CLAM BAYOU RESTORATION PROJECT: A CASE STUDY IN WETLAND RESTORATION

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I. INTRODUCTION

"*When we try to pick out anything by itself, we find it hitched to everything else in the universe.*"[2]

In today's modern, fast-paced world it is easy to forget about the innate interconnectedness of our natural surroundings and the benefits they provide us. For many years, wetlands, for example, were characterized as cesspools for malaria and disease. It was not until scientists brought to light the multivariate benefits of wetlands—such as biodiversity, water purification, storm surge protection, and the fact that wetlands are key areas for wildlife to breed and grow—did destruction begin to slow.[3] To date, over half of the wetlands in the United States have been destroyed,[4] and Florida alone has lost over 9.3 million acres of wetlands.[5] Clam Bayou, a tributary wetland of Boca Ciega Bay, located in Gulfport, Florida, presents a case study of this destruction. Thankfully, Clam Bayou also provides an example of successful restoration.

Estuaries are the cradle of life for coastal environments.[6] Coastal environments depend on tidal creeks to balance salinity levels through the timing

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[2] John Muir, *Welcome*, http://discoverjohnmuir.com/ (last visited Nov. 18, 2014). This quote has personal meaning for me. The first time I read it, I was in Muir Woods National Park just outside of San Francisco, California—the same place that Mr. Muir spent many of his days.
[3] Mary E. Kentula, *Restoration, Creation and Recovery of Wetlands*, United States Geological Survey Water Supply Paper 2425 (1996).
[4] Thomas E. Dahl & Gregory J. Allord, *Techincal Aspects of Wetlands: History of Wetlands in the Conterminous United States*, National Water Summary—Wetland Resources 19 (1996).
[5] *Florida Wetlands: Wetlands Threats and Loss*, UNIVERSITY OF FLORIDA (August 2015), https://soils.ifas.ufl.edu/wetlandextension/threats.htm.
[6] Dahl & Gregory, *supra* note 4, at 20.

and distribution of freshwater flows and creeks. They also provide an essential nursery habitat for a variety of sport fish and the forage they consume.[7] This essential function of Clam Bayou had been eliminated, and the bayou's restoration sought to rejuvenate it.

This article examines Clam Bayou's restoration and argues that the interdisciplinary approach used by the Florida Department of Environmental Protection (DEP), Southwest Florida Water Management District (SWFWMD), and private ecological groups, coupled with the support of local government and citizens to achieve this restoration, present a framework that could be adopted on a national scale. While SWFWMD largely spearheaded the restoration, many community partners and levels of government made this project possible. Part II looks at the history of Clam Bayou, including its ecological character, water, wetlands, wildlife, and functions. Additionally, Part II will focus on both the importance and value of Clam Bayou within the greater community. Part III examines the extensive Clam Bayou Restoration Project. Next, Part IV discusses the results of the restoration, the response from the local community, continued government involvement, and litigation. Finally, this article concludes with recommendations for the future and suggests how elements of the Clam Bayou Restoration Project could be applied to similar restoration efforts.

II. THE HISTORY OF CLAM BAYOU

In the early 1900s Clam Bayou was a small, but well-functioning, estuarine wetland. However, due to development in the 1920s and 1930s, Clam Bayou became a dumping ground for St. Petersburg, Seminole, Gulfport, and North St. Petersburg. As SWFWMD reports, "[u]ntil the 1920s, Clam Bayou was relatively untouched by human alteration."[8] But soon, untreated sewage, stormwater, trash, and urban refuse from the surrounding 2,600 acres began to funnel through the stormwater system directly into the wetland. Aerial

[7] *Id.*
[8] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, 21ST ANNUAL FUTURE OF THE REGION AWARDS PROJECT DESCRIPTION AND SUPPLEMENTAL INFORMATION, CLAM BAYOU PHASE 3 ECOSYSTEM RESTORATION AND STORMWATER TREATMENT PROJECT 3 (2013) (copy of report on file with author).

photographs document how urban development around the Bayou drastically altered the habitat and hydrology. Clam Bayou originally included a shallow, low-energy U-shaped embayment that harbored an undulating shoreline, at least five tidal creeks, small mangrove islands, sand flats, seagrass beds, coastal pine flatwoods, various avian and marine species, and scattered hammocks.[9] At the time, little thought was given to how the vast amounts of pollution would impact Clam Bayou, let alone the greater water system of Tampa Bay and the Gulf of Mexico.

