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TURNING FAILURE INTO SUCCESS WITH INNOVATIVE DREDGING SOLUTIONS FOR AQUATIC PRESERVE RESTORATION

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ABSTRACT

Through innovative redesign of dredging and dewatering methods Gator Dredging completed one of its most prominent restoration projects on the Stevenson Creek Aquatic Preserve in Clearwater, Florida. The objective was to restore the original estuary habitat by removing the accumulated organic sediments and muck. Stevenson Creek has been one of the most polluted bodies of water in Pinellas County. Removal of vital wetlands and ponds, sanitary sewer overflows, combined with run-off from the adjacent 2552-hectare (6,300-acre) drain area had polluted the creek for decades. Stormwater runoff could not filter through the natural environment and illicit discharges compelled City of Clearwater to clean up the estuary.

The first two contractors were terminated from the project for: not meeting permitted discharge water requirements, insufficient construction/treatment techniques that disallowed for proper dewatering on the small land footprint available, noncompliance with environmental regulations, and not meeting production requirements. In mid-2013 Gator Dredging was hired to ensure original design and permitting conditions were met.

The project scope involved dredging approximately 69,000m^3 (90,000yd^3) of sediment. Reach 1 called for the removal of over 38,000m^3 (50,000yd^3) of sediment from 518m (1,700 linear ft) to a depth of -4.4 feet NGVD. Reach 2 called for the removal of 30,500m^3 (40,000yd^3), from 580m (1,900 linear ft) to a depth of -3.5 feet NGVD. Gator Dredging developed a unique material management plan to process and transport the separated sediment to the disposal site located 21 miles to the northeast. Gator Dredging designed a material separation plan which separated clean sand from the sediment and debris; the clean dredged sands were reused to create 13,000m^2 (15,488yd^2) of mangrove habitat. Turbidity monitoring and Acute / Chronic Elutriate testing for polymers used in the dewatering process was performed to ensure waters from the dredging process had no negative effect on the estuarine environment.

Keywords: dewater, restoration, polymer, estuary, sediment

INTRODUCTION

Through years of stormwater runoff and wastewater discharge the Stevenson Creek Estuary had accumulated sediment and become extremely polluted. Following two separate attempts to dredge and restore the creek, the City of Clearwater hired Gator Dredging to complete the work. The dredging was performed with two 203 mm (8 in) hydraulic dredges and the sediment was dewatered by utilizing a tri-flow belt-press dewatering system. The highly polluted sediment was decontaminated through the use of polymers added during the dewatering process. Gator Dredging restored the estuary to the original water depth for improved water flow, removed contaminated sediments from the creek bed, disposed of the sediment to an approved upland site, and created over 13,000m^2 (15,488yd^2) of new mangrove habitat.

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STEVENSON CREEK ESTUARY RESTORATION

Estuary Conditions Prior to Dredging

Stevenson Creek in Clearwater, Florida is a 15.8-hectare (39-acre) tidally influenced estuary located in one of the more urbanized regions of Florida. Over the past 70 years the creek had become one of the most polluted bodies of water in Pinellas County. Due to the removal of vital mangroves, wetlands and ponds, local wildlife had stopped living in and around a once thriving habitat. In addition, sanitary sewer overflows combined with run-off from the adjacent 2552-hectare (6,300-acre) drain area had polluted the creek for decades (Parson, 2001). Stormwater runoff could not filter through the natural environment and illicit discharges by the nearby population forced the City of Clearwater to clean up and restore the estuary. Following many years of sediment deposition the reduced flow in the streambed had severely impacted water quality, natural habitat, aesthetic value, and recreational use.

Dredging Process

Initial Dredging Attempts

The City of Clearwater previously bid the project to two other companies. However, the project was barely started before the contractors were both terminated. The reasons for the terminations included: not meeting permitted discharge water requirements, insufficient construction/ treatment techniques that disallowed for proper dewatering on the small land footprint available, noncompliance with environmental regulations, and not meeting the agreed upon production requirements.

2013 – 2014 Dredging Operations

Following a new bidding process and lengthy consultation in mid-2013 Gator Dredging was hired to ensure original design and permitting conditions were met to restore the delicate estuary. The revised project scope involved dredging approximately 69,000m^3 (90,000yd^3) of sediment from the creek. Reach 1 was identified as the northwest portion of the estuary and called for the removal of 38,000m^3 (50,000yd^3) of sediment from 518m (1,700 linear ft). This area would be dredged to a depth of -4.4 feet NGVD. The second portion, identified as Reach 2, was located in the southeastern part of the estuary. It called for the removal of approximately 30,500m^3 (40,000yd^3), from 580m (1,900 linear ft) of the creek to a depth of -3.5 feet NGVD. Figure 1 is provided below showing Reach 1 and Reach 2 respectively.

