

**STORMWATER RETROFITTING
FOR
WATER QUALITY AND FLOOD PROTECTION
MARTIN COUNTY, FL**

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Introduction

Prior to 1998 Martin County's stormwater program consisted of 'as needed' repairs to failing infrastructure and minimal maintenance of major drainage ways. Beginning in 1972 with the advent of subdivision regulations the Martin County Code included provisions to control rate, quality, volume, and timing of stormwater discharges at pre-development levels under similar events. The concept of "Legal Positive Outfall" was introduced to Code which precluded site development unless it could be demonstrated that the developing site had documented rights to drain from the site all the way to the receiving body, and that the flows were by gravity and not pumped. In 1988 Martin County adopted the Comprehensive Growth Management Plan (MCCGMP), with extensive goals, objectives, and policies to protect coastal areas, estuaries, wetlands, aquifers, and provide drainage. Many existing drainage facilities were identified in that plan as being Level of Service (LOS) deficient for flood protection. The extensive policies and regulation and an environmentally outspoken Martin County Board of County Commissioners (BOCC) has contributed significantly to Martin County being the least developed county in southeast coastal Florida.

In response to extreme rainfall years of 1993, 1994 and 1995 after 5 years of drought Martin County attempted to address flooding and water quality problems by developing a master plan to comprehensively manage stormwater in the unincorporated county. Funding was sought through a special assessment proposed in 1996. The assessment failed but useful tools came out of the effort. Planimetry of development shown on 1979 aerial photos (1979 Redi Map Atlas) identified 10,000 acres of Martin County developed without water quality treatment and 80 projects were proposed. These projects were identified in the Stormwater Master Plan in 1997 and incorporated into the MCCGMP. From these 2 documents a capital improvement program (CIP) was developed. In 1998 the BOCC began funding that program with advalorem taxes placed in a dedicated MSTU. Since that time some twenty three (23) projects and sub-projects have been completed which provide water quality treatment and enhanced flood protection. Eleven (11) additional projects are currently underway. Cost and time data have been compiled and aggregated into fourteen (14) completed projects which are reported on here to provide insight into the various project elements and stormwater retrofitting overall.

Funding

Martin County has utilized many funding sources to finance projects including; advalorem, telecommunications, and sales taxes, State Revolving Fund (SRF) Loans which are guaranteed by sales tax but repaid by advalorem tax, US Environmental Protection Agency (EPA) Section 319 grants, Indian River Lagoon National Estuary Program (RLNEP) grants administered by the St. Johns River Water Management District (SJRWMD), St. Lucie River Issues Team (SLRIT) grants administered by the Florida Department of Environmental Protection (FDEP) and South Florida Water Management District

(SFWMD), Loxahatchee River Preservation Initiative (LRPI) grants, FDEP Total Maximum Daily Load Program (TMDL) grants, developer contributions of land and money offered during the development process, Florida Department of Transportation (FDOT) Joint Participation Agreement (JPA), incorporation of County owned land and right of way into projects, and in-Kind Services.

The fourteen (14) projects reported on here, utilized seventy-seven (77) discrete funding sources. *Table 1: Funding Sources*, shows those sources and how many instances each was utilized for each project.

Table 1: Funding Sources:

Project Name	Taxes	SRF	SLRIT	TMDL	Sec. 319	LRPI	SJR WMD	FDEP	LAND	FDOT	County Land / ROW	In - Kind Services	Contributions	# of Funding sources by Project
Coral Gardens	1	1	2								1			5
Cedar Pointe	1		1								1		1	4
Fern Creek	1	1	2								1	1	1	7
Golden Gate PI,PII,PIII	1	1	3		1						1			7
Hibiscus Park PI & PII	1		1								1	1		4
Kitching Creek/Flora Ave	1				1	1						1	2	6
Little Club PI & PII	1				1	1						1	1	5
Manatee Creek Retrofit P1	1	1	1	1	1									5
Old Palm City PI & PII	1				1						1			3
Palm Lake Park	1		3											4
Poinciana Garden PI & PII	1		1										2	4
Rio St Lucie PI	1	1	1				1				1	1		6
Salerno Creek / RPI & PII	1	1	2		1			1	2	1	1	2		12
Tropic Vista	1	1			1						1	1		5