As one might expect, Clam Bayou became severely degraded—the wetland simply could not support the amount of pollution flowing through it. As District Senior Professional Engineer Janie Hagberg commented to SWFWMD, "most of Clam Bayou watershed was developed prior to the state's implementation of stormwater regulations requiring treatment."[10] Further, in the 1940s a natural stream was converted into a channel at the end of 26th Avenue in Gulfport to accommodate overflow and stormwater from the surrounding 800 acres.[11] When the channel was created, the bed of the existing stream was dredged and widened.[12] This process removed natural vegetation and changed the natural flow of the water. Essentially, it lessened the amount of time water spent in the stream, meaning fewer pollutants could be filtered out—resulting in more pollution into the greater water system.[13] The toxicity of the water killed many native marine species, and the Bayou became overrun with nonnative species, such as Brazilian pepper, Australian pine trees, and Guinea grass, causing many of the native plant species to die.[14]

Fortunately, things began to change in the 1990s when the Florida DEP and SWFWMD paired with a private wetland restoration firm, Scheda Ecological

[9] *Id.* at 3.
[10] *Id.*
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] *Final Clam Bayou Restoration Phase Under Way*, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT (Oct. 2010), *available at* https://www.swfwmd.state.fl.us/documents/publications/watermatters/sep-oct2010/1.html) [*hereinafter* Final Clam Bayou Restoration Phase Under Way].

Associates,[15] to restore Clam Bayou. The Bayou's restoration officially began in 1995 with wide support from the local community, who had witnessed the Bayou's destruction.

Before it could be implemented, the restoration project had to go through multiple permit processes. First, the restoration was classified as storm water restoration under the Army Corps of Engineers' Nationwide Permit (NWP) 27.[16] SWFWMD, which provided the majority of the restoration's funding, had to have the project approved through the DEP permit process.[17] Pinellas County, however, exempted the project through the Inland Navigation District, which states that anything that comes into contact with mangrove, a protected species, can be restored without a permit.[18]

SWFWMD began the restoration process by dividing the Bayou's 170 acres into seven restoration areas, which would be restored in three phases. The Phase I project, initiated by the Florida DEP, the City of Gulfport, and SWIM, focused on the 10-acre area now known as Clam Bayou Nature Park.[19] Phase I included restoring coastal uplands, creating an open water lagoon, marshes, coves, and a tidal channel, and stabilizing the southern shoreline.[20] Phase II began in 2000 and focused on restoring ten additional acres of estuarine channels, lagoons, and marshes.[21] During this phase, SWIM also had a $1,721,600 budget for the 1999, 2000, and 2001 fiscal years[22] to create two new areas for improved

[15] Interview with Thomas Ries, Executive Vice President & Principal Scientist, Scheda Ecological Associates, in Tampa, Florida (Oct. 28, 2014) [*hereinafter* Ries Interview]. As the lead scientist on the Channel Area Restoration Project, Ries worked with the DEP and SWFWMD to complete the survey, renderings, and restoration. Ries was also involved with the North Pond Restoration and the Spoil Mound Restoration while working for SWIM.
[16] 33 C.F.R. § 320.4.
[17] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *supra* note 8, at 3.
[18] *Id.*
[19] *See generally Final Clam Bayou Restoration Phase Under Way*, *supra* note 14.
[20] *Id.*
[21] *Surface Water Improvement and Management (SWIM) Plan: Tampa Bay,* SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT 25 (Feb. 8, 1999), *available at* http://www.swfwmd.state.fl.us/files/database/site_file_sets/34/tampabay.pdf); *Final Clam Bayou Restoration Phase Under Way*, *supra* note 14.
[22] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *supra* note 8, at 25.

stormwater treatment.[23] Phase III spanned forty-four acres, including twenty-four acres of restored habitat and twenty acres of improved stormwater treatment.[24]

The Clam Bayou restoration was completed in October 2012 and dedicated on October 27, 2012.[25] The seven restored areas became known as the North Stormwater Pond, Central Stormwater Pond, South Stormwater Pond, Spoil Mound Restoration (String-of-Pearls), Channel Restoration Area, Central Restoration Area, and Southern Restoration Area Projects.[26] These individual projects covered approximately 200 acres of landform change and were completed from 1995–2012.[27]

