

# PROJECT PROFILE

**EverLast**<sup>®</sup>  
SYNTHETIC PRODUCTS, LLC

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11,000 LF OF  
ESP 6.5  
VINYL SHEET  
PILE FOR  
CITY OF  
SEBASTIAN,  
FL



## COLLIER CANAL SEAWALL REPLACEMENT Stormwater Retrofit

By Carl A. Hazenberg, P.E.

### BACKGROUND

As with most of our coastal communities, storm water treatment is extremely important to the overall health of our streams, lakes, coastal waterways, and ultimately the oceans. Collier Canal is the primary storm water detention area for over 50 percent of the City of Sebastian, along the east coast of Florida. The canal directly discharges into the Sebastian River, which discharges into the

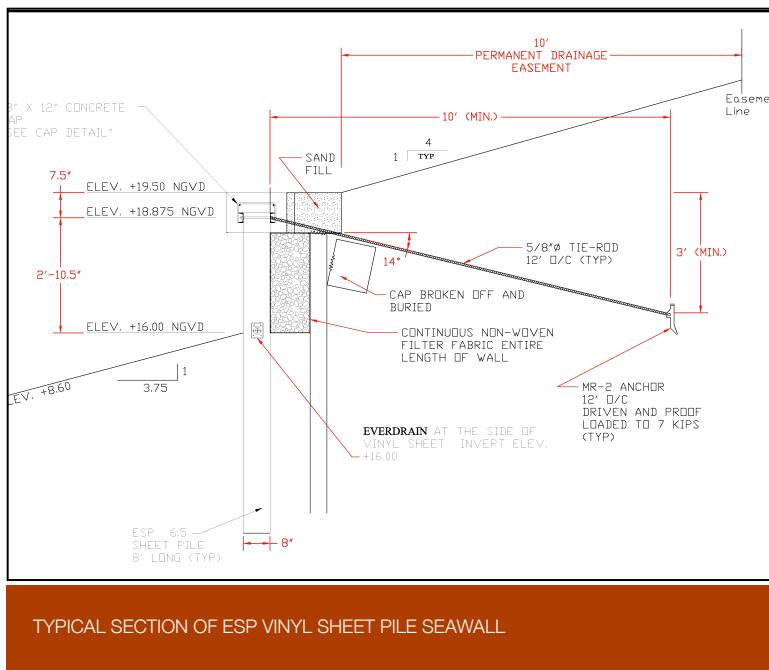


FAILING TRANSITE WALL

Intracoastal Waterway and subsequently into the Atlantic Ocean. After 2000, the service life of their transite concrete walls had reached a critical state and started failing. The City realized they needed to take action in order to preserve their water quality. Many of the sections along the 2 mile stretch of Collier Canal had failed, and some of the areas of the existing wall had ruptured and literally fallen into the canal. Furthermore, as walls along the canal had deteriorated, silt had

# Why Vinyl Sheet Pile? long life economical fast installation

filled in the canal and reduced water storage capacity and compromised water quality. The City of Sebastian determined it was time to replace the existing sea wall, but had concerns about the service life of traditional materials. They asked their consultant to consider the use of vinyl sheet piling as the primary material for stabilization of the canal banks. However, the initial consulting firm believed that a vinyl sheet pile structure would not be economically feasible and recommended a stone rip rap solution. Originally the project was then designed and bid in December 2007 as a rip rap system. During the advertisement period vinyl sheet pile systems were proposed by some of the contractors as a feasible cost effective alternative. S.E. Cline Construction went so far



as to offer the vinyl sheet pile seawall option as a value engineer solution. This resulted in the City asking their consultant to rebid the project as a design/build vinyl sheet pile solution with the consultant establishing the performance criteria for the bulkhead structure. After months of various design iterations, political protocols, and proposal reviews, a

design build team was eventually selected. S.E. Cline Construction of Palm Coast, FL was the successful General Contractor with Everlast Synthetic Products, LLC of Woodstock, GA manufacturing the vinyl sheet pile material and providing engineering design of the wall.

