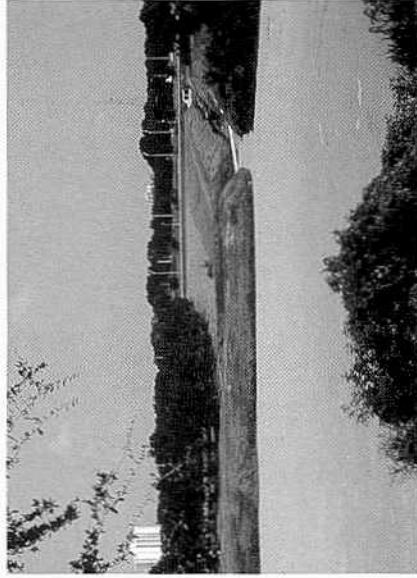
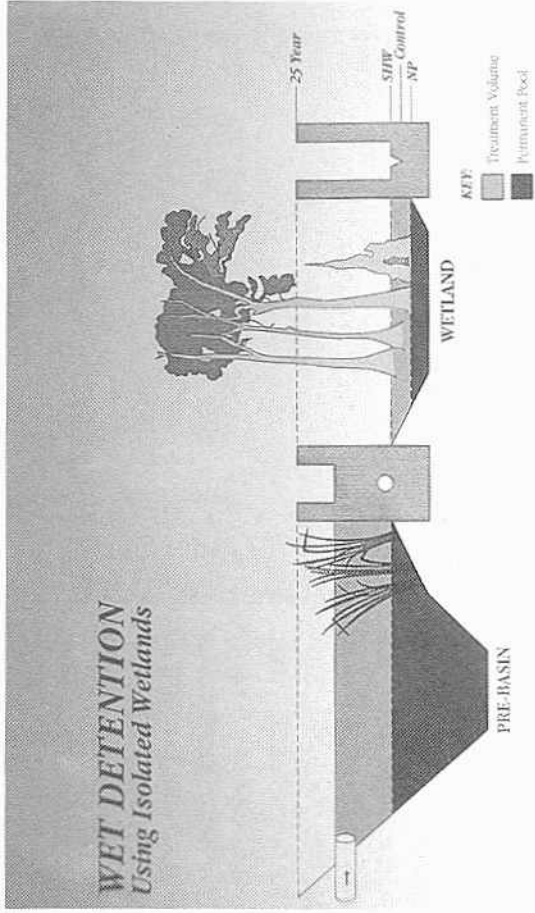