Since the restoration's completion, local community groups continue to support the state's efforts through cleanups and local awareness campaigns.[28] However, more work still needs to be done to protect the Bayou. For instance, in 2008, local Brownie Troop 906 collected forty-two pounds of garbage in the Nature Park, including everything from styrofoam cups and beer bottles to cigarette lighters, lipstick, Burger King wrappers, and plastic forks.[29] Further, due to record amounts of rain and the shutting down of a stormwater treatment plant in the summer of 2015, over fifteen million gallons of raw untreated sewage flowed through Clam Bayou in August 2015.[30] The amount of trash in the Bayou

[23] *Id.*
[24] *Id*.
[25] Press Release, City of St. Petersburg, Clam Bayou Nature Preserve Restoration Dedication and Skyway Trail Ribbon Cutting Ceremony (Oct. 23, 2012).
[26] *Overview of Clam Bayou Habitat Restoration and Stormwater Treatment Project,* SOUTH WEST FLORIDA WATER MANAGEMENT DISTRICT, http://www.swfwmd.state.fl.us/projects/clambayou/ClamBayouRestorationStormwaterProjectSitesSummary.pdf (last visited Nov. 18, 2014).
[27] Ries Interview, *supra* note 15.
[28] Stephen Nohlgren, *Little Hands do Big Job Cleaning Clam Bayou*, ST. PETE TIMES (Oct. 18, 2008), http://www.tampabay.com/news/environment/water/little-hands-do-big-job-cleaning-clam-bayou/861285.
[29] *Id.*
[30] Jacqueline Ingles, *15 Million Gallons of Raw Sewage Dumped into Clam Bayou by City of St. Pete is costing Businesses*, ABC ACTION NEWS (Sept. 3, 2015), http://www.abcactionnews.com/news/region-pinellas/15-million-gallons-of-raw-sewage-dumped-into-clam-bayou-by-city-of-st-pete-is-costing-businesses); Zachary T. Sampson, *Sewage pumped into Clam Bayou place St. Petersburg and Eckerd College at odds, again, over Wastewater*,

today and the risk of raw sewage being dumped into the Bayou again demonstrates that additional work still needs to be completed to protect this wetland.

III. THE RESTORATION PROJECT

As discussed above, Clam Bayou's restoration involved seven different restoration projects. This article analyzes the three largest projects that resulted in the greatest impact: the North Stormwater Pond Restoration, Channel Restoration Area Project, and Spoil Mound Restoration.[31]

A. *The North Stormwater Pond*

Clam Bayou's restoration began in 1995 with the North Stormwater Pond Restoration with SWIM and Thomas Ries leading the project.[32] North Pond covers 5.81 acres and receives runoff from 630 acres of surrounding lands.[33] The pond is located between a public golf course on its north end and Clam Bayou on its southwestern end.[34]

The project focused on a retrofit of a retention pond to allow untreated stormwater to settle in the pond, filter out debris and nutrients, prevent trash and floatable material from entering the upper reaches of Boca Ciega Bay, and improve stormwater runoff through wet detention.[35] For this project, stormwater runoff enters the systems from the Clam Bayou Canal through a 10-foot by 8-foot box culvert.[36] Further, "[a] diversion weir was installed in the canal immediately downstream from the culvert to directly flow into the North Pond."[37] Installed in

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TAPMA BAY TIMES (Aug. 6, 2015), http://www.tampabay.com/news/localgovernment/raw-sewage-pumped-into-clam-bayou-places-eckerd-college-and-city-at-odds/2240328.

[31] Thomas Ries, *Clam Bayou Tract Phase 3: Habitat Restoration Project*, C1–C10 (Mar. 2009).

[32] *Id.*

[33] VANASSE HANGEN BRUSTLIN, INC., CLAM BAYOU STORMWATER TREATMENT PROJECT PERFORMANCE EFFICIENCY EVALUATION PINELLAS COUNTY, FLORIDA 4, 28 (Oct. 2013) (copy of report on file with author) [*hereinafter* Vanasse].

[34] Ries Interview, *supra* note 15.

[35] Vanasse, *supra* note 33, at 1.

[36] *Id.* at 4.