Grants and developer contributions combined are estimated at \$12.49M. Grant values are the value of the grant contract with the granting agency. Contributions are the benefit the project received from sources outside of County or grant funds. Contributions were received towards five (5) projects and included; cash, raw land or work towards constructing the facility. Taxes and SRF loans provided \$19.02M dollars. Costs for the completed projects total \$31.52M. Funding by grants and contributions ranged from \$127,000 to \$1,960,542, constituting 40% of the total project costs for the 14 projects and ranged from 5% to 70% of individual project costs. *Table 2: Funding by Project* depicts funding by project and by aggregate of project phases.

Table 2: Funding by Project

Project Name	Total Funding (\$)	Ad Valorem Taxes (\$)	SRF Loans ^[1] (\$)	Grants & Contributions ^[2] (\$)	Percent Funding by Grants & Donations
Cedar Pointe	398,027	271,027		127,000	32%
Coral Gardens	2,321,860	312,119	995,991	1,013,750	44%
Fern Creek	2,660,200	564,363	228,907	1,866,930	70%
Golden Gate PI,PII,PIII	2,630,515	961,710	246,805	1,422,000	54%
Hibiscus Park PI & PII	1,390,574	702,859	537,715	150,000	11%
Kitching Creek PI (Flora Ave)	1,143,144	391,796		751,348	66%
Little Club PI & PII	2,075,593	745,593		1,330,000	64%
Manatee Creek Retrofit PI	2,795,086	0	834,543	1,960,542	70%
Old Palm City PI & PII	1,544,600	993,174	239,507	311,919	20%
Palm Lake Park	1,741,098	255,162	920,936	565,000	32%
Poinciana Gardens PI & PII	2,960,547	200,456	1,928,841	831,250	28%
Rio St Lucie PI	354,161	0	225,179	128,982	36%
Salerno Creek / MP RPI & PII	4,715,074	2,373,761	547,245	1,794,068	38%
Tropic Vista	4,786,046	2,218,578	2,326,468	241,000	5%
Totals	31,516,525	9,990,600	9,032,136	12,493,789	40%

^[1] Martin County utilized three State Revolving Funds (SRF) Loans and the loans will be paid back with current and future Ad Valorem taxes

^[2] Grants and Contributions consist of funds, land and/or work.

Retrofit Strategy

Much of the developed area of Martin County is nearly level with poorly drained soils with groundwater closer to the surface than 4 feet. Early platting and development practices resulted in communities being built on grade with ad hoc drainage. Subsequent development of surrounding areas at higher levels, to newer standards, obstructed historic flowways and storage areas and channelized untreated runoff to environmentally sensitive areas from the older developed areas. Those obstructions have also resulted in localized; structure, roadway and property flooding. The initial goals for these retrofit projects *Table (3) - Retrofit Levels of Service* are to create surface water management systems that meet current regulatory standards and LOS for water quality treatment and flood protection. Retrofits in these areas are constrained by; high groundwater tables, scarcity of undeveloped land to convey and store runoff, and close proximity of outfalls to the Indian River Lagoon and the St Lucie Rivers. These constraints and limited funding have at times resulted in the need to find compromise between the goals and what can be reasonably achieved. By permitting retrofits without providing credits for future development within the basin, projects are able to move forward while meeting reduced standards.

Table 3 : Retrofit Levels of Service

Facility	Standard	Levels Achieved
Water Quality treatment	Greater of 1" over the entire basin or 2.5" x impervious area for 80% pollutant removal plus ½" treatment for 95% pollutant removal before discharge to Outstanding Florida Waters (OFW) (SFWMD)	Partially or completely met
Roadway flood protection	Road Centerlines above 10-Year, 24-Hour storm peak stage. (Martin County LDR)	Generally met
Structure flood protection	1 st Floors above 100 yr 3 day storm peak stage (SFWMD, Martin County LDR)	Not always met for all structures

The primary ingredients to providing water quality treatment and flood protection for a project is to provide storage within its drainage basin and to convey runoff from localized flooded areas to those storage areas with the least amount of headloss. By settling pollutants and infiltrating runoff in storage areas, pollutants are removed. By attenuating discharges from the storage areas to pre-project levels conveyance away from flood prone areas can be increased and lower flood stages achieved. A number of storage types often called Best Management Practices (BMP's) *Table (4): Storage / BMP Types* are available and have been utilized in the projects to provide treatment and attenuation.

