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## Holiday Shores Stormwater Retrofitting Project

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# **HOLIDAY SHORES STORMWATER RETROFITTING PROJECT**

DEP AGREEMENT S0098 FINAL REPORT – JANUARY 2009

CONTRACTOR:  
WALTON COUNTY PUBLIC WORKS DEPARTMENT



**This project was funded in part by a TMDL Water Quality Restoration Grant from the Florida Department of Environmental Protection, Bureau of Watershed Restoration. Total project cost was \$672,678 of which \$205,700 (31%) was provided by the TMDL Grant.**

## EXECUTIVE SUMMARY:

The Holiday Shores Retrofitting Project was a joint effort between Walton County and the Florida Department of Environmental Protection Bureau of Watershed Restoration with participation from local utility departments. The contract S0098 was executed on July 10, 2003 and originally provided 30 months for completion of the project. A variety of permitting issues delayed the start of construction until the summer of 2005. An amendment was executed to allow 18 additional months for work to be done. Good progress was made but a second amendment providing six additional months was needed in the spring of 2007 to allow the project to be finished. The project was completed in November 2007

The project site had numerous drainage problems along with less than adequate storm water treatment with runoff discharging directly into Choctawhatchee Bay. Standing water was occurring throughout the watershed due to improperly set culverts and flooding was occurring due to an undersized conveyance system. Increased impervious surfaces associated with recent new development added to these problems.

Existing roadside ditches were reshaped into swales to provide pre-treatment of runoff and culverts were sized to better match the capacities needed for storm water conveyance. The watershed was divided into two sub-basins. About one-third of the contributing area was directed to a wet detention pond and the remaining two-thirds to a second generation baffle box for final treatment.

A third contiguous basin was recognized as having inadequate swales for conveyance. It was more cost effective to include this area in the project than return to it later so the scope of work was modified to reshape the road side swales and install new culverts in this area also.

The project was finished in November, 2007 and has been tested by several major storm events and proven to be a well thought out and designed plan. It has accomplished all of the desired objectives of reducing wide spread flooding, providing treatment of storm water run off from Holiday Shores before it enters Choctawhatchee Bay, and improving access and amenities for county owned land within a residential setting creating a multi-use facility with great public education potential.

In the original application, the County committed 23% of the total estimated budget or \$60,136.80 through in-kind services for this project. The in-kind services included construction crews, equipment use and wetland mitigation land that was purchased for permitting wetland impacts. Due to project modifications and the increased cost of construction materials since the project was conceived, the county's actual match increased to 69% or **\$466,977.96**

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**PROJECT TITLE:** Walton County Urban Stormwater Retrofit Project

**LEAD ORGANIZATION:** Walton County Board of County Commissioners

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**COOPERATING ORGANIZATIONS:** Walton County Public Works Department

**PROJECT OBJECTIVES:**

- Provide treatment for direct discharges of stormwater runoff to Choctawhatchee Bay from an older subdivision that was developed in the 1960s prior to the current stormwater rules being in effect.
- Provide adequate drainage for the project area which was experiencing flooding during significant rainfall events due to undersized drainage ditches and misaligned culverts that created standing water conditions.
- Compare and contrast the benefits and transferability of two treatment alternatives – a wet detention pond and a second generation nutrient removing baffle box - to other county locations
- Use an exiting county owned property within a residential setting to develop a multi-function facility providing stormwater treatment, improved recreational access and public education opportunities.
- To use the available right of way to the maximum extent practical to reshape existing drainage ditches with steep 1:1 side slopes into functional swales with 3:1 side slopes and well established vegetation.

**PROJECT MANAGEMENT:**

The Public Works Department, a sub-organization of Walton County within the oversight of the Board of County Commissioners, managed the day to day activities of the project. Mr. Russ Barry was the County Public Works Director at the onset of the project. He was assisted by Mr. Dan Arner, the County Engineer, who was the original designated contact person for the County. Mid-way through the project, Mr. Barry was succeeded by Mr. Lyle Seigler and Mr. Arner by Mr. Aaron Warren. Mr. Seigler became the designated project manager responsible for administering the contractual obligations and in-house services for this project. Mr. Seigler also certified the County's progress

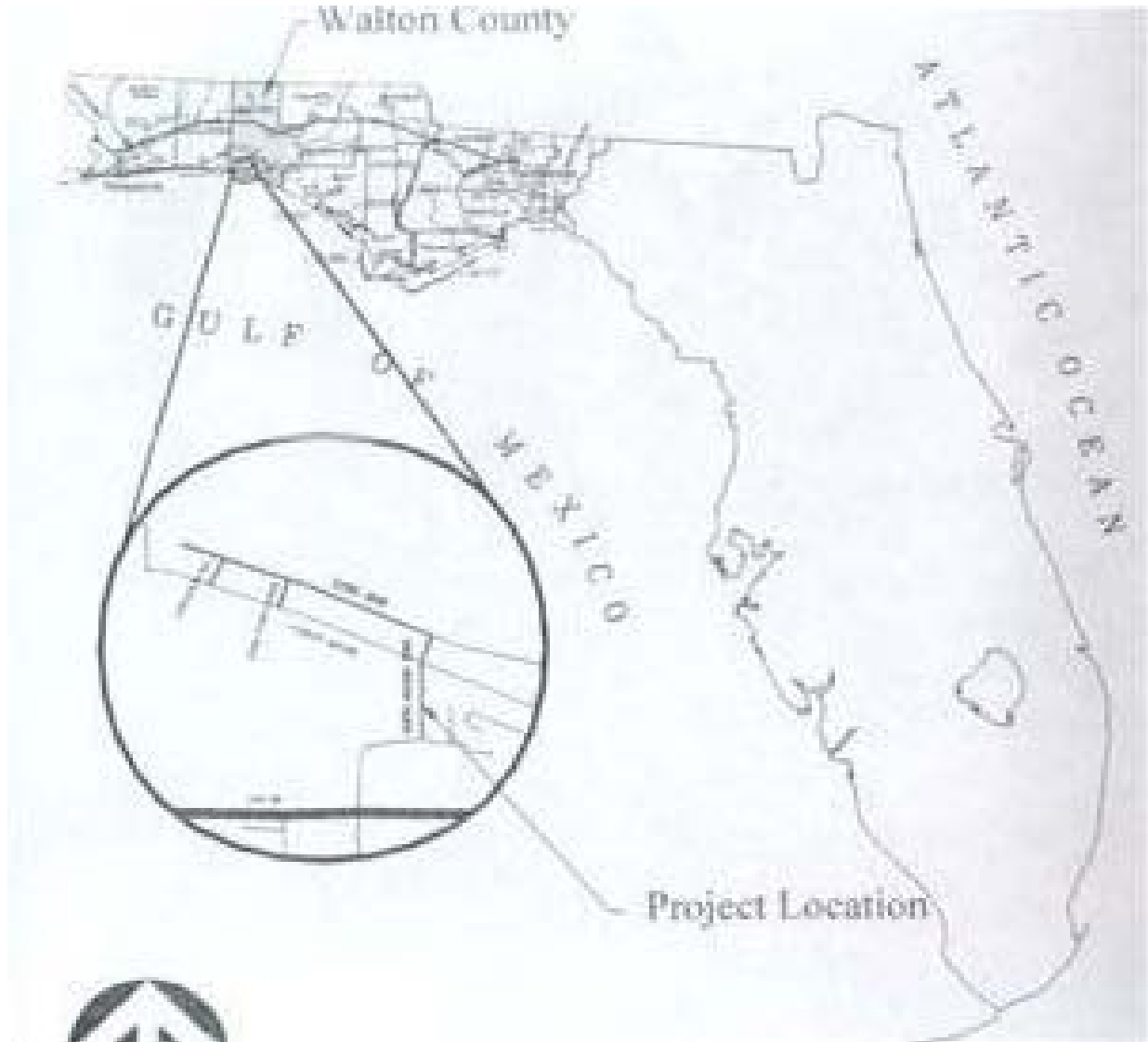
reports and invoices submitted to the FDEP. Mr. Warren conducted many site visits during the project to verify progress and provided engineering assistance as needed. Further engineering assistance was provided by Cliff Knauer of Preble-Rish Inc. and Michael Bomar of Tetra Tech Inc.