[37] *Id.*

the pond are a number of turbidity barriers and nets that help catch trash and other debris and keep it from flowing through the pond and entering Clam Bayou.[38]

The pond's restoration did not disturb the pond's existing mangroves or the adjacent wetlands along the east side of the pond. A variety of saline tolerant plants were integrated into the pond area, such as smooth cordgrass (*spartina altemiflora*), seashore paspalum (*paspalum vaginatum*), and Walter's vibumum (*vibumum obovatum*).[39] The addition of such plants aimed to help filter and clean the water that enters North Pond.[40]

Due to the restoration, the upper portion of North Pond now has a barrier to prevent water from immediately running into Clam Bayou. Currently, water stays in North Pond for approximately fourteen days, which allows for pollutants and nutrients to drop into the sediment of the pond instead of flowing into Boca Ciega Bay.[41] In addition, stormwater is now diverted and moved through a spillway and filter system in order to collect large pieces of trash and debris.[42]

According to Ries, the most important factor of the stormwater retrofit is the addition of the vegetation.[43] In his opinion, because it had such a profound effect on the surrounding watershed, the North Pond restoration was the model for the rest of the restoration projects to follow.[44] Furthermore, due to the intensity of the chemicals and fertilizers running off from the golf course, creating a retention pond to collect and filter the pollutants was paramount to the restoration and cleanup of Clam Bayou.

[38] Ries Interview, *supra* note 15.
[39] *Id.*
[40] *Id.*
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] *Id.*

B. *The Channel Restoration Area Project*

The Channel Restoration Area Project began in 2012, with construction lasting twelve months.[45] The project's focus was to restore the natural flow and vegetation that had been removed from the channel during the 1940s and 50s.[46] Before the restoration, a drainage ditch bisected the Bayou and was bordered by a spoil berm inundated with nonnative species.[47] By reconfiguring the ditch and berm to create a meandering tidal channel, the project provided more coastal habitat and increased the channel's natural flow and turbidity. Water now moves more slowly through the habitats, allowing more dirt and pollution to be filtered out before it enters the Bayou and Tampa Bay.[48]

As Ries notes, restoration projects like this should "design around existing features in the area, be it an oak tree, uplands, marshes, and tidal areas."[49] This concept of "adaptive management" allows for changes in the initial plans to better reflect the actual landscape of the areas being restored.[50] Specifically, in the Channel Restoration Area Project, the parties wanted to ensure that oak trees and mangroves were preserved during the restoration.[51] In addition, large limestone rocks that were on site were re-deposited in the channel to act as critical habitat for juvenile recruits of several game fish species native to the area, such as snook, tarpon, and redfish.[52] Furthermore, only certain areas were smoothed, and ruts were increased in other areas, to create a more natural flow in the water.[53]

In addition, contour lines were added to increase the natural flow of water, a silt fence was inserted along the sides and at the end of the channel, a rock-filled ditch area was created at the beginning of the channel to catch trash from stormwater, and floating turbidity barriers were installed.[54] Each of these elements

[45] Ries, *supra* note 31, at C2.
[46] *Id.*
[47] *See generally* Southwest Florida Water Management District, *supra* note 8.
[48] *Id.*
[49] Ries Interview, *supra* note 15.
[50] *Id.*
[51] Ries, *supra* note 31, at C2.
[52] *Id.*
[53] *Id.*
[54] *Id.*

of the restoration allowed for the channel to better filter water, essentially creating a habitat mosaic, in which each element of the channel—from the bed, to the flow of the water, to the tree and mangrove preserves—make this a more natural habitat.[55] In the channel today, the water is approximately fifty percent stormwater and fifty percent natural flowing water from the watershed.[56]

C. *The Spoil Mound Restoration*

The Spoil Mound Restoration, commonly referred to as the "String of Pearls," is located in a mangrove forest. Before it was restored, the area contained mosquito ditches and spoil piles dominated by nonnative, invasive vegetation, such as Brazilian pepper.[57] The String of Pearls project features open water lagoons as the "pearls" and tidal channels as the "strings."[58] The project aimed at creating a series of small tidal channels and lagoons by excavating spoil piles and restoring critical open-water and fishery habitats in Clam Bayou.[59]

The City of St. Petersburg constructed a temporary road that extended the length of the spoil mounds, beginning with the mound closest to the water and moving inward toward 26th Avenue.[60] As each spoil mound was eliminated, the road was slowly removed and the land returned to its natural state.[61] Here, the most difficult aspect of the restoration, as the SWFWMD's Chief Environmental Scientist Brandt Henningsen noted, was the fact that the original creeks of the Bayou could not be restored "'because there ha[d] been so much alteration of the watershed and development as an urban landscape.'"[62] As a result, SWIM worked to create a tidal creek that would flow naturally, but that would be filled with