Most Martin County projects rely on wet detention to provide water quality treatment and flow attenuation. Most wet detention facilities incorporate STA marshes. It is believed that native, perennial, emergent and aquatic plant species enhance nutrient removal. At this time that has not been confirmed but since the primary pollutant removal mechanism in ponds is settlement the marshes do not compromise the facility's effectiveness.

Typically, the only remaining land available for storage in project areas is in and around existing and often heavily impacted jurisdictional wetlands. Although not suitable for water quality treatment, jurisdictional wetlands can be utilized for flood protection once water quality treatment for runoff from the retrofit area is provided. Many projects have utilized jurisdictional wetland areas for flood protection. Above the elevation where water quality treatment is provided by conventional BMP's storm flows can be attenuated in the adjacent incorporated wetlands before ultimate discharge to the receiving waters. Those wetlands are sometimes vertically adjusted to restore a hydrologic regime needed to support native wetland species, placed in conservation easements to assure their perpetual wetland identity, and kept free of exotic species by regular maintenance as a condition of permits.

In addition all of the STA's constructed to date allow public access. Public perception of the facility as a community enhancement is essential to a successful program. With their extensive, gently sloped, shallow, heavily planted and well maintained littoral areas attractive viewing and useful bird and fish habitat is provided while water access is discouraged and risks to the public minimized.

Table 4 : Storage / BMP Types

BMP Type	Relative treatment value of various BMP's	Relative flood protection value of various BMP's	Predominance in Martin County retrofit projects
Wet Detention with or without STA marshes	1	1	Generally used with marshes
Dry Detention	1.33	1	Sometimes used (groundwater limiting)
Retention	2	1	Infrequently used (groundwater and infiltration limiting)
Exfiltration	2	0	Occasionally used with sediment traps (groundwater and infiltration limiting)
Swales	0.2	N/A Conveyance	N/A Conveyance
Baffle Boxes	0 (some gross solids and sediment removal)	0	Only used directly adjacent to receiving waters where no available land for storage exists

Project Development

For budgeting, tracking, and reporting purposes, work is typically divided into 5 elements with similar activity types: Study, Design & Permitting; Land Acquisition; Construction; Maintenance; and Monitoring. Project managers maintain records on each of these activity groups and this study presents a compilation and analysis of those records.

Study, Design & Permit

Once a project is included in the CIP and receives initial funding, Engineering firms are selected for individual projects based upon a contract let by the County to implement the Office of Water Quality (OWQ) CIP projects. The first step is preparation of a basin study and preliminary engineering design. The preliminary study typically includes; hydrologic & hydraulic analysis of the entire drainage basin affecting or affected by the project, geotechnical investigation of groundwater elevations in the area, topographic data, potential BMP types and possible locations, existing and proposed conveyance routes, mapping of flooding and septic failure data acquired from; the American Red Cross, the Health Department and interviews with county staff and residents, quantification of water quality treatment deficiencies in the basin, environmental assessments and mapping of; wetlands, threatened and endangered species, presence of historical and archeological features in the project area, and refined costs estimates for the project. The preliminary engineering report becomes the basis for future budgets, permit applications, land acquisition, grant applications, and final designs.

Once the preliminary study is complete, permit level drawings are prepared and applications are submitted to the appropriate agencies which may include: SFWMD, US Army Corps of Engineers, FDOT, FDEP, Florida Fish and Wildlife Conservation Commission, and the EPA. Time to complete the engineering phase varied from zero (0) months to one-hundred and ten (110) months, permitting ranged

from zero (0) months for permit exempt projects to twelve (12) months. Total cost for the engineering phase varies from zero (0%) of total project costs for in-house designs to thirty four percent (34%) of total project costs (exclusive of land costs) for the fourteen (14) completed projects in this study as shown in *Table 5: Time and Cost for Study, Design and Permitting*.