The Public Works Department Zone 3 Maintenance crew, in concert with the Drainage and Asphalt Paving crews performed most of the work associated with this project including constructing the ditch improvements, stormwater pipe installations, construction of the Wet Detention Pond, installation of the Second Generation Baffle Box, the construction of the littoral shelf and other field services. Additional in-kind help was provided by the County's Paving Crew and Inmate Labor Division, crews from other county districts and the local utility departments (Gulf Power, South Walton Utilities, Mediacom and Embarq). South Walton Utilities loaned the County a 6" pump that was instrumental for drawing down the wet detention pond on two occasions to prepare its final configuration and plant the littoral shelf. Gulf Power cut power along Shore Drive and lowered some overhead power lines that allowed a County crane operator to install the baffle box at the outfall of the east sub-basin. Mediacom and Embarq responded to many calls to relocate and/or restore service connections. Field work was overseen by Harold Petty, (Project Manager). Michael Widdon is the Drainage crew foreman who was instrumental in the installation of all the drainage structures associated with the project.

Michael M. Scheinkman, an Environmental Specialist III with the Florida Department of Environmental Protection, was the State's project manager for the entire project. Michael assisted the county with preparing the scope of work for the original contract and helped to obtain two extensions that were needed in order to complete the project. Michael provided the county with advice about preparing and submitting invoices and made sure the county was reimbursed for its grant eligible expenses. Michael conducted frequent site visits and provided suggestions and assistance when problems were encountered. Michael also went above and beyond his usual duties by preparing and submitting this final report. Frequent management turn-over at the County's Public Works Department coupled with the county's computer system crashing resulted in the loss of many important files. This led to a situation where Michael was the only individual remaining who had sufficient knowledge of the project to prepare a comprehensive report. After several failed attempts to try pass this information on and lead county staff and their consulting engineers through the process, Michael took over and prepared the report with support from county staff rather than the other way around as DEP is accustomed to.

**PROJECT LOCATION:** Choctawhatchee Bay (WBID 778C)  
See Figure 1, Project Location & Area Map

FIGURE 1, PROJECT LOCATION & AREA MAP





## **WATERSHED RESTORATION ACTION STRATEGY AND PROJECT BACKGROUND:**

In recent years, Walton County, Florida has made efforts to understand the stormwater issues associated with its existing infrastructure, hydrology, pollutant load estimates, land development code requirements and upcoming regulatory requirements. In 2000, the County began preparing a Stormwater Master Plan (SMP) for the entire County. This was the first step the County had ever taken to understand the influence of the watersheds and basins on surface water quality. In August 2002, the County adopted its SMP as the basis for the County's efforts in improving water quality associated with non-point source runoff. This project was initiated in the spring of 2003 by Dan Arner, then Walton County's Engineer, in direct response to the SMP's recommendations. The project was submitted to the Florida DEP for funding through the TMDL Water Quality Restoration Grant Program to reduce storm water pollutant loadings discharged into Choctawhatchee Bay and was awarded \$205,700.

This project provided for the construction of two different stormwater treatment systems to reduce pollutant loads to the Choctawhatchee Bay. The Choctawhatchee Bay is listed on the 1998 Section 303(d) impaired water list as WBID 778C. The project is located within the Holiday Shores drainage basin which is listed a Priority 1 Basin in the County's SMP signifying the highest priority ranking.

The existing stormwater drainage system in the project area was constructed before the implementation of Florida's stormwater treatment rules. Discharge of the basin was via a ditch network consisting of secondary conveyance ditches with a top width of two to three feet with 2:1 side slopes to the final primary conveyance discharge ditch with a top width of approximately 12 feet with 2:1 side slopes with minimal treatment. Furthermore, mismatched culvert elevations and insufficient capacity resulted in tremendous flooding issues for the Mariner Way and Hidden Harbor portions of the basin. This project provided stormwater treatment for the basin prior to discharge to the Bay and eliminated the flooding and water quality concerns.

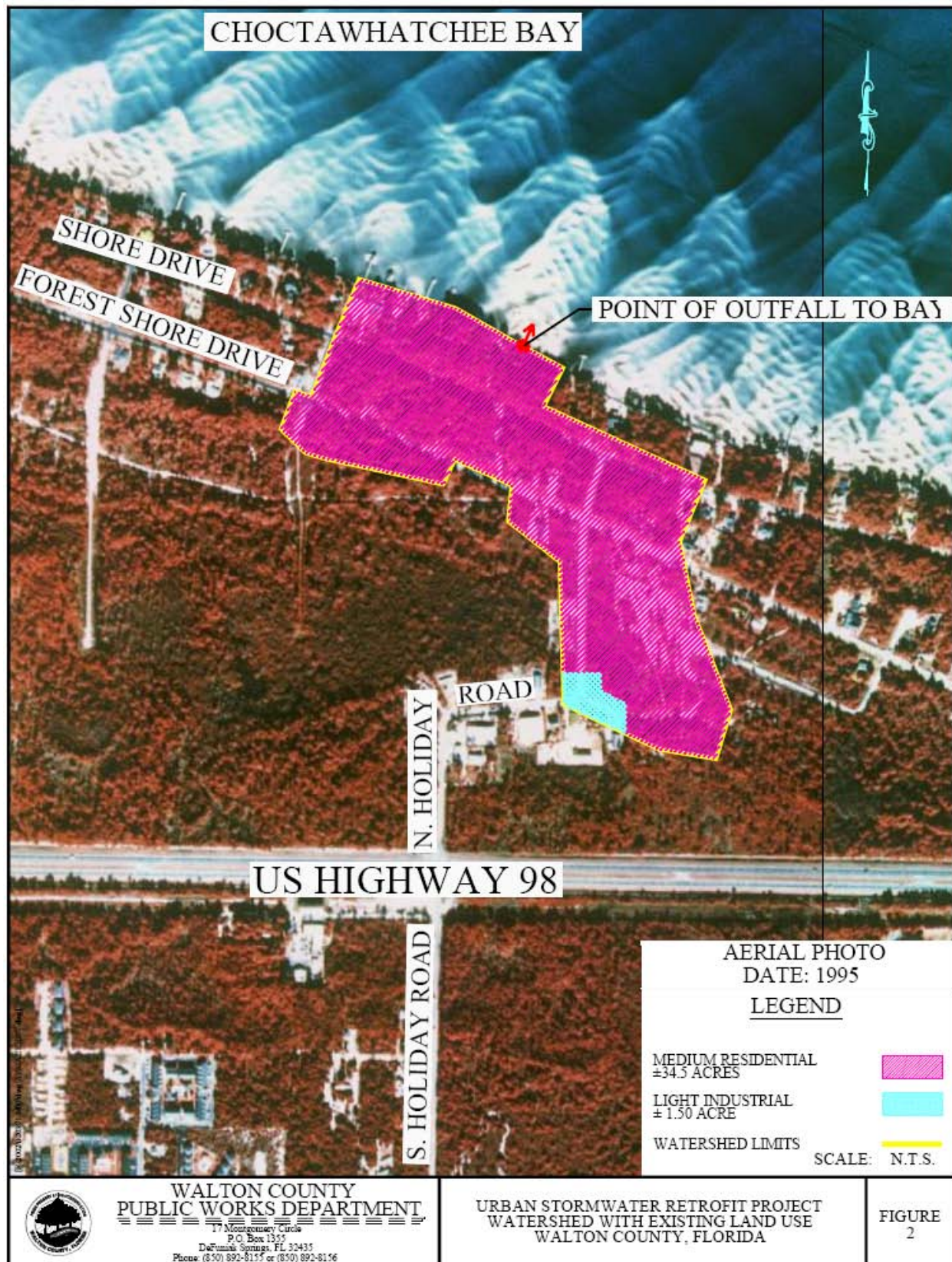
This project in part also fulfilled Section V, Part 5.2, Sub-part 5.2.3 of the Choctawhatchee River and Bay SWIM Plan which lists "Urban BMP Demonstration Project" and implementation of BMPs as necessary Water and Sediment Quality Projects.

In 2006 & 2007, the County hosted an Environmental Forum designed to raise awareness about critical environmental issues (including stormwater runoff) and activities and people working in the area to protect and restore natural resources such as Choctawhatchee Bay. This project was discussed at both events which led to many valuable community contacts being made and another great project being initiated to implement unpaved road/stream crossing improvements for the Oakwood Hills subdivision that drains to the Shoal River.