[55] Ries Interview, *supra* note 15.
[56] *Id.*
[57] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *supra* note 8.
[58] *Id.* at 7.
[59] *Id.*
[60] Ries, *supra* note 31, at C1.
[61] Ries Interview, *supra* note 15.
[62] David Brown, *Making Pearls on Tampa Bay,* FLORIDA SPORTSMAN (Aug. 12, 2013), http://www.floridasportsman.com/2013/08/12/making-pearls-on-tampa-bay/ (quoting Brandt Henningsen).

stormwater rather than pristine waters. This would allow some of the habitat benefits and functions of a natural creek to be present.[63]

IV. RESULTS OF THE RESTORATION

The construction and restoration, completed in 2012, vastly improved the water quality in Clam Bayou as a whole.[64] However, there has been backlash from local community members regarding the speed and thoroughness of the restoration.[65]

Throughout the restoration project and during the initial months afterwards, the FWCC and private ecological groups performed various water quality tests. Vanasse Hangen Brustlin, Inc. (Vanasse), an environmental and ecological services company, released a report in October 2013 that demonstrated the water quality of Clam Bayou post-restoration.[66] In July 2012, SWFWMD created and submitted their Quality Assurance Project Plan (QAPP) for the Clam Bayou project.[67] The Vanasse study then used the QAPP to create the parameters for their subsequent study.[68] Vanasse followed an eighty-five-day evaluation period from August 17 to November 9, 2012, and took data and samples from North Pond, Central Pond, and South Pond to determine the efficacy of the restoration in these sites. The purpose of the study was to review the concentrations of nutrients, sediment, and floating trash in the pond based off reports from the permanent field data monitoring equipment, and then develop

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[63] *Id.*
[64] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *supra* note 8, at 3.
[65] Telephone Interview with Tom W. Reese, Attorney (Oct. 18, 2014).
[66] It is important to note that all of the pre- and post-restoration water quality studies are permitted under Clean Water Act § 319 Nonpoint Source Management Program through the EPA and Florida DEP. Through the § 319 program the EPA is required to help fund the project in return for performance monitoring of the site once restoration is completed. The Clam Bayou Restoration Project in total cost $5,094,495, and approximately 17.6% or $898,800 was provided by the EPA. Vanasse, *supra* note 33, at i.
[67] *§ 319(h) Project Summary FY2005 Section 319 Grant*, FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION 23, http://www.dep.state.fl.us/water/nonpoint/docs/319h/FY05-319h_Project_Summary.pdf.
[68] Vanasse, *supra* note 33, at 5.

removal efficiencies and create a total maximum daily load (TMLD) as required by the Clean Water Act.[69]

During Vanasse's experiment, three different types of testing were performed: stormwater flow, baseflow, and *in situ*.[70] The site modules were calibrated to begin testing during two different periods: (1) when there was any rainfall greater than 0.2 inches to measure the stormwater runoff; and (2) in times of baseflow.[71] Benchmark EnviroAnalytical, Inc. analyzed each sample from the modules for ammonia, nitrogen, nitrite and nitrate nitrogen, total kjeldahl nitrogen, total nitrogen, orthophosphorus, total phosphorus, total suspended solids, turbidity, total cadmium, total chromium, total cooper, and total zinc.[72] The *in situ* data referenced temperature, pH, dissolved oxygen, conductivity, and salinity.[73]

During the eighty-five days, North Pond received the most rainfall overall, including 2.2 inches on October 5, 2012. According to Vanasse, the increased runoff volumes from these larger rain events "serve to shorten the residence time within the stormwater treatment ponds, which in turn reduces their efficiency."[74] As a result, in the summer months and during the rainy season when rainfall is greater in the Tampa Bay area, the efficiency of the restoration project decreases simply because the amount and volume of water flowing through the ponds and restoration sites is so great. The efficiency of the Bayou restoration is also impacted during the summer due to increases in tidal flows associated with the position of the sun and moon and their respective gravitational forces.