Table 5: Time and Cost for Study, Design and Permitting

Project Name	Study, Design & Permitting		
	Cost (\$)	Percent of Total Project Cost ^[1]	Time to Complete (Months)
Cedar Pointe	\$ 65,800	17%	38
Coral Gardens	\$ 209,000	22%	23
Fern Creek	\$ 274,775	12%	53
Golden Gate PI,PII,PIII	\$ 349,135	18%	34 ^[2]
Hibiscus Park PI & PII	\$ 250,106	18%	37 ^[2]
Kitching Creek PI (Flora Ave)	\$ 157,380	14%	110 ^[3]
Little Club PI & PII	\$ 308,023	18%	105 ^[2]
Manatee Creek Retrofit PI	\$ 116,026	5%	41 ^[3]
Old Palm City PI & PII	\$ 381,400	34%	41 ^[3]
Palm Lake Park	\$ 251,270	16%	24
Poinciana Gardens PI & PII	\$ 284,700	10%	24 ^[2]
Rio St Lucie PI	\$ 7,500	2%	82 ^[3]
Salerno Creek / MP RPI & PII	\$ 306,973	8%	74 ^[2]
Tropic Vista	\$ 673,178	21%	76
Totals	\$ 3,635,266	15%	

^[1] "Total Project Cost", in this table, **does not** include the costs associated with Land.

^[2] Project is completed, no future phases.

^[3] Project is completed through indicated phase, future phases are not included.

Land Acquisition

After completion of preliminary engineering and concurrent with permitting, land acquisition begins. Land acquisition is the most highly variable element of a project. Land costs can range from no cost when utilizing County owned land including: parcels, decommissioned water and wastewater treatment plants, and abandoned road rights of way up to 60% of Total Project Cost can be attributed to land costs as shown in *Table 6: Cost of Land in Dollars and as Percent of Total Project Cost*.

Two examples of the benefits of incorporating right of way into project sites are the Salerno Creek Retrofit where 10.3 acres of the 28 acre project site consisted of road and ditch rights of way and the Golden Gate retrofit where 5.1 acres of the 14 acre site consisted of abandoned road rights of way. Contributions by real estate developers during the Planned Unit Development (PUD) process can also reduce land costs as well as construction costs *Table (2)*. During the PUD process close coordination with the Martin County Growth Management Department resulted in a developer contribution of 2.94 acres for a wet detention pond and STA marsh in the Little Club Phase 1 retrofit. In Poinciana Gardens the developer of an adjacent golf course community dedicated 15.84 acres for a wet detention pond in exchange for the excavated material and also the community receiving the retrofit dedicated 3.87 acres

of commonly held land to the project. At the upper end of the cost spectrum 6.2 acres of substandard lots of record scattered throughout the 28 acre Salerno Creek Retrofit project site was acquired by eminent domain in the year 2000 for \$730,000 of the total \$1,000,000 of land cost, or \$117,000 per acre. When high value roadway frontage was required for the Coral Gardens Retrofit in November 2003, 8.1 acres cost \$1,400,000 or approximately \$173,000 per acre.

Table 6: Cost of Land in Dollars and as Percent of Total Project Cost

Project Name	Cost (\$)	Percent of Total Project Cost
Cedar Pointe		
Coral Gardens	\$ 1,365,400	59%
Fern Creek	\$ 350,300	13%
Golden Gate PI,PII,PIII	\$ 712,121	27%
Hibiscus Park PI & PII	\$ 16,947	1%
Kitching Creek PI (Flora Ave)	\$ 51,000	4%
Little Club PI & PII	\$ 338,400 [1]	16%
Manatee Creek Retrofit PI	\$ 454,545	16%
Old Palm City PI & PII	\$ 432,200	28%
Palm Lake Park	\$ 141,114	8%
Poinciana Gardens PI & PII	\$ 153,400	5%
Rio St Lucie PI		
Salerno Creek / MP RPI & PII	\$ 971,261	21%
Tropic Vista	\$ 1,651,322 [2]	35%
Totals	\$ 6,638,010	21%

^[1] Land was appraised for \$330,000 and donated to Martin County through PUD agreement with adjacent developer.

