowered through the area, and that the proposed storm sewer is not a significant restriction that would limit future improvements upstream. However, this situation would likely result in an increase of flows into Long Branch Creek by approximately 50 cfs for a 100-year storm event and raise water levels by approximately 0.06-ft based on this scenario. This result shows that some additional investigation of impacts will be required with any additional storm drainage improvements upstream (west) of the project area along Whitney Road. Overall, this slight rise in water

surface elevation (0.06-ft) is still well below the FEMA effective flood plain elevation of 9.00-ft shown on the current FEMA panels in this area. Therefore, there would be no impact to the current FEMA base flood elevation. A damage or flood hazard evaluation to determine the increased flood risk of minimal riverine water surface elevation (WSEL) increases was not part of this analysis. The evaluation of potential storm drainage improvements upstream of this project is also beyond the scope of this study, and would require additional evaluation. At this time the County has no specific plans for additional storm drainage improvements upstream of this project along Whitney Road, as this project concentrates on the area of highest maintenance concern. Table 3 shows the HGL results when structures upstream of the project are doubled in size.

Table 3 - Proposed Conditions SWMM Summary (with Upstream Improvements)

Description	Node	Existing Conditions		Upstream – Double 48" upstream to represent future upstream improvements	
		25-yr	100-yr	25-yr	100-yr
		ft	ft	ft	ft
Downstream section	DS-BOX	5.61	6.4	5.62	6.19
Existing 3-10x8 box	48CON	5.83	6.7	5.72	6.42
	DITCH-4	6.97	7.39	5.85	6.54
	DITCH-3	6.99	7.41	6.68	7.66
	DITCH-2	7.86	8.69	6.87	7.92
	DITCH-1	7.97	8.76	7.58	8.86
EXIST 48" OUT - START IMP	DITCH-1	7.97	8.76	7.58	8.86
INLET/JB	P-01	10.57	12.21	9.02	10.39
Long Branch Flow downstream of bridge (cfs)	LB-CHAN2	863.11	1,250.75	908.41	1,306.74

D. Conclusions

Based on the hydrologic and hydraulic analysis of the study area, the installation of 2-54-inch RCPs was found to meet the hydraulic requirements; however a 91-inch x 58-inch elliptical pipe also meets the hydraulic requirements. A single 91-inch x 58-inch ERCP should be easier to install and maintain rather than two 54-inch RCPs. Preliminary cost research indicates that both pipe sizes and quantities are nearly equivalent for materials delivered to the project site. There is sufficient cover for a proposed shallow swale recommended in the Phase I PDM above either option. The resulting 25-yr HGL approximates the average Whitney Road drainage ditch slope within the project area. The proposed storm sewer will be at a lower flowline to allow additional cover for the proposed pipe, therefore the existing 48-inch RCP culvert crossing of the Arbor Trace driveway will need to be removed and replaced with the proposed elliptical pipe. Relocating the outfall of this system downstream of the 3-10-foot x 8-foot box culverts for Long Branch Creek does help reduce head losses through the system. However, there are some potential utility conflicts that have been identified that need further evaluation. If the proposed outfall becomes a project, the vegetation located at the northeasterly corner of the Whitney/Wolford Roads intersection would need to be removed. This channel work would better define the channel and much of the existing vegetation would need to be removed as part of the construction of this new outfall. Removal of this vegetation would benefit future intersection improvements by providing better sight distances at the intersection.

Preliminary discussions with SWFWMD and the Army Corps of Engineers regarding this proposed outfall are currently being scheduled as part of Phase III. The results of those meetings may be incorporated into an addendum to this document.

Riverine water surface impacts to downstream areas are below the current FEMA effective flood elevations in this area. The effective flood elevations are currently based on storm surge conditions, and not riverine conditions. The proposed enclosed elliptical storm sewer system would still maintain the current overflow conditions at the existing driveway at the southwest corner of Whitney Road and Long Branch Creek as this driveway is relatively low in elevation. However, due to the proposed improvements the frequency of this occurrence would be less due to the reduced HGL of the proposed elliptical storm sewer and outfall on the north side of Whitney Road. As proposed, there are no flow impacts to Long Branch Creek downstream of the project as a result of the proposed improvements.