**PROJECT WATERSHED CHARACTERISTICS:****Watershed Size** (in acres): 36 acres**Land Uses within the Watershed** (acres/percentage):

Medium Density Residential:	34.5 acres (96% of total basin)
Light Industrial:	1.5 acres (4% of total basin)

The majority of the basin's current land use consists of medium density residential with a small area of light industrial. Figure 2 on the following page shows the delineation of the drainage basin with associated existing land uses overlaid on a 1995 infrared photograph. The medium density residential area covers 34.5 acres (96% of total basin) of the basin and the light industrial covers 1.5 acres (4% of total basin).



## **PERMITTING:**

The Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (ACOE) were the permitting agencies for this project. The project was permitted through FDEP Submerged Lands section as a stormwater and wetlands impact project. The ACOE permit addressed wetland impacts falling under the jurisdiction of the ACOE. No local permits were needed.

The ACOE permit was issued without incident. Impacts to the jurisdictional wetlands on the site were offset through mitigation within a tract of wetlands purchased in May 2002 for such purposes. However, it took over 18 months for the county to obtain FDEP stormwater and dredge and fill permits for the project. The initial application was filed in the fall of 2003 shortly after the agreement was executed. On or about August 10, 2004 the county was told the permit was in the review for signature chain. However, between August 2004 and March 2005, three separate FDEP project managers were subsequently assigned to the project and new Requests for Additional Information (RAIs) were filed by each. Walton County attempted to provide the requested information, but there was much uncertainty about what was being requested. On one occasion the same information was provided for Holiday Shores and another project. One was permitted, while Holiday Shores was assigned a new project manager that requested additional information. The project was eventually permitted by the spring of 2005.

## **PROJECT SCHEDULE:**

Delays encountered during permitting resulted in the project falling behind schedule. The original agreement was executed on July 10, 2003 and provided 30 months (through January 9, 2006) to complete the project. Due to the permitting delays mentioned earlier, construction could not begin until the summer of 2005. Therefore, about that time a 16 month extension through May 10, 2007 was requested and granted through Amendment 1.

Despite the excellent progress and efforts made by the Zone 3 Maintenance crew, in the spring of 2007 it was apparent that the project would not be completed by May 10 due to difficulties encountered working in areas with high water tables, delays resulting from several hurricanes that struck the area while the project was underway and design modifications that were agreed upon by all parties to improve the treatment provided by the Best Management Practices (BMPs). A second request for additional time was submitted and six more months were granted through Amendment 2 that extended the completion date to November 10, 2007 by which time all of the construction activity was completed.

## **PROJECT DESCRIPTION:**

This project sub-divided the drainage basin into two separate areas noted as West Sub-basin and East Sub-basin (see Figure 3a). In each sub-basin, the existing secondary conveyance ditches were reshaped to the maximum extent practical given right-of-way

constraints into swales with shallow side slopes (3:1) and vegetated sides and bottom (except for sections constrained by baseflow resulting from a high water table) to encourage filtering, nutrient uptake and velocity reduction. There were many areas of standing water in the ditches under the existing conditions. The reshaping provided a positive gradient (continuously flowing water) to the discharge location. Figure 3 shows the constructed improvements overlaid on the aerial photo. This included approximately 5,735 linear feet (LF) of reshaped ditches to swales in both sub-basins. This is about 30% more than the 4,265 LF that was originally anticipated (please see next section which discusses design modifications) .

The West Sub-basin (11.5 acres) had approximately 3,580 LF of reconstructed ditches (shown in red on Figure 3b) directed to a new wet detention treatment pond with an outfall to the existing primary discharge ditch. The Wet Detention Pond was sized to treat 0.5-inch of runoff and bypass larger storm events to the primary swale through Haugen Park. The pond is approximately 65 feet wide by 180 feet long. It is constructed with as large as possible permanent pool that is 6 – 8 feet deep blending into a littoral shelf planted with wetland species at the outfall that is about 2 feet deep. The littoral shelf occupies 25 – 30 % of the pond area. The treatment volume is approximately 20,260 cubic feet. Pollutants are removed through settling, biological activity in the permanent pool, vegetative uptake of nutrients and retention in the soil of the pond.

For the East Sub-basin (24.5 acres) approximately 2,155 LF of ditch was reconstructed plus 1,239 LF of new hard pipe installed (shown in green on Figure 3b) to allow for shallower side slopes and positive flow into a Second Generation Baffle Box. The Second Generation Baffle Box retains pollutants by first diverting flow and associated solids and pollutants in stormwater runoff over a Nutrient/Vegetation/Litter Separation screen into three concrete sediment chambers. The box's dimensions are 14' long X 8' wide X 8' tall with 48" weirs. The screen separates the foliage from the water preventing nutrient loss to the water flow while heavier sediment gets separated out and falls to the bottom of the chambers. The structure is sized to accept flow from the 24.5 acres (East Sub-basin) at a rate of approximately 11 cubic feet per second (cfs) which equates to the first ½-inch of runoff for the East Sub-basin. The Second Generation Baffle Box is equipped to bypass storm events producing greater than a ½-inch of runoff without blocking flow.

Figure 4 shows the site plan for the two different stormwater treatment systems, Wet Detention Pond and Second Generation Baffle Box. As shown in this figure, the County used existing land owned by the Walton County Board of County Commissioners for the Wet Detention Pond and Second Generation Baffle Box. Therefore, no additional land purchases were required for the installation of the two different treatment systems.