Lake Greenwood Before Redesign



Lake Greenwood After Redesign





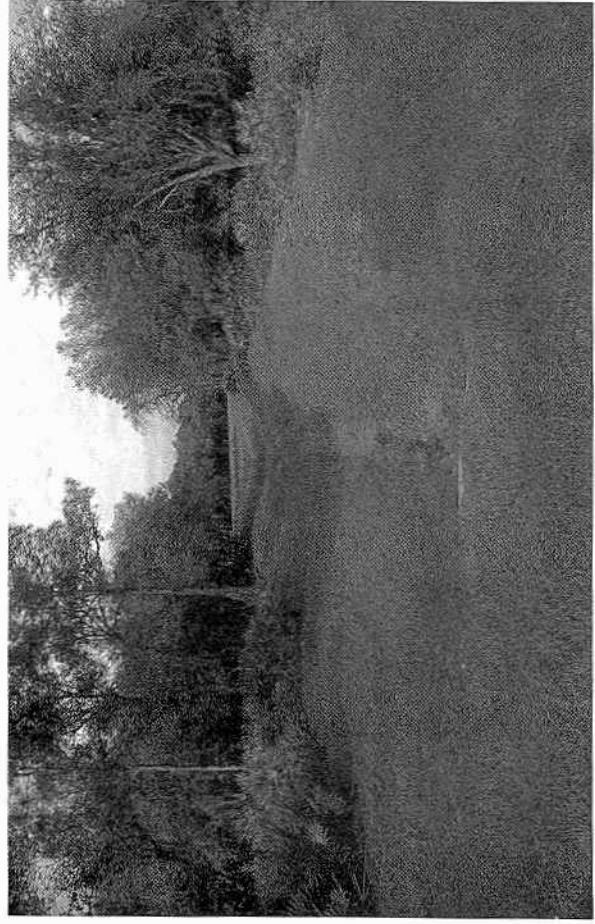
Conceptual Design



Pretreatment Pond



Wetland Treatment System



Swale Discharge From Wetland

F. Wetland Stormwater Systems

The contributions of wetlands to a high quality environment are substantial and irreplaceable. Wetlands help improve water quality by trapping sediments, filtration and adsorption of pollutants, and natural flood protection through water storage and conveying flows. Wetlands are nature's kidneys.

The incorporation of wetlands into a comprehensive stormwater management system provides a way to achieve many objectives—flood protection, water quality enhancement, reduced operation and maintenance, aesthetic buffer, development amenities, enhanced wetland value, and wetland preservation and enhancement. However, the use of wetlands for stormwater management is neither a panacea nor a refined science.

In 1984, the Florida Legislature authorized the use of certain wetlands for stormwater management if the ecological values of the wetlands were protected or restored. Wetlands that have been ditched and drained and which are connected

to state waters by such a ditch may be used for stormwater management. These wetlands have been damaged. Typically they are dry and upland plants are invading and replacing wetland plants. Using these kinds of wetlands for stormwater management revitalizes them and provides valuable new fish and wildlife habitat and aesthetic benefits. Isolated wetlands that are intermittently connected and which flow to other waters when ground water rises above the land surface also may be used for stormwater management. This program has helped to preserve wetlands that otherwise would have been destroyed or damaged during development, while helping to provide effective stormwater management.

In designing stormwater management systems that incorporate wetlands, the stormwater treatment train concept is essential. Pretreatment practices such as swales, off-line landscape infiltration or a pretreatment pond are needed to reduce oil, grease and sediment loads to protect the wetland filter—the vegetation, sedi-

ment and microorganisms—that treats the other stormwater pollutants. The pretreatment pond also provides stormwater storage and attenuates peak discharges to help protect the hydroperiod of the wetland. The hydroperiod—the duration that water stays at various levels—determines the form, function and nature of the wetland. It must be preserved or restored.

Careful attention to detail is essential in the design of wetland stormwater systems. The BMPs in the treatment train must be carefully planned to work together to convey and pretreat stormwater. To protect the hydroperiod, the allowable high-and-low water levels in the wetland must be skillfully determined from field indicators. A distribution system that assures sheet flow of stormwater through the wetland must be designed to avoid channelized flow and to assure maximum contact of the stormwater with the wetland's vegetation, sediment, and microorganisms. Imaginative planning and design can create a stormwater system that is attractive, effective, and nearly self-maintaining.