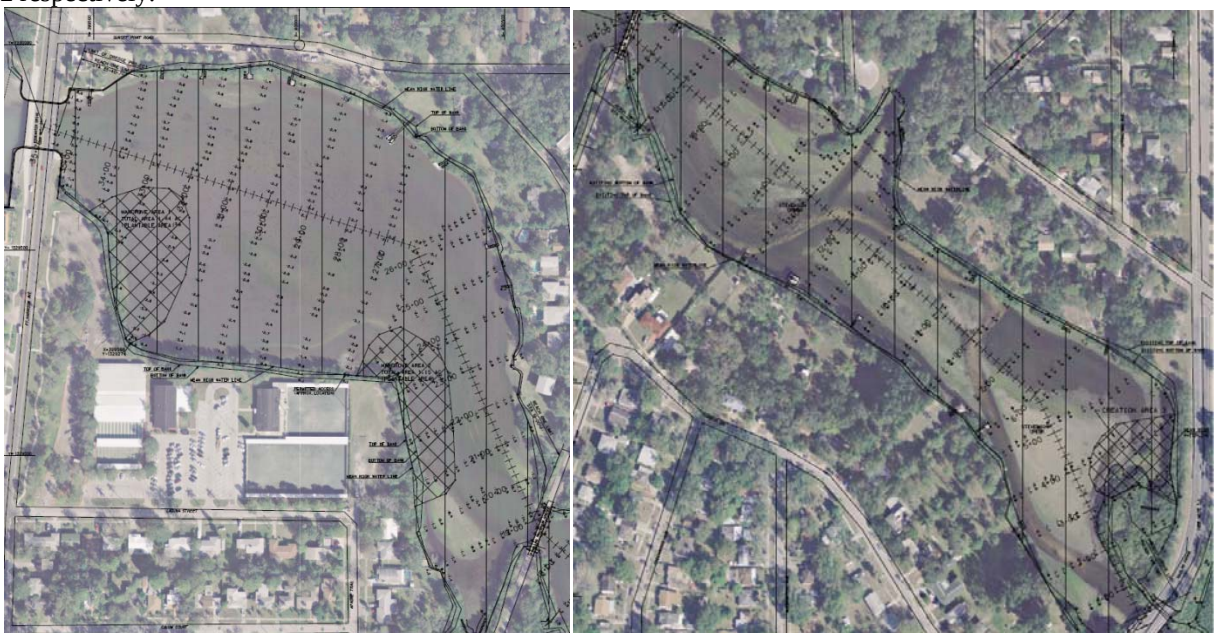

Figure 1. Map of Reach 1 shown on the left, Reach 2 shown on the right.

Gator Dredging deployed a 2011 Ellicott 300SL Swinging Dragon 203 mm (8 in) cutter head hydraulic dredge into Reach 1 (Shown in Figure 2). To assist this dredge, an Ellicott 302 mm (10 in) booster pump was deployed on a barge to facilitate pumping to the proposed dewatering facility located at Overbrook Avenue shown in Figure 4.

Figure 2. 2011 Ellicott Dredge in Reach 1.

As the project progressed Gator Dredging deployed a 2005 IMS 5012 Versi augerhead/paddlewheel dredge in Reach 2 (See Figure 3). Geotechnical investigation indicated that the material in Reach 2 was mostly sandy material. The dredge material was pumped from Reach 2 to a temporary sand separation basin at the Calumet Avenue site onshore of Reach 1.

Figure 3. 2005 IMS 5012 Versi Dredge in Reach 2.

Dredging was monitored in real-time through the use of HYPACK Dredge Pack© Software to ensure that the dredge depths and slopes were followed. In addition, this allowed for an accurate measurement of the volume of dredged material.