^[2] Cost includes a Martin County net loss of \$855,000 of land value from a Land Exchange Agreement with the State of Florida.

Construction

For purposes of this study, construction begins with preparation of bid documents and ends with final payment to the construction contractor. Bid documents typically consist of; plans and technical specifications, prototypical Stormwater Pollution Prevention Plan (SPPP) and permit application for contractor use in obtaining a National Pollutant Discharge Elimination System (NPDES) Permit for Large and Small Construction Activities, construction contracts, all project permits, and grant and loan documents relevant to the construction contractor.

Construction projects are publicly advertized for a minimum of 30-days during which a pre-bid meeting is held and after which bids are opened. Bids are reviewed by staff and a contract is typically awarded to the lowest responsive, responsible bidder. Once a contract is awarded, a pre-construction meeting is held where all aspects of the project are discussed including required submittals, inspections, safety, NPDES and permitting regulations, invoicing, schedule, and Notice to Proceed. The start date for construction is also usually established at that meeting. From the time a project is first advertised until construction commences is typically three (3) months.

Construction time, from mobilization until payment of final invoice, for these 14 projects has ranged from six (6) months to twenty seven (27) months with a median time of eight (8) months, as shown in *Table 7: Construction Cost, Time and as % of Total Project Costs*. Although the type of work is similar for all projects the physical size of the excavation and amount of storm drain installation predominates construction time. Weather conditions such as the Hurricanes in 2004 combined with a late to arrive permit, delayed completion of the Tropic Vista Retrofit, while unforeseen site conditions and the lack of a sufficiently detailed construction schedule delayed the Salerno Creek Retrofit. A Critical Path Method construction schedule at project start and updated with each invoice is required from the contractor. The schedule must have sufficient tasks to account for all significant components of the project, and be linked together to establish the critical path. The schedule is indispensable in keeping the project on track and accounting for delays as variability of demand for excavated material would otherwise result in projects going on indefinitely while contractors attempt to maximize value of excavated material. Construction costs of the 14 projects discussed here range from \$332,227 for the Cedar Pointe Retrofit to \$3,336,840 for the Salerno Creek Retrofit. The total cost of the 14 construction projects was \$20,331,878 which represents an increase of \$1,533,768 over the initial contract cost, or a nine percent (9%) increase in overall construction cost. Construction costs ranged from 3% to 7% under budget at Palm Lake Park and Rio St. Lucie PI respectively due to conservative bid quantity estimates to 19% over budget at Salerno Creek due to unforeseen site conditions, repairs to damages caused by extreme weather, and enhancements to the original design.

Table 7 : Construction Cost, Time and as % of Total Project Costs

Project Name	Construction		
	Cost (\$)	Percent of Total Project Cost ^[1]	Time to Complete (Months)
Cedar Pointe	\$ 332,227	83%	6
Coral Gardens	\$ 747,460	32%	8
Fern Creek	\$ 1,995,125 [2]	75%	9
Golden Gate PI,PII,PIII	\$ 1,494,445	57%	20
Hibiscus Park PI & PII	\$ 1,123,521	81%	14
Kitching Creek PI (Flora Ave)	\$ 792,264	69%	6
Little Club PI & PII	\$ 1,389,570	67%	10
Manatee Creek Retrofit PI	\$ 1,868,076	67%	7
Old Palm City PI & PII	\$ 658,450	43%	6
Palm Lake Park	\$ 1,297,714	75%	8
Poinciana Gardens PI & PII	\$ 2,522,447 [3]	85%	16
Rio St Lucie PI	\$ 346,661	98%	5
Salerno Creek / MP RPI & PII	\$ 3,336,840	71%	27
Tropic Vista	\$ 2,427,078	51%	23
Totals	\$ 20,331,878	65%	Median 8

^[1] "Total Project Cost", in this table, *does* include the costs associated with Land.

^[2] This cost includes \$1,325,225 of construction performed by the developer.

^[3] This cost includes an estimated \$525,000 of construction performed by the developer.