G. Detention with Filtration

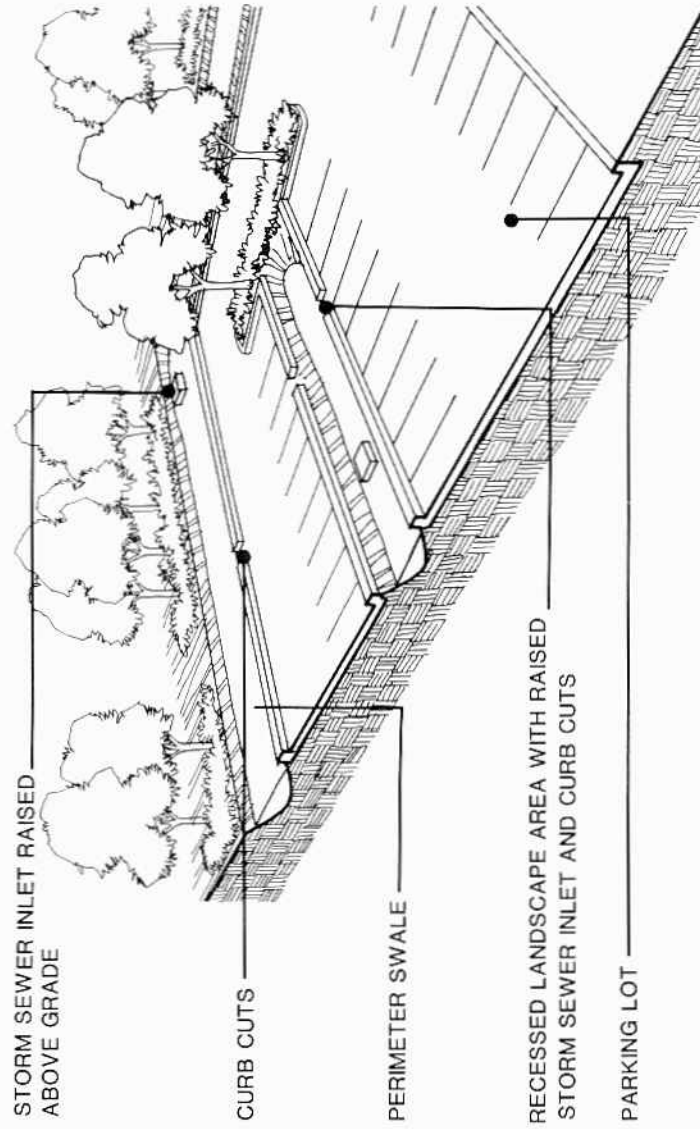
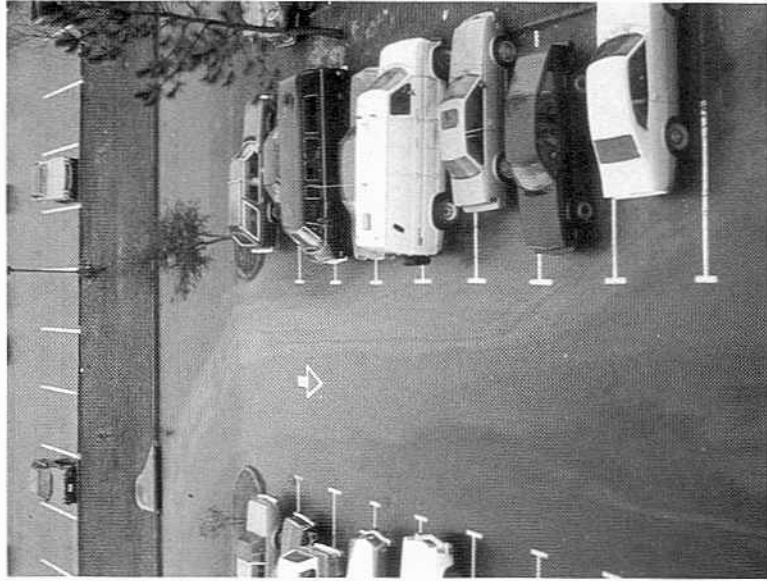
A BMP commonly used in Florida since 1982 is detention with filtration in which stormwater is held in a detention system and then is discharged through a filter. The filter removes particulate pollutants but does not remove dissolved pollutants and, therefore, is of limited value for protection of water quality. Typical filter systems have included bottom or side bank sand or natural soil filters. Recently, more exotic techniques such as multi-media filters composed of alum sludge or activated charcoal have been tried to improve the ability of a filter to remove dissolved pollutants. The Japanese garden filter shown to the right was built as part of the Lake Eola restoration project but, like other filters, it suffers from design and operation problems.