Dewatering

Calumet Site Dewatering

Dredged material from Reach 2 was pumped onshore into a temporary sand separation basin identified as the Calumet site. The temporary sand separation basin was constructed to protect any native mangroves in the area. Return water from the basin was gravity discharged into an area encircled with a double turbidity curtain and located within an

Acceptance Area, (previously part of a pre-dredging survey performed by the Government). When sediment built up inside the curtain such that the area needed maintenance dredging, the Ellicott dredge was moved into the discharge area and the discharge area was dredged with the material pumped to the Overbrook Ave. dewatering plant. Sands captured in the Calumet DMMA was distributed to the mangrove creation areas, and excess sand was removed. At the end of the project, the Calumet site was restored to its previous condition.

Overbrook Site Dewatering

Dredged sediment from Reach 1 was pumped to the Overbrook Avenue dewatering facility for separation of sand and organic/silt. Sand and debris was then separated using a Tri-Flo DSS2000. The DSS2000 is designed to remove particles with sizes exceeding 40 microns. The dredge material passed through a series of screens and finally hydro-cyclones. Sand separated by the DSS2000 was then transported to a stockpile by a conveyor at the north end of the Overbrook site and either loaded for disposal or pumped via a 203 mm (8 in) hydraulic pump to the proposed Mangrove Creation Area. The Overbrook site and the Tri-Flow DSS2000 are shown in Figure 4.

Figure 4. Overbrook Ave. dewatering site and DSS2000 Tri-Flo.

After de-sanding, the overflow water was sent to the mixing basin at the muck dewatering facility. The fines, silts, and organics not separated by the Tri-Flo were then pumped to the adjacent muck dewatering facility at the Overbrook Site. As the water overflowed the mixing basin weir, it was dosed with polymer (Flopam C-3227) by automated equipment supplied by SNF Environmental at rates below the maximum rates approved by the FDEP, to facilitate settling of solids. The polymer dosed water then entered a clarification basin for settling. The clarification basin, the mixing basin, and the polishing area all had an impermeable liner installed over the existing asphalt and up the side walls. The impermeable liner was a 30 mil liner provided by Colorado Lining International (designated "Non-Skid PE") underlain with a Mirafi 160N nonwoven geotextile for liner protection.

The Overbrook dewatering system was designed to handle up to 19,000 liters/minute (5,000 gallons per minute) of flow. The basin was sized such that the water residence time was approximately 30 minutes. Clean over-flow water then spilled into the polishing maze and underwent additional clarification by way of gravity settling prior to return to the project waters. The consolidated sediment from the bottom of the clarification tank was then pumped by a series of pumps at a rate of 1900 liters per minute (500 gallons per minute) to three (3) 2.0 meter belt presses for final dewatering. Prior to entering the belt presses from the clarification basin the slurry could be dosed again with polymer to facilitate the belt press operation. The polymer dosing at the belt presses was automated and controlled by instrumentation integral to the belt presses. The dewatered muck was then moved from the presses via conveyor to a stock pile for loading and disposal. Processed water from of the belt presses was returned to the mixing basin. Sand that had been scalped was stockpiled and either loaded for disposal or pumped via a 203 mm (8 in) hydraulic pump to the proposed mangrove creation area(s).

Mangrove Creation Areas & Disposal of Sediment

Sand generated from separation at either site was loaded into a slurry tank and pumped back to the mangrove creation areas via a 203 mm (8 in) hydraulic pump and pipeline. The pipe discharge was located within floating turbidity barriers surrounding the mangrove creation area limits depending on fill rates and required elevations. Turbidity monitoring and Acute / Chronic Elutriate testing for polymers used in the dewatering process was performed to ensure waters from the dredging process had no negative effect on the estuarine environment. Clean and dewatered sand separated from the dredge slurry was returned to the Mangrove Creation Areas located adjacent to Reach 1 and the Calumet site. Over 13,000m^2 (15,488yd^2) of new mangrove habitat was added to the estuary. Dewatered sediment from the Overbrook site was trucked to the contract disposal site in Patsy Acres, located approximately 33.8 km (21 miles) to the northeast of the dewatering site.

CONCLUSIONS

Following years of frustration for residents of the Stevenson Creek area and the City of Clearwater, the Stevenson Creek Estuary was successfully dredged and restored to a healthy and functioning environment. By simultaneously dredging both sections of the creek the project time was greatly reduced, cutting down on local environmental impact. Combined with the innovative use of polymers and the belt-press dewatering system, the contaminated sediment was removed, and new mangrove habitat was created with clean material.

REFERENCES

Parson Engineering Science, Inc., 2001. *Stevenson Creek Watershed Management Plan Draft Final Report.*

CITATION

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