Monitoring

Monitoring of projects for wetland function and pollutant removal has been required for many of the projects in this study. On projects where jurisdictional wetlands were acquired and incorporated into the project site water management district permit conditions require that the wetlands be kept free of nuisance and exotic plant species. Annual reporting to the water management district is required. Costs for monitoring and reporting are contracted in the project design phase and after construction the county public works group manages the maintenance.

On projects receiving EPA Section 319 and FDEP TMDL grants water quality monitoring is required to determine pollutant removal effectiveness of the facility. Early Section 319 grants allocated \$25,000 to \$30,000 for grab sampling of an extensive suite of pollutants at inflow points and discharge points from the facilities during storm events. Given that flow weighted composite sampling was not required and funding was extremely limited pollutant removal estimates are not reported on here. Since that time technological advances have reduced the cost of automated flow weighted composite sampling, the list of parameters has been tailored to those of interest at particular facilities, and the need for improved funding of monitoring efforts has been acknowledged. Presently the Manatee Creek retrofit is being monitored continuously at five (5) locations for a three (3) year period for \$315,000 to better quantify the effectiveness of removing pollutants with an STA marsh. At the Kitching Creek / Flora Ave. retrofit two (2) locations will be monitored continuously for 1 year beginning in May 2008 for \$84,600. Little Club is currently being monitored five (5) storm events at 2 locations in seven (7) months for \$40,000.

Maintenance

After construction is completed the project is turned over to County public works staff who contracts with local lake and landscape maintenance firms for cutting grassed areas, controlling exotic and nuisance vegetation within the upland and littoral areas, debris clean up, and replanting. Contributing factors in determining maintenance costs are; lake area, STA area, upland and wetland preserve areas, and green upland areas for cutting grass. Maintenance costs average approximately \$1260 per year, per acre of project acres, with a total annual cost for these completed projects of \$189,000/year.

Summary of Time and Cost

Comprehensive stormwater retrofitting to provide water quality treatment and flood protection for developed areas to today's standards is a long process with many stops and starts along the way that can occur within any phase of project implementation. Delays due to funding short falls can be reduced by preparing basinwide studies and designing and permitting stand alone projects throughout the basin. This allows individual project phases to be completed in the absence of sufficient funding to complete the entire basin retrofit. Variability in funding can also be reduced by use of SRF loans and grants. Where mandates such as NPDES and TMDL's are present for the basin a stormwater utility can provide dedicated funding.

Table 8: Summary of Overall Project Time & Cost

Project Name	Total Project Cost (\$)	Total Project Time (Years)
Cedar Pointe	\$ 398,027	4.90
Coral Gardens	\$ 2,321,860	3.20
Fern Creek	\$ 2,660,200	8.10
Golden Gate PI,PII,PIII	\$ 2,630,515	5.30
Hibiscus Park PI & PII	\$ 1,390,574	7.60
Kitching Creek PI (Flora Ave)	\$ 1,143,144	10.50
Little Club PI & PII	\$ 2,075,593	10.80
Manatee Creek Retrofit PI	\$ 2,795,086	4.90
Old Palm City PI & PII	\$ 1,544,600	4.10
Palm Lake Park	\$ 1,741,098	3.20
Poinciana Gardens PI & PII	\$ 2,960,547	3.90
Rio St Lucie PI	\$ 354,161	7.90
Salerno Creek / MP RPI & PII	\$ 4,715,074	8.50
Tropic Vista	\$ 4,786,046	9.50
Totals	\$ 31,516,525	Median 6.5

The completed projects in Martin County have ranged from slightly over three (3) years from beginning of formalized study until construction is complete for the Palm Lake Park retrofit to over ten (10) years for the Little Club Retrofit. *Table (8): Summary of Overall Project Time & Cost depicts overall time and project cost.*

Conclusions

Without NPDES or TMDL mandates to remove pollutants from runoff the use of dedicated funding such as assessments and fees is limited and competition for advalorem revenues is intense. SRF loans with their attractive interest rates and long repayment schedules can provide dedicated funding for projects. SRF loans may also be used to match grants from federal and state agencies and reduce the tax burden on the local community while cementing community commitment.