FIGURE 3a

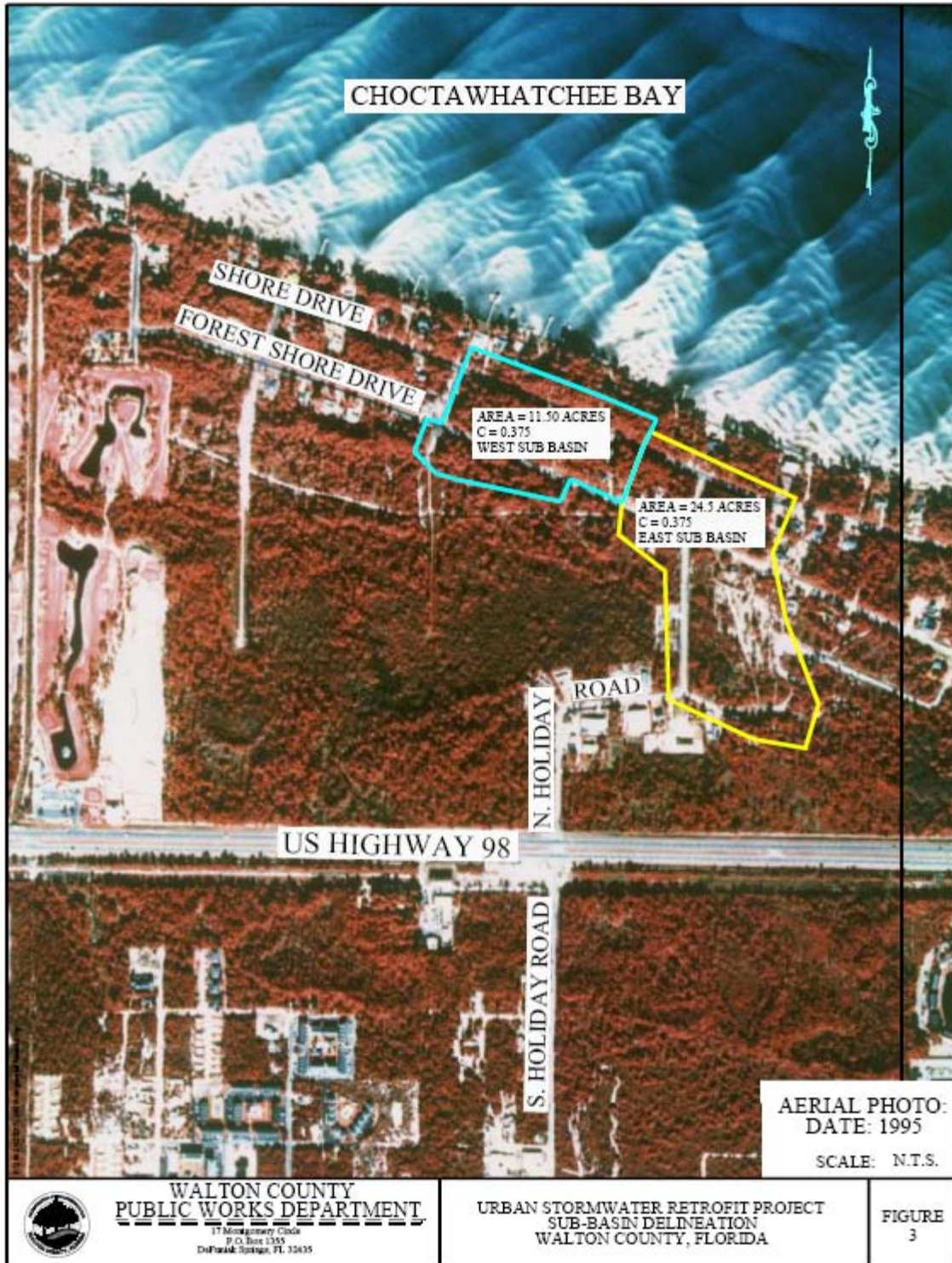




FIGURE 3b







## DESIGN MODIFICATIONS:

The initial (and permitted) plans for the project were designed by Hartmann & Associates, Inc. For the east sub-basin, the plans provided increased conveyance from the Hidden Harbor area along the east side of Holiday Road with 18" & 24" RCP and Type-C inlets from Mariner Way to Shore Drive and then west along the north side of Shore Drive with 38" X 24" ERCP to the baffle box for treatment prior to discharge. For the west sub-basin, there was a limited area of conveyance improvements planned for the south side of Shore Drive west of the detention pond. Several sections of double 24" RCP were proposed to tie into a section of double 19" X 30" ERCP that crossed under Shore Drive to the wet pond. The design for both sub-basins was for a 10 year storm event with the contributing area limited to the width of the public right of way. At the time these plans were prepared there was no additional work planned or scheduled in the immediate vicinity of the project.

However, in February 2004, Preble-Rish was commissioned to provide a basin delineation and stormwater evaluation for a broad area extending from US-98 north to the Choctawhatchee Bay between New Elba Drive and the Okaloosa County line, which included the Holiday Shores sub-basins for which Hartmann & Associates had already designed this project. An extensive surveying and aerial mapping effort was underway in March 2005 and the basin delineation was completed in July 2005. Through discussion with the Public Works Department regarding the scope of work of this project, the designs for the Holiday Shores Urban Stormwater Retrofit Project were reviewed. The decision was made to use the data that was generated for the overarching basin study and revise the design for Holiday Shores to meet the same 25 year storm criteria that the rest of the basin was being designed to. This redesign reduced the amount of hard piping called for in the original plans but also significantly increased the number and sizes of ditches being improved and culverts installed, which added to the cost of the project. It also provided capacity that will be needed when the remainder of the basin is retrofitted in accordance with the overall plan. Improvements that will eventually be made for portions of East and West Forest Shore Drive for example, will tie into the infrastructure provided through this project. Not planning for this would have resulted in critical bottlenecks, unacceptable levels of service and disappointed citizens.

A portion of a third sub-basin with frontage along Shore Drive directly west of the original project area was retrofitted with approximately 3,210 LF of reshaped swales, (shown in blue on Figure 3b) new 18" RCP culverts for driveway crossings and a control structure in the vicinity of the outfall. The positive hydraulic gradient resulting from the new culverts and ditch reshaping eliminated the existing standing water and flooding issues in the basin and the control structure maximized detention and treatment in the swales before discharging to the Bay. Including this area in the project allowed for work along Shore Drive to be completed from Holiday Shore Road to its western termination point. This was much more efficient for the county than stopping short of the terminus and having to remobilize in that area at a later date.

There was some confusion regarding the optimal configuration of the wet detention pond. At one point the pond was redesigned as a gravel-lined dry retention area. It is unclear whether this was a result of the county yielding to citizen concerns about a wet pond at the site or DEP permitting staff being concerned about the proximity of the site to Choctawhatchee Bay and the high water table. When the question was resolved at the permitting level, the plans again showed a wet pond, but with a uniform depth of only 2 feet. Ultimately field changes were agreed upon by DEP and the County which provided for fencing around the perimeter of the pond and excavating to a typical configuration. About 70 % of the pond area is a 6 – 8 foot deep permanent pool and approximately 30 % of the area is a vegetated littoral zone. In addition, a diversion weir and bypass swale was added to the design to maximize the effectiveness of the pond for treating the first flush of runoff.

The design modifications were discussed with the Department of Environmental Protection (DEP) staff that permitted the original plans and it was determined they were inconsequential since the changes were mainly concerned with conveyance which was not regulated in northwest Florida at the time this project was constructed. The wet detention pond and baffle box at the outfall location (and jurisdictional wetland impacts) were the only features of the original design that were subject to permitting and the changes being proposed for these components of the design did not require a permit modification and only needed to be shown on the as built plans. When the county committed to cover any additional costs resulting from the design changes it was agreed upon to proceed with the modified plans. Although the cost increase was substantial, it was a wise investment from the county's perspective compared to the prospect of having to revisit the Holiday Shores sub-basins prematurely to try and upgrade to the 25 year storm event basin standard.

## **PERFORMANCE OF STORMWATER IMPROVEMENTS:**

There have been a number of severe rainfall events since the completion of the stormwater management improvements and the system has performed exceptionally well. There was one area where Class II riprap was installed to eliminate erosion at the corner of North Holiday Road and Shore Drive but otherwise there have been no breaches to the system that would normally be associated with insufficient capacity. The diversion weir that was field changed at the primary outfall to the detention pond appears to work as designed with overflow being directed to the primary outfall ditch to the east through Hagan Park. The ditches have had very little erosion or scour during the severe rainfall events and have been fully stabilized. Routine inspections will need to continue however the entire system appears to function as designed.

## **POLLUTANT LOAD REDUCTION ESTIMATE AND MONITORING DISCUSSION:**

Several published studies were reviewed to facilitate the calculation of watershed pollutant loadings for the project area. Pollutant loading rates for land use categories were extracted from "Stormwater Loading Rate Parameters for Central & South Florida" (Environmental Research and Design 1994). This data was reviewed along with data from the Carpenter's Creek/Bayou Texar Watershed and Stormwater Management

Assessment Report (Dames & Moore, May 2000), which produced stormwater pollutant loading values for an area in the City of Pensacola. As Pensacola's land uses were similar to those found in Walton County, the Pensacola values were utilized rather than those from the central and south Florida study. Table 1 lists the Walton County land use categories with descriptions. Table 2 presents pollutant concentrations (milligrams/liter) for four different pollutants (TN, TP, TSS, and BOD) for each land use category.

Prior to calculation of pollutant loadings, runoff volumes for each land use were calculated. Percent impervious area values were assigned to each land use category, and resultant runoff coefficients were multiplied by the annual precipitation volume for Walton County according to the Florida Meteorological Survey, (58.28 inches per year). Pollutant loading rates were estimated by multiplying each of the pollutant concentrations for each of the land use categories by the annual runoff volume for each designated land use. These pollutant loading rates were then multiplied by the number of acres of each land use category in each sub-basin which yielded land use specific pollutant loadings for each sub-basin. The total pollutant loadings for each pollutant were then estimated by summing the pollutant loadings for each land use category within each sub-basin as presented in Table 3.