**INSTALLATION:**  
S.E. CLINE  
INSTALLS ESP  
6.5 SHEETS  
WITH APE 6  
VIBRATORY  
HAMMER



# Rip Rap would have required 1,000 dump trailers Vinyl only 10 flatbed trucks

## *PERMITTING AND ENGINEERING*

The project was permitted through both the St. Johns River Water Management District at the state level, and the U.S. Army Corp of Engineers at the federal level. One of the primary design parameters was that 30,000 C.Y. of dredging, with offsite disposal and the 11,100 L.F. of shoreline stabilization had to be accomplished with a minimum impact to the 125 homes directly along the canal and approximately 500 homes in adjoining neighborhoods. Site access was very limited. Performance based design criteria was established by the City's consultant requiring the wall design to be considered two ways - an extreme condition that contained a differential water level during a potential flood event and a common condition with a 250 psf surcharge. Another challenge for the Everlast Engineering Team was that traditional deadman systems could not be utilized due to the confined space and location of pools, garages, and various other structures along the 11,000 linear feet of wall. Over 940 driven earth anchors were called out in the design. Each earth anchor was proof loaded and documented to the specified minimum load of 9 kips. A reinforced concrete cap was designed to support the top of the sheet pile and spans the distance between the tie-rod/earth anchor system.



### **Earth Anchors:**

Left: Manta Ray Earth Anchor with epoxy coated tie-rod

Right: Load locker to pull and measure capacity of the earth anchor

**The City's selection committee was very satisfied with the qualifications and expertise of the design/build team...**



**DESIGN/BUILD TEAM: CARL HAZENBERG(L)  
WITH EVERLAST SYNTHETIC PRODUCTS AND  
HAP CAMERON(R) WITH S.E. CLINE**

The bridge along Flemming Street required special sheet pile and anchor designs to account for confined spacing and alignment of abutment end-bents. Design modifications were also required when loose sands were discovered by Cline's crew towards the south end of the project. These modifications mandated the use of longer vinyl sheets and driven W-sections for deadmen. Unexpected drainage pipes and culverts required special





Flemming Street Bridge

sheet pile designs for the tie-in as well. All of these unforeseen obstacles were successfully solved by the Cline/Everlast Team.

#### *INSTALLATION*

The 2 miles of canal bank stabilization would have required dumping 1,000 trailer loads of rock, while the vinyl sheet pile wall only required 10 flatbed trucks. The sheets were easily offloaded and stored in designated staging areas. The sheets were driven with a modified APE 6 vibratory hammer mounted to a excavator. Manta Ray earth anchors by Foresight Products were driven utilizing the same vibratory hammer with a slight modification to the drive steel. Areas near the Flemming Street Bridge required higher capacity anchors and tighter spacing to account for the larger load. Due to the skew of the abutment in relation to the wall alignment, Cline had not only to work with the horizontal angle of driving the anchor, but the pitch as well. After installation of the Manta Ray Anchors and the Everlast Vinyl Sheet Pile, tie-rods from the anchors were secured to the tops of the sheet by use of two steel channels bolted on the front and rear of the vinyl sheets. This provided structural support as a temporary wale while the backfilling took place. Once fill was placed and compacted, minor alignment and adjustments were made just prior to the forming and pouring of the concrete cap.

#### *QUALITY CONTROL AND ASSURANCE*

The City's Chief Building Inspector, Cline, and Everlast worked together closely to develop a detailed QA/QC program. Some of the procedures implemented included: collection and testing of a minimum of 3 concrete cylinders for each one of the 200 pours for the concrete cap; every bundle of ESP vinyl sheets were marked with a production code for manufacturing accountability; each of the 940 Manta Ray Earth Anchors were proof loaded and documented. Some of the common items inspected included verifying the sheets were driven to proper grade, verification of rebar location in cap prior to pouring, verification of drainage stone and geotextile placement, and verification of EverDrain weep-hole placements. The City of Sebastian realized additional cost savings by utilizing their own inspection team to carry out



POURING OF CONCRETE CAP AND WALE

# Less expensive and longer life than traditional rip rap, concrete, or steel; and it looks better

the QA process. This coupled with the city procuring materials directly to save on sales tax, yielded a savings of \$60,000.

## *CHALLENGES*

Some of the challenges faced by the construction team included undetected drainage pipes, culverts, bridges, unpredictable soils, debris, and alligators. For example, the Barber Street Bridge only had 7.5 feet of head room, which precluded the sheet piling from being vertically driven with any kind of hammer. Water-jetting of the entire



wall as a single unit was the only way to install the sheets adjacent to both bridge abutments. Nevertheless, in spite of these challenges, completion of the project was less than eight months from issuance of the Notice to Proceed.

## *THE END RESULT*

Not only was the goal of improved water quality and increased storage capacities met, the construction had only minimal disruption to the homeowners and their properties. An aesthetically pleasing structure was an added benefit that the community appreciates as well. The project was a dramatic success and is an example of how municipalities can stretch their dollars. Not only did the vinyl sheet pile solution have a lower initial cost, life cycle costs are expected to be far below than that of traditional materials - steel, concrete, or rip-rap.

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