Difficulties associated with the design, construction and, most importantly, the maintenance of stormwater filters has lead the Department of Environmental Regulation to deemphasize use of these systems. Experience shows that it is not a question of whether a filter will clog, but when—and then who will maintain it. Wet detention systems with planted littoral zones should be used rather than detention with filtration. However, where wet detention systems are impractical such as on small sites, sodded bottom filters are an acceptable alternative. The importance of vegetation cannot be over-emphasized for both enhanced treatment and minimum maintenance.



H. Parking Lots

Parking lots are one of the largest generators of runoff and polluted stormwater. These vast paved deserts generate stormwater after every storm. Many parking areas, such as for shopping centers are rarely completely filled with cars. This suggests that local regulations specifying parking requirements might need revision, while our design of parking lots could use greater imagination. The grassed parking lot at Tampa Stadium is a good example of a creative solution.



Another creative design is to recess landscaped islands so they are small retention and pretreatment areas. Placing a raised storm sewer inlet in the landscape island helps filter heavy metals, oils and greases. The raised inlet allows some retention and infiltration of the first flush before the stormwater is routed to a detention system. Using a curb cut allows the stormwater to flow into the landscape island easily.



POROUS CONCRETE is another innovative BMP with widespread applicability for parking areas. Paving with porous concrete allows water to percolate into the underlying soil. By using porous concrete, a parking lot can remain pervious and act as a large retention area, thereby reducing stormwater volume, peak discharge rate and pollutant load. In addition, porous concrete eliminates water pockets and provides a safer, skid resistant surface.

However, porous concrete is only feasible and cost effective on sites with gentle slopes, permeable soils and relatively deep water table and bedrock levels. When properly designed and carefully installed, porous concrete has load bearing strength and longevity similar to that of conventional concrete. The design and installation of porous concrete should be done only by a professional team of engineers and contractors who are familiar with its properties. Routine inspection and maintenance is essential to preserve the high infiltration rate of porous concrete paving. The surface should be routinely checked after a prolonged storm for evidence of debris, ponding of water, clogging of pores or other damage. Regular vacuum sweeping should be performed to prevent clogging of the porous

parking surface. High pressure steam cleaning may be needed annually. During construction it is essential that sound erosion and sediment control practices be used to keep sediment off the pervious pavement and prevent clogging.

If properly designed, installed and maintained, pervious concrete provides a cost-effective, viable solution to parking lot stormwater management problems.



I. Alum Treatment

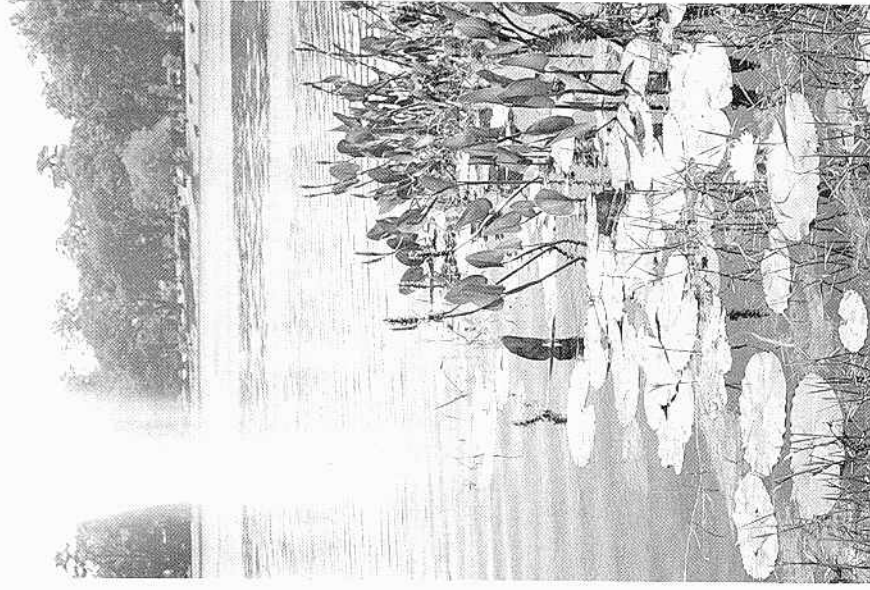
Aluminum sulfate (alum) has been used to clarify potable water supplies, remove phosphorus from wastewater, and to inactivate phosphorus in lake sediments. Injection of liquid alum inside storm sewers to treat stormwater represents another innovative, cost-effective BMP with widespread application, especially to reduce stormwater pollutant loads to urban lakes.