Preliminary study of as wide a basin area as possible, design of stand alone sub-projects within the basin and permitting of all required basin improvements serves to; provide flexibility for project implementation, defines and refines basin needs and costs to objectively identify where available funds can generate the greatest benefits, provide a basis for securing grants and loans, and identifies all the work needed to retrofit a drainage basin while allowing for implementation of sub-projects as funding becomes available.

Developing understanding of overall basin needs and a suite of sub-projects serves as an important hedge against the uncertainty of land acquisition. Market conditions and the eminent domain costs can wreak havoc on project budgets and schedules. Phasing of projects allows portions of the project to move forward as land acquisitions are completed and difficult negotiations continue. Most funding partners are receptive to modifying grant scopes of work to facilitate successful completion of “turn dirt” projects. Incorporation of publicly owned parcels and rights of way also assist in reducing land costs.

Construction of stormwater retrofits is not particularly complicated but requires.; diligent maintenance of contract required project schedules, regularly scheduled project meetings on neutral territory to enable free exchange of ideas and concerns, documentation of; meetings, discussions and agreements between the owner and contractor, careful invoice processing, fairness, reason and honesty to keep construction of projects within budget and on schedule. For a project to function as designed and permitted it is important to have a thorough understanding of the project so seemingly minor construction changes don't adversely effect the design, compromise permit requirements, or prevent Engineer of Record certification.

Martin County has been able to perform retrofits in basins totaling 6046 acres. *Table 9: Basin Area, Treatment Area and Volume, Costs per Area Treated and Treatment Volume* shows that of the 6046 acres that have received retrofits, treatment has been provided for 4506 acres. For the 4506 acres treated approximately 0.44 inch of treatment has been provided to supplement treatment provided existing stormwater management systems in those drainage basins. Overall basin retrofitting is not complete and future phases are underway in Manatee Creek, Kitching Creek, Rio, and Palm City.

In light of recent changes to real estate taxation in Florida funding by taxes has diminished and Martin County is pursuing development of a stormwater utility to fund operations and maintenance of stormwater facilities beginning in FY 09 (October 2008). Funding of maintenance by fees is expected to provide funding for capital projects with remaining advalorem taxes. TMDL's scheduled for implementation in several impaired water bodies slated for retrofit which will enable use of utility fees for water quality retrofitting.

Table 9: Basin Area, Treatment Area and Volume, Costs per Area Treated and Treatment Volume

Project Name	Basin Area (acres)	Treated Area (acres)	Treat-ment Volume (ac-ft)	Equiv. Treat-ment (inches)	Cost per Area Treated (\$ / Acre)	Cost per Treatment Volume (\$ / Ac-Ft)
Cedar Pointe	57	57	1.7	0.36	\$ 6,983	\$ 234,134
Coral Gardens	2,260	2,260	8.5	0.05	\$ 1,027	\$ 273,160
Fern Creek	1,190	443	29.8	0.81	\$ 6,005	\$ 89,268
Golden Gate PI,PII,PIII	298	229	17.4	0.91	\$ 11,487	\$ 150,919
Kitching Creek PI (Flora Ave)	220	220	2.5	0.14	\$ 5,196	\$ 460,945
Little Club PI & PII	77	77	8.2	1.28	\$ 26,862	\$ 252,505
Manatee Creek Retrofit PI	833	107	8.9	1.00	\$ 26,110	\$ 313,350
Old Palm City PI & PII	98	98	4.2	0.51	\$ 15,761	\$ 371,298
Palm Lake Park	80	80	7.7	1.16	\$ 21,709	\$ 225,531
Poinciana Gardens PI & PII	188	188	10.6	0.68	\$ 15,723	\$ 278,509
Rio St Lucie PI	104	9	1.0	1.36	\$ 39,351	\$ 347,217
Salerno Creek / Hibiscus Park	900	633	54.9	1.04	\$ 9,646	\$ 111,214
Tropic Vista	412	100	10.6	1.27	\$ 47,860	\$ 451,088
Totals	6,723	4,506	166.1	0.44	\$ 6,994	\$ 189,779