**TABLE 1**  
**Land Use Categories & Descriptions for Walton County**

<b>Land Use Type</b>	<b>County Land Use Classification</b>	<b>Description</b>
Medium Density Residential	Coastal Center	The areas within this mixed use land use district are primarily residential, allowing medium residential densities and supporting uses
	Neighborhood Planning Area	Consists of a mixture of existing platted or vested development, unplatted or undeveloped vacant areas, infill areas and small neighborhoods
	Conservation Residential 1 Unit per 2.5 Acres	Includes private, larger tract ownership intended for very low-density use and enhancement of natural resource conservation
Light Industrial	Light Industrial	Non-residential district created to include areas containing a combination of uses, such as offices and light industrial uses

**TABLE 2**  
**Estimated Pollutant Concentration for Walton County Land Uses**

<b>Reference Land Use</b>	<b>South Walton County Land Use</b>	<b>Total N (mg/L)</b>	<b>Total P (mg/L)</b>	<b>BOD (mg/L)</b>	<b>TSS (mg/L)</b>
Light Industrial	Industrial	1.91	0.41	12.04	35.62
Medium Density Residential	Medium Density Residential	1.78	0.64	5.03	41.42

**TABLE 3  
ESTIMATED POLLUTANT LOADINGS**

**West Sub-Basin**

Land Use Type	Description	Acres	Pollutant Concentrations (mg/L)	% Impervious	Runoff Coefficient	Runoff Volume (ac-ft)	Total Nitrogen (Kg/yr)	Total Phosphorous (Kg/yr)	BOD (Kg/yr)	TSS (Kg/yr)
Medium Density Residential	Consists of a mixture of existing platted or vested development, unplatted or undeveloped vacant areas, infill areas and small neighborhoods.	11.5	Total N = 1.92 mg/L Total P = 0.41 mg/L BOD = 10.84 mg/L TSS = 32.98 mg/L	25%	0.375	20.89	49.5	10.5	279.2	850
						Totals (Kg/yr)	49.5	10.5	279.2	850

**East Sub-Basin**

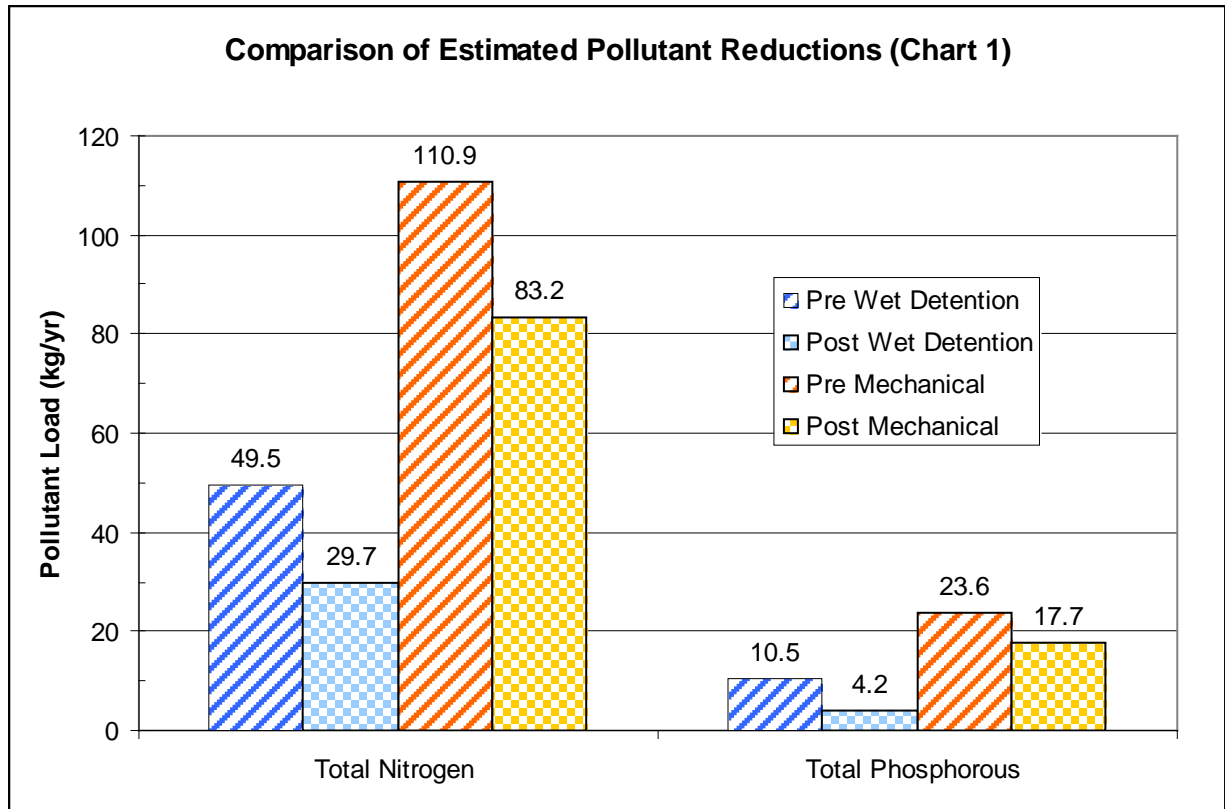
Land Use Type	Description	Acres	Pollutant Concentrations (mg/L)	% Impervious	Runoff Coefficient	Runoff Volume (ac-ft)	Total Nitrogen (Kg/yr)	Total Phosphorous (Kg/yr)	BOD (Kg/yr)	TSS (Kg/yr)
Industrial	Non-residential district created to include areas containing a combination of uses, such as offices and light industrial uses.	1.5	Total N = 1.9 mg/L Total P = 0.39 mg/L BOD = 8.96 mg/L TSS = 77.01 mg/L	72%	0.704	3.42	12	2.5	56.6	486.3
Medium Density Residential	Consists of a mixture of existing platted or vested development, unplatted or undeveloped vacant areas, infill areas and small neighborhoods.	23	Total N = 1.92 mg/L Total P = 0.41 mg/L BOD = 10.84 mg/L TSS = 32.98 mg/L	25%	0.375	41.8	98.9	21.1	558.5	1699
						Totals (Kg/yr)	110.9	23.6	615.1	2185

The project focused on removing the parameters of concern for the Bay in the WBID 778C area such as BOD, coliforms, nutrients, turbidity, and TSS. Based on *Pollutant Removal Efficiencies for Typical Stormwater Management Systems in Florida*, Florida Water Resources Journal, September 1999, by Dr. Harvey H. Harper, Ph.D., P.E., the estimated pollutant load reduction for the West Sub-basin (reconstructed ditches followed by Wet Detention Pond) is shown in Table 4. The estimated pollutant load reductions for the East Sub-basin (reconstructed ditches followed by Second Generation Baffle Box) are based on information obtained from Suntree Technologies, Inc. The quantified reduction estimates for these structures are also shown in Table 4.

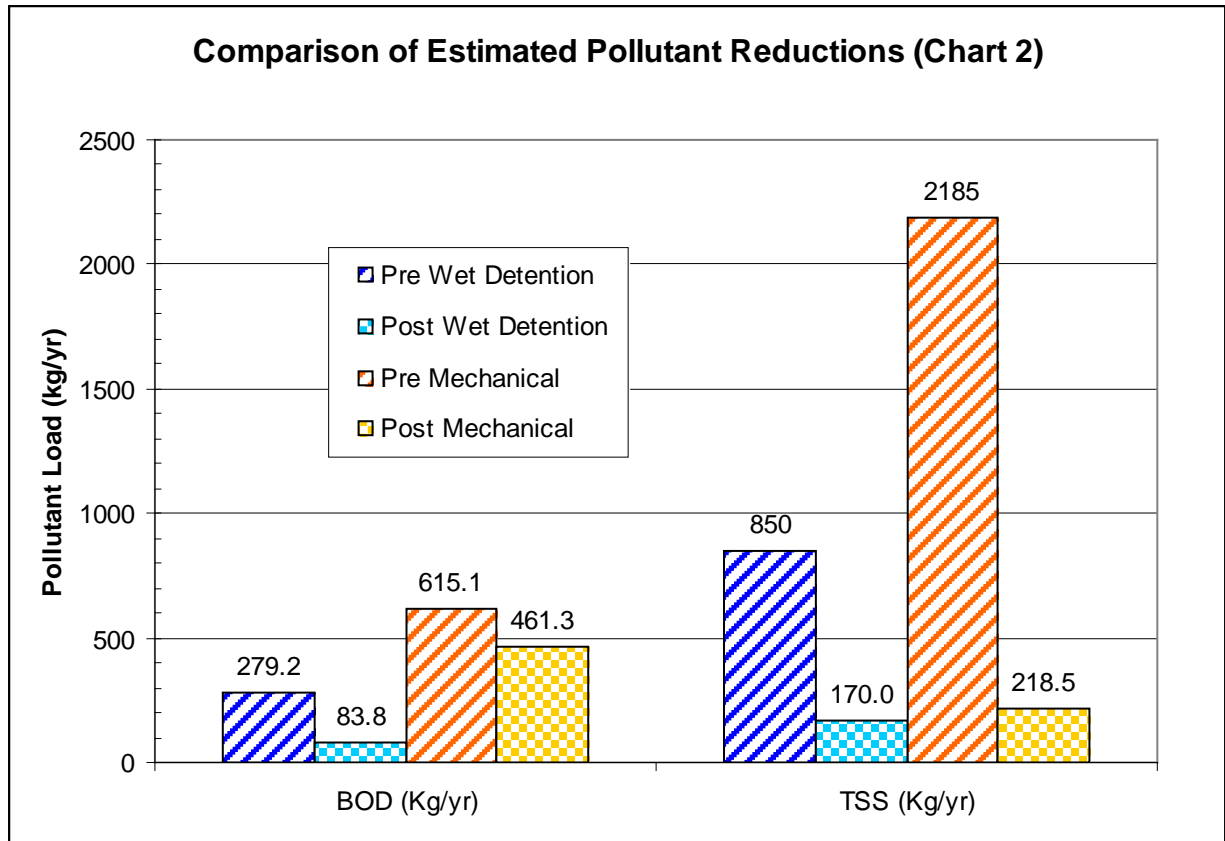
Table 4  
Pollutant Load Reduction Efficiency

<u>Parameter</u>	<u>Wet Detention Pond</u>	<u>Second Generation Baffle Box</u>
TSS	80%	90%
BOD	70%	25%
Total N	40%	25%
Total P	60%	25%

Figures 5 and 6 compare the estimated pre and post pollutant levels in both the wet detention pond and the second generation baffle box.