However, these periods of lower efficacy do not mean that the North Pond Restoration has not been successful; rather it demonstrates that a larger area of land to hold water would be able to better treat stormwater and tidal flow pollution. In fact, Environmental Research & Design, Inc. found that for an "average annual rainfall year based on a 50-year period of record, the North Pond

[69] *Id.*
[70] *Id.* at 4.
[71] *Id.* at 9.
[72] *Id.* at 10.
[73] *Id.* at 20.
[74] *Id.* at 15.

and Central Pond would treat 87.3% and 90% of the estimated annual runoff volume."[75]

In total, the Vanasse study completed fourteen sampling events: ten storm-related and four baseflow.[76] Of those samplings, seven storm events and three baseflow events were measured at North Pond. In the pond the "average removal efficiencies for total nitrogen were 37.0% and 32.6% for storm events and baseflow events respectively, with an overall removal efficiency of 36.9%."[77] The average removal efficiency for total phosphorus was 14.8 percent, with similar removal efficiencies for total suspended solids.[78] While these percentages may seem small or disproportionate to the money spent on the Bayou's restoration, it must be considered that prior to the project there were no removal efficiencies, and that the removal efficiencies will improve over time generally and during periods with lower rainfalls.

According to SWFWMD, the North Pond alone has accounted for a "33 percent annual load reduction for total nitrogen and greater than 80 percent annual load reduction for total suspended solids," both of which are the primary contributors to habitat degradation.[79] First, nitrogen inputs accelerate the growth of algae, negatively affecting water quality and light availability for other native species to grow and thrive. Second, total suspended solids alter the turbidity and sediment in the Clam Bayou ecosystem. As the amount of total suspended solids enter the water, they change the clarity and density of the water and eventually settle to the bottom of the wetland ecosystem, which changes the depth and natural flow of the water moving through the area. By installing the box culvert and reconstructing the pond, the restoration has resulted in an "estimated reduction of 576 kilograms or 1,267 pounds of total nitrogen per year and an

[75] ENVIRONMENTAL RESEARCH & DESIGN, INC., SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, CLAM BAYOU STORMWATER TREATMENT PROJECT FEASIBILITY STUDY RESULTS (2004); ENVIRONMENTAL RESEARCH & DESIGN, INC., SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, CLAM BAYOU STORMWATER TREATMENT PROJECT HYDROLOGIC MODELING REPORT (2008).
[76] Vanasse, *supra* note 33, at 21.
[77] *Id.* at 24.
[78] *Id.*
[79] SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, *supra* note 8, at 6.

estimated reduction of 6,483 kilograms or 14,263 pounds of total suspended solids per year."[80]

The String of Pearls restoration was also pivotal to restoring habitat and ensuring the potential growth of mangrove pockets. In the String of Pearls, the mangrove roots act as the ideal place for juvenile fish to mature by protecting them from larger predators that cannot navigate through the mangroves. The Spoil Mound Restoration has brought back some of the original tidal creeks, and as a result, the rejuvenated Clam Bayou is a better representation of the natural wetland before the development and alterations that occurred throughout the mid-1900s.[81] Due to the String of Pearls restoration, Clam Bayou can now more efficiently function as a wetland and provide enhanced ecosystem benefits, such as cleaner water, fisheries habitats, and species diversity.

In addition, the String of Pearls receives treated stormwater from the adjacent North Stormwater Pond. The flow of freshwater from the pond through the new series of lagoons and channels helps to establish salinity gradients, including low salinity habitats, which are critical for fisheries.[82] In addition to purifying water, the wetland complex is now further cleansing stormwater as a result of the restoration, which SWFWMD refers to as "stormwater polishing."[83] This additional layer of purification prior to discharge to the open waters of Clam Bayou allows for cleaner water to eventually enter Boca Ciega Bay.[84]

SWFWMD also contends that the entire seven-site restoration project has restored some of the original hydrology and landscape of Clam Bayou. As Henningsen noted, "as with the string-of-pearls design, not only have some of the original open water habitats been restored, but the restored hydrology of tidal and freshwater flows is helping drive salinity gradients important for fisheries productivity as well as promote some additional stormwater polishing."[85] In

[80] *Id.*
[81] *Id.* at 10.
[82] *Id.* at 7.
[83] *Id.*
[84] *Id.*
[85] *Id.* at 8.

addition, this sinusoidal tidal creek complex helps offset the loss of the original four tidal creeks that historically drained to this corner of the Bayou.