**Figure 5**



**Figure 6**

The monitoring that was planned for the project was deleted from the scope of work for two reasons. First, the outflow from the wet detention pond that provides treatment for the 11.5 acre west sub-basin could not be isolated from the primary swale that bisects Hagan Park. These samples would have been contaminated on many occasions with the by-pass flow from the west sub-basin as well as flow from the 24.5 acre east sub-basin which also discharges through the Haugen Park swale after passing through the 2<sup>nd</sup> generation baffle box. Secondly, the baffle box site was not conducive for monitoring because flow at the outfall of the box on many occasions mixes with by-pass flow from the west sub-basin before discharging to Choctawhatchee Bay through the Hagan Park swale.

Although conventional monitoring could not be conducted to verify the performance of the two constructed BMPs, detailed cleanout data is being collected for the baffle box by the County. When this data is cross-linked with the results of a separate comprehensive baffle box study that is presently being conducted by the DEP we will be able to verify the benefits of the box for reducing contamination of the Bay. Wet detention ponds have been monitored for many other locations and are a well understood BMP. The estimated load



reductions for this practice are assumed to be accurate and will be compared to the baffle box when we have completed the assessment for the box.

## **PUBLIC EDUCATION:**

This project was the first stormwater public education project implemented by the Walton County Public Works Department. The County prepared a variety of educational materials describing the impacts of stormwater runoff to surface waters and ways to minimize such impacts. These materials explained the purpose of the County's Urban Stormwater Retrofit Project through graphics and written descriptions. These materials included brochures and other information that were distributed during County Commission meetings and at other times when the Public Works Department staff members gave public presentations on the project. In addition, these brochures were distributed to the FDEP, local environmental and non-governmental clubs to help educate the public on the benefits of treating stormwater runoff.

Permanent signage will be prepared and established at Haugen Park with information about the project and the impact of stormwater runoff on surface water after other Park improvements and amenities are in place. This effort is being coordinated with DEP and Walton County's Tourist Development Council which is in charge of improvements to county parks.

## **SPECIFIC OUTPUTS/DELIVERABLES**

The following section describes the project milestones along with details regarding the specific outputs accomplished for each task.

## **PROJECT MILESTONES:**

### **Task 1 - Final Design**

Due to having limited in-house engineering staff, the County contracted first with Hartmann and Associates and then with Preble-Rish to prepare the final design documents. There is a thorough discussion in the project description section of this final report regarding the reasons for using two firms. Ultimately, the Hartmann and Associates design for the stormwater treatment BMPs were merged with the Preble-Rish design for conveyance except for the Hidden Harbor and Mariner Way areas where the Hartmann & Associate design was used for conveyance.

### **Task 2 - Submit Permit Applications**

Hartmann and Associates prepared and submitted the required stormwater and wetland permits to the FDEP and ACOE in fall 2003. Permits were not required for the Preble-Rish components of

the design since these only involved stormwater quantity, not quality, which was not regulated at the time in northwest Florida.

- Task 3 - Obtain Permits, Solicit Bids & Award Contract Elements  
Documents pertaining to Requests for Additional Information from regulatory agencies were prepared and submitted and the required permits were eventually obtained in spring 2005. In addition, requests for bids for the Second Generation Baffle Box and project materials (pipe, erosion controls, etc.) were generated and obtained by the County. The contracted elements of the work were awarded.
- Task 4 - Order Material, Preconstruction Meeting & Begin Construction  
The County ordered the required construction material (pipe, erosion materials, etc.) and conducted a preconstruction meeting with the engineering consulting firm providing part-time construction inspections for the project. Construction activities began in summer 2005.
- Task 5 - Complete Construction  
County work crews completed construction in fall 2007. This included the Wet Detention Pond, installation of the Second Generation Baffle Box, stormwater pipes, ditch reconstruction, driveway reconstruction and sodding of all road shoulders, front slopes, back slopes, ditch bottoms, and repaving of Shore Drive, North Holiday Road, and Mariner Way.
- Task 6 - Prepare Public Education Materials  
Several Public Meetings were conducted at the beginning of the project and the community was reminded often throughout the project of the water quality benefits that are anticipated. Signage will be prepared and established at Hagan Park in cooperation with the Walton County Tourist Development Council providing information about the project and the impact of stormwater runoff on surface water after other Park improvements and amenities are in place.
- Task 7 - Submit Draft Project Report  
The County requested that the Preble-Rish engineering firm prepare and submit a draft Project Report of the project's activities. A summary and overview of their involvement in the project was provided. Since the DEP project manager was the only person involved in the project from its inception through to completion, he was the only one capable of providing much of the necessary content in this report and spent several weeks preparing the draft report.

**TASK 8 - Submit Final Project Report**

The County reviewed and finalized the report in cooperation with its engineering consulting firms and DEP and submitted 5 hard copies and an electronic version of the report to DEP.

**PROBLEMS ENCOUNTERED AND LESSONS LEARNED:**

1) With any construction project it is best to have an accurate and complete understanding of the project from the outset. Field changes are inevitable when unexpected conditions occur but they should be kept to a bare minimum in order to keep a project on schedule and preserve good relations with citizens and contractors. Project plans that result from the efforts of multiple design firms such as was the case for this project should be avoided. Major design modifications such as occurred with this project should also be avoided. These were difficult situations to deal with once the project was underway and weighed heavily upon the project managers and field staff throughout the project.

2) Walton County like much of Florida is influenced by a high water table. This should be carefully considered during the design process for BMPs. Swales are not a good choice for conveyance or treatment under high water table conditions unless there is enough land area available that they can be kept sufficiently shallow so as to dry out within 72 hours following a storm event under normal antecedent conditions, support vegetation and percolate or absorb the first flush of runoff. Wet swales are perceived to be mosquito breeding areas even when water is flowing rather than standing. Although wet swales can be an effective BMP and deliver water quality benefits, it is expensive and difficult to maintain appropriate wetland vegetation in wet swales. Homeowners and other maintenance entities often spray or mechanically clear this vegetation without recognizing the benefits it provides. Wetland or wet swales are best suited for locations where maintenance activities can be controlled.

3) Swales by definition have 3:1 or greater side slopes. One of the goals of this project was to reshape the existing steep sided ditches into swales with gradual side slopes. Unfortunately, there was insufficient right of way available to accomplish this for much of the project area. The larger culvert sizes and deeper conveyance channels that were a part of the design modifications prepared by Preble-Rish were counter productive in this regard. A 30 " culvert having 6 inches of ground cover sits at an elevation at least 3 feet below the ground surface. A minimum of twenty-one feet of right of way on each side of the roadway is required in order to have a 3:1 grade for both the front and back slopes in this situation and enough bottom area to form a trapezoid for the swale. Add to this the 6 feet of shoulder width that is required by DOT and 27 feet on each side of the road bed is needed. We rarely had more than 20 feet per side available which meant that the side slopes were more often 2:1 or steeper rather than the gradual side slopes that were intended. Walton County and other

communities need to plan for and acquire sufficient right of way to construct properly shaped swales when they are a component of a project design.

4) An innovative approach involving staking down seeded and seedling impregnated coir mats was used in an attempt to establish wetland vegetation on the littoral shelf of the wet detention pond and in the wet swale that discharges through Hagan Park to Choctawhatchee Bay. The mats were provided and installed by a firm based in Naples, Florida called Key Restoration, Inc. The company exhibited its products at the 2007 Florida Lake Management Society (FLMS) conference held in Naples and caught the attention of DEP staff that attended the event. The methods employed have been successful in similar situations in southwest Florida. Unfortunately, for this project the results were not as good as we had expected. This may be partly due to north Florida conditions where winter dormancy occurs for many species and/or there may not have been enough exposure of the littoral shelf to allow germination and establishment of the selected wetland species.

The situation was discussed with Professor Mark Clark of the University of Florida who explained that:

He concurred with the species selection and with what was being seeded in targeted zones. However, he was concerned with the likelihood of most of these species germinating if the site is continuously flooded? If the mat will be exposed for sufficient duration during the year to germinate the seeds and allow the plants to become established then there is a good chance of success. However without some exposure of the seed to the atmosphere, only the Water Lilly and Lotus will likely germinate under water, and even these species may not be able to make it up through 4 feet of water.

The issue comes down to energy conversion efficiencies under aerobic (drained/exposed) and anaerobic (flooded) conditions. Seeds contain only so much energy that must be sufficient to get the plant to the point that it can put out the first leaves and start producing its own energy. Under aerobic conditions the conversion of sugars to energy is relatively efficient; however under anaerobic conditions this conversion efficiency is significantly reduced. Some species with large seeds have sufficient energy available to overcome the inefficiency of anaerobic metabolism. However, most seeds are small and do not have large carbohydrate reserves to allow for germination under anaerobic conditions often caused by flooding.

When water levels fluctuate there are events that provide opportunities for the establishment of vegetation at lower elevations than what may be average to the system. Reproduction from shoots and other means of vegetative reproduction then allow those established individuals to creep further down the bank or expand even in the absence of another event that allows seeds to germinate. This vegetative expansion utilizes the parent plants energy while

moving into the unexploited submerged habitat. Water lilies and Lotus can get established under flooded conditions as they have relatively large seeds and can germinate underwater however their survival is influenced by the depth of water. Not until the leaf blade makes a connection with the atmosphere will sufficient oxygen be available for optimal carbohydrate metabolism.

If the water levels will at some point expose the mat and that low water condition will be sufficient in duration for the seed to germinate and the plant to become established then this seeded mat technique should work. I can see how this sort of technique would be good along a riparian system where sediment stabilization is important, but also where the area may only be intermittently flooded. If however the water body where the mats are deployed is hydrologically more stable or if the mat is being deployed below the average pool, then seed germination may be delayed significantly until the mat becomes exposed.

This is essentially the case for the Holiday Shores project site, therefore the duration of seed survival in the seed bank may be a factor with some seeds being short lived and others being long lived. Long lived seeds will sit there in the seed bank until the conditions are conducive to germination and then they will become established. Short lived seeds only have a narrow window of time for establishment and if conditions are not good in that window the seeds will die.

The 2008 FLMS conference was held June 2 -5 at the Sandestin Resort, which is only a few miles from the pond location and Key Restoration was hoping our project would be a feature of their exhibit. Instead of showing off the success of the coir mats, the company replanted the matted areas with vegetated logs containing well established root stock while in the area for the conference. All parties were disappointed the mats failed in this particular application, but Key Restoration Inc went the extra mile and ultimately provided the vegetation that was needed in order to complete the BMP treatment train at the outfall of the project.

5) Frequent management turn-over at the County's Public Works Department coupled with the county's computer system crashing resulted in the loss of many important files. This led to a situation where the DEP project manager was the only individual remaining who had sufficient knowledge of the project to prepare a comprehensive report. After several failed attempts to try pass this information on and lead county staff and their consulting engineers through the process, Michael took over and prepared the report with support from county staff rather than the other way around as DEP is accustomed to. The lesson learned is that the county must backup all critical files on disks and make sure that more than one staff person has these files and sufficient knowledge of the project to complete the final report.

## FISCAL ANALYSIS:

The total project cost was \$672,678 of which \$205,700 was provided by the TMDL Water Quality Restoration Grant from DEP. Without grant assistance, the proposed project would not have been included as a capital project for the County for many years and discharge of untreated stormwater runoff to Choctawhatchee Bay would continue. In lieu of waiting, the County sought assistance through the TMDL Water Quality Restoration Grant Program to be a proactive stakeholder in the management of the Bay. In the original application, the County committed 23% of the total estimated budget or \$60,136.80 through in-kind services for this project. The in-kind services included construction crews, equipment use and wetland mitigation land purchase for permitting wetland impacts. Due to project modifications and the increased cost of construction materials since the project was conceived, the county's actual match increased to 69% or **\$466,977.96**. This included cost sharing by the county to cover up-charges for supplies as well as additional in-kind services (labor and equipment) necessary for the successful implementation of the project.

Please note that the preparation of this final report and some of the site amenities at Haugen Park such as signage, entrance fencing, picnic tables, etc. were provided by Walton County after the official end date of the agreement. These costs were not reimbursed with grant funds or considered as in-kind match

### TABLE 5

#### ORIGINAL PROJECT BUDGET: GRANT FUNDING REQUESTED: \$205,700.00

<u>Project Funding</u>	<u>FDEP Grant Funding</u>	<u>Matching Funds</u>
<u>Activity</u>		<u>By Source (Entity)</u>
Staff	0	\$ 25,736.8 (County)
Travel	0	0
Equipment	0	\$ 4,400.00 (County)
Supplies	\$ 88,000.00	0
Contractual	\$ 100,700.00	0
Monitoring	\$ 14,000.00	0
Public Education	\$ 3,000.00	0
Mitigation Land	0	\$ 30,000.00 (County)
<b>TOTAL</b>	<b>\$ 205,700.00</b>	<b>\$ 60,136.80 (County)</b>
<b>TOTAL PROJECT COST:</b>	<b>\$ 265,836.80</b>	<b>% Match 22.6 %</b>

**TABLE 6**

**REVISED PROJECT BUDGET PER AMENDMENT 2 SHOWING INCREASED  
MATCHING FUNDS:  
GRANT FUNDING REQUESTED (SAME): \$205,700.00**

<u>Project Funding</u>	<u>FDEP Grant Funding</u>	<u>Matching Funds</u>
<u>Activity</u>		<u>By Source (Entity)</u>
Staff	0	\$ 51,473.60 (County)
Travel	0	0
Equipment	0	\$ 8,800.00 (County)
Supplies	\$ 165,000.00	\$ 82,500.00
Contractual	\$ 40,700.00	0
Monitoring	0	0
Public Education	0	\$ 3,000.00 (County)
Mitigation Land	0	\$ 30,000.00 (County)
<b>TOTAL</b>	<b>\$ 205,700.00</b>	<b>\$ 175,773.60 (County)</b>
<b>TOTAL PROJECT COST:</b>	<b>\$381,473.60</b>	<b>% Match 46.1 %</b>

**TABLE 7**

**ACTUAL PROJECT COSTS:  
GRANT FUNDING: \$205,700.00**

<u>Project Funding</u>	<u>FDEP Grant Funding</u>	<u>Matching Funds</u>
<u>Activity</u>		<u>By Source (Entity)</u>
Staff	0	\$ 93,634.74 (County)
Travel	0	0
Equipment	0	\$ 8,800.00 (County)
Supplies	\$ 165,000.00	\$ 308,890.39 (County)
Contractual	\$ 40,700.00	\$ 22,445.83 (County)
Monitoring	0	0
Public Education	0	\$ 3,000.00 (County)
Mitigation Land	0	\$ 30,000.00 (County)
<b>TOTAL</b>	<b>\$ 205,700.00</b>	<b>\$ 466,977.96 (County)</b>
<b>TOTAL PROJECT COST:</b>	<b>\$672,677.96</b>	<b>% Match 69.4%</b>

## Appendix - Photos

### Holiday Shores Stormwater Management Improvements Walton County, FL

#### Preconstruction



This was the original untreated discharge under Shore Drive from sub-basins 1 and 2 to the swale in Haugen Park before the flow was divided and routed to two treatment alternatives. This runoff ran about 135 feet through the Park to Choctawhatchee Bay. Treatment is now provided at the Park site for almost 35 acres of contributing watershed area by a wet detention pond and a baffle box.