While the cooperation between Florida DEP, SWFWMD, environmental groups, the City of St. Petersburg, and Gulfport have been largely praised for the work completed at Clam Bayou, some feel that it is not enough. In 2008, Alfred and Cynthia Davis, local residents of Gulfport, Florida, filed suit against the U.S. Environmental Protection Agency (EPA) claiming that the EPA had not done enough with the Clam Bayou restoration project.[86] In their initial letter, the Davises claimed the EPA and state of Florida failed to establish ambient water quality in Clam Bayou as is required by the Clean Water Act (CWA).[87] The Davises felt that the restoration project should have restored the Bayou's water quality to 1975 levels.

The Davis' main point of contention was the amount of sediment in the Bayou, rendering much of it non-navigable.[88] In the first case, the focus of litigation was interpretation of CWA § 303,[89] regarding DEP's obligation to designate, protect, and clean the waters of Clam Bayou. The DEP dismissed the petition.[90] Next, the Davises sued the EPA, which led to the parties reaching a settlement.[91] As of September 2014, the Davises planned to file a third phase of litigation in light of FWCC studies on fish flesh in the Bayou, such as striped mullet, snook, and sheepshead, which showed degradation from pollutant contamination.[92]

In addition, as of January 21, 2014, the Gulfport City Council felt additional review of the water quality was warranted, indicating that the community wanted more to be done to restore Clam Bayou. As reported in the St. Petersburg Times, "City Council told the staff [of Clam Bayou] to retain an

[86] Austin Bogues, *The Battle for Clam Bayou*, ST. PETERSBURG TIMES, Dec. 13, 2008, http://www.tampabay.com/news/environment/water/the-battle-for-clam-bayou/936245.
[87] *Id.*
[88] *Id.*
[89] 33 U.S.C. §1313; Ries Interview, *supra* note 15.
[90] *See generally* Bogues, *supra* note 86.
[91] Telephone Interview with Tom W. Reese, Attorney (Oct. 18, 2014).
[92] *Id.*

outside firm to review and compile all existing data as the first step in developing plans for the estuary."[93]

V. CONCLUSION

The restoration of Clam Bayou provided opportunities for community members, members of the local and federal government, agencies, and environmental groups to unite and create a functioning wetland ecosystem that provides services to both local habitat and community members who enjoy the area. A large group of stakeholders came together to restore this wetland, including the Native Plant Society, Audubon Society, the local units of Boy Scouts and Girls Scouts, Keep Pinellas Beautiful, SWFWMD, Florida DEP, over 500 volunteers, and five environmental consulting groups.

SWIM worked in conjunction with Tampa Bay Watch to organize and implement a series of volunteer marsh plantings, installing tens of thousands of marsh grasses throughout various project intertidal marsh platforms.[94] The marsh plugs themselves were, in part, grown by the Fish and Wildlife Conservation Commission (FWCC) in ponds associated with filtering effluent water from the FWCC's Port Manatee Fish Hatchery. Inmates from the Manatee County Correctional Facility or public volunteers then harvested the marsh plugs.[95]

It is evident that the restoration of Clam Bayou is due to this unique interplay between all of these actors that continue to work toward a better habitat and ecosystem for Clam Bayou. As Ries notes, "I can write you the best possible sketches and hire the very best contractor to put into place those designs, but the difference comes in when we are on site, working together with volunteers and community members to best invigorate the habitat already there."[96] At Clam Bayou, all of these groups were able to take a synergistic approach to the restoration, which allowed for ongoing revisions to the project plans, which

[93] Diane Craig, *Community News: City Council Orders Clam Bayou Review*, ST. PETE TIMES, Jan. 21, 2014, http://www.tampabay.com/news/humaninterest/gulfport-community-news-city-council-orders-clam-bayou-review/2162029.
[94] *Id.*
[95] *Id.*
[96] Ries Interview, *supra* note 15.

resulted in the best possible restoration given the landscape, stormwater concerns, and development surrounding the wetland.

The Clam Bayou Restoration project is an example of mutual reinforcement—the community advocated the project and now maintains it through cleanups. SWFWMD estimates that daily volunteer efforts, coupled with several well-organized group efforts, have retrieved an estimated 200,000 pounds (100 tons) of trash from the Bayou.[97] It is the collaborative and interdisciplinary cooperation that has made the Clam Bayou restoration successful. And while the restoration does not prevent untreated stormwater releases, it has allowed a valuable natural resource to rebuild in a local ecosystem. The stormwater system and management still need to be improved, but the restoration of Clam Bayou represents a step in the right direction.

[97] Southwest Florida Water Management District, *supra* note 8, at 9.