This is the north side of Mariner Way at the entrance to the Hidden Harbor Estates subdivision after a routine storm event. This subdivision is the origin for much of the runoff that is now diverted to a second generation nutrient removing Baffle Box that was installed in Haugen Park. The rest originates from yards and side streets along the east side of Holiday Road and Malibu Gardens to the south. This watershed is sub-basin 1. It is the largest of the three contributing watersheds that were a part of the Holiday Shores project.



This is further east on Mariner Way in sub-basin 1 looking towards the cul-de-sac at the rear of the Hidden Harbor Estates subdivision.



This is Hidden Harbor Lane in sub-basin 1 looking north towards the cul-de-sac at the end of the street. There was no outlet for the runoff that accumulated on this street.



This is a selection of typical preconstruction photos showing widespread flooding throughout the Holiday Shores project. In addition to resolving flooding and standing water concerns the BMPs also provided water quality benefits by treating the runoff prior to discharge to Choctawhatchee Bay





This is the corner of Mariner way and North Holiday Road in sub-basin 1 looking south towards Choctawhatchee Bay. Undersized culverts and mismatched invert elevations were contributing to flooding problems and long periods of standing water. The lack of positive drainage prevented the system from recovering its capacity between storms. Several rainy days in quick succession was causing extreme problems for upstream residents.



There was very little runoff discharged through this unimproved easement in sub-basin 3 before wide spread flooding of nearby residential properties occurred. In between storm events, there were long periods of standing water in sub-basin 3 because there was not a functional outfall.



## Construction and Post Construction for Sub-Basin 1



The solution for the entrance to Hidden Harbor Estates was a properly graded swale.



The solution for the rear section of Mariner Way consisted of installing inlets and hard pipe to convey the runoff to an improved swale system along North Holiday Road.



Several large common areas of sub-basin 1 were graded and sodded to provide pre-treatment of sheet flow prior to it being conveyed by pipes and swales downstream to the baffle box





The solution for Hidden Harbor Lane consisted of installing a small drain (shown in the bottom right photo between the palm and the two mailboxes) and routing some flexible PVC line through a narrow drainage easement between several homes on the cul-de-sac providing a connection to the main conveyance system along North Holiday Road and the baffle box that was installed near the outfall to the Bay.



This is the corner of Mariner Way and North Holiday Road looking south or upstream towards Hidden Harbor Estates. The large swale at the entrance of the subdivision merges from the left with the hard pipe from the uppermost and south sections of the watershed at the mitered end which is visible top center in the photo. Several driveways were hard-piped as a single unit at this particular location due to underground utilities that needed to remain buried. From here to the inlet of the baffle box in Haugen Park swales provide conveyance and the culverts normally occur underneath individual driveways.



Typical swale along N. Holiday Road.



Twin 24" pipes under Forest Shore Dr.





This is the corner of North Holiday Road and Shore Drive where the upstream flow from sub-basin 1 is brought underneath Shore Drive.



Culverts throughout sub-basins 1 and 2 range from 18 inches at the top of the sub-basins to 24, twin 24s, then 30 and finally twin 30s.





Excavation for baffle box to be installed.



A gravel rock base was prepared to provide a stable surface for the box.



Gravel base being leveled. Note the well point in the background that kept site dry.





A crane was needed to install the base unit and screen assembly.



The crane was also needed to install the upper section of the box. Note the beads of sealant around the seam where the two halves meet.





The lid for the baffle box was installed using a large back hoe.



The back hoe was also useful for backfilling around the box.



This is a view of the rip-rap that was installed around the box.



A vertical grill was installed to keep children and pets from becoming entrapped in the box but it collected too much debris and caused the swales to backup. This nearly caused a serious flood. The grill was removed and re-installed horizontally with about one foot of clearance at the bottom to allow for runoff to pass freely through the system.





The completed Baffle Box at Haugen Park on Shore Drive where treatment is provided for all of the runoff from sub-basin 1 prior to it being discharged through an existing swale to the outfall from the Park to Choctawhatchee Bay.



## Construction and Post Construction for Sub-Basin 2



As was done for sub-basin 1, swales were constructed and culverts ranging from 18 inches to twin 30s were installed to convey runoff to Haugen Park. In this case, treatment is provided by a wet detention pond rather than a baffle box as was used for sub-basin 1.





This is the inflow location for the wet detention pond prior to being rip-rapped or the diversion weir and the by-pass being installed.



This is the outfall weir of the detention pond under construction. Three six inch PVC bleed down pipes are shown.





The wet detention pond was initially designed with a uniform depth of about two feet across the entire pond. It became apparent very quickly that it would be taken over by cattails and end up functioning as a wetland marsh rather than a detention pond.



The pond was drawn down and excavated to provide a permanent pool 6 – 8 feet deep and a littoral shelf covering about 35% of the pond surface area. Several attempts were made to establish wetland vegetation on the littoral shelf. This was not very successful. Salinity variations may be part of the reason.





This is the view looking north towards Choctawhatchee Bay of the completed wet detention pond that was constructed in Haugen Park on Shore Drive to provide treatment for the runoff that is discharged from Sub-basin 2. The pond is located just slightly west of the baffle box that provides treatment for sub-basin 1. They both discharge to an existing swale that transects Haugen Park.



This is the diversion weir that was constructed to direct excess runoff around the pond. The bypass was added as a change order to provide the maximum amount of detention and treatment of the first half inch of runoff and avoid overloading the system hydraulically.



### Construction and Post Construction for Sub-Basin 3

The solution for sub-basin 3 consisted of reshaping swales and installing culverts under all of the obstructing driveways with invert elevations correctly set to provide positive drainage towards the outfall eliminating standing water under most conditions. These improvements virtually eliminated the flooding that was such a big concern and resulted in cleaner discharges to the Bay through settling, absorption and bio-treatment in the swales and the extra detention that the control structures provide.



View of the contributing watershed and reshaped vegetated swale on Shore Drive looking east from the control structures in sub-basin 3 during dry conditions.



View of the contributing watershed and reshaped swale on Shore Drive looking west towards the cul-de-sac from the control structures in sub-basin 3 during dry conditions.



Control structure being set for sub-basin 3.



View looking north towards Choctawhatchee Bay at the outfall control structures for sub-basin 3. These structures increase the amount of detention provided in the swales. Storms that generate more than the design volume of runoff top the weirs and discharge to the Bay through a double row of 18" flex pipe. A wide swale in the right-of-way provides an emergency overflow for extreme storm events. Bleed down occurs slowly over several days through perforated six inch PVC pipes at the base of the structures



## Miscellaneous Photos



A swale recently constructed and ready for sod to be installed. Swales provide positive conveyance to outfalls and treatment of runoff prior to discharge.



Concrete rubble that was generated when existing driveways were demolished was used to stabilize seawalls and provide habitat along the shoreline.





High quality reinforced concrete pipe was used throughout the entire project..



The headwall construction, pipe alignments, and rip-rap at this location where the conveyance for sub-basin 2 passes underneath Shore Drive was done in a manner that allowed a resident to keep the landscape timbers and landscape buffer shown above.





This is a view of the swale through Haugen Park which the baffle box and the wet detention pond discharge to. This swale connects directly to Choctawhatchee Bay.



This is a view of rip-rap that was installed to prevent erosion at the head of the swale where the wet pond bypass channel and the baffle box outfall converge.





As the project was being finished a high water table kept the bottom of the swales wet for a prolonged period and raised concerns that vegetation would never get established. Planting wetland species throughout the swales or rip-rapping them was considered in order to prevent erosion. However, residents clearly preferred a manicured look and would not accept having wetlands and snakes in front of their homes and rip-rap was not aesthetic either. Fortunately, the water table receded and acceptable vegetation became established.



The need for twin 30s along Shore Drive was disputed but the engineer insisted they were necessary in order to convey the 25 year design storm which is about 8.5 inches of rainfall. Shortly after the project was completed, a storm of this magnitude occurred. The system worked perfectly and every bit of the capacity provided by the twin 30s was needed to keep the swales from overtopping and causing flooding of residences.



This is a swale in sub-basin 2 near the outfall to the wet detention pond at maximum capacity but still in bank following a major storm event.



This is after the same storm event at an unimproved location along Shore Drive where the swales were over topped and flooding occurred.