The first application of this technique was in the 1986 restoration of Lake Ella in Tallahassee. Lake Ella is a 13-acre shallow lake whose 160 acre watershed is intensively developed. The lack of available land, and heavy clay soils prevented the use of traditional BMPs to reduce stormwater pollutant loads to the lake.

The Lake Ella stormwater management system consists of flow meters which measure stormwater flowing in the storm sewers, and injectors which periodically add a predetermined dose of alum to the stormwater as it moves through the storm sewer. As the alum mixes with stormwater, it produces a small floc which attracts suspended and dissolved pollutants. The pollutants become bound to the floc, which settles and becomes incorporated into the lake's sediments. An added benefit is that the alum floc attracts pollutants within the lake water itself and re-moves them also.

The system has successfully removed more than 90% of the stormwater pollutants and Lake Ella's water quality and clarity is outstanding. Lake Ella is once again a heavily used recreational area for Tallahassee residents.



The City of Orlando also used alum injection on a project that demonstrates how a commitment to environmental quality and coordination of retrofitting with a new project can provide multiple benefits and substantial cost savings. The City was building a new arena for its expansion franchise in the National Basketball Association. A traditional stormwater management system using underground exfiltration systems was designed to treat the runoff from the 42 acres associated with the new arena and its surrounding parking areas. The cost of constructing this system was estimated at over \$2 million. Because of its past experiences with stormwater management, the City felt that alternative options, namely, a regional approach to stormwater management, were available that could provide additional benefits for less cost. A desirable benefit was retrofitting the existing drainage system that flowed through the project area and discharged untreated stormwater from the 305 acre basin into Lake Dot which is located directly in front of the new arena. The City constructed an alum injection system that incorporates a dual feed system - one for alum for treatment, and a second for sodium hydroxide to maintain desirable pH levels in Lake Dot - at a cost of \$450,000.



J. Maintenance of Stormwater Systems

The ultimate success of any stormwater management program depends on proper maintenance. If a system is not properly maintained, the possibility of failure and subsequent downstream damage is very real. Sooner or later, damage will result and the investment in management facilities will have been wasted.

Continuing maintenance should be incorporated into the planning and design of stormwater management systems. Along with the consideration of who is ultimately responsible for maintenance, design decisions concerning safety, soil conditions, topography, watershed size, land use, slope of vegetated banks and overall effectiveness all have a bearing on system maintenance. Proper handling of these elements during design and construction can minimize maintenance activities and costs associated with stormwater management.

Traditionally, well designed and constructed systems on industrial and commercial sites generally receive maintenance. One reason for this is that the organization responsible for planning, design and construction is also responsible for maintenance. These facilities are often intended to provide a major site amenity and, as such, require maintenance on the same basis as does lawn and building care.

However, stormwater systems for residential developments generally have not received much maintenance. In most cases a property owners association is legally responsible for maintenance, but does not have the technical ability or the money to do the job. While these facilities should be designed and built to allow as much owner maintenance as possible, the ultimate responsibility for continuing maintenance should be a local government's. Stormwater

systems are part of the public infrastructure just like roads or water systems, and they should be maintained in the same way. Proper easements for all stormwater management facilities must be required, with easements recorded to insure adequate access for maintenance. Easement requirements typically are found within the state stormwater criteria.

Finally, methods to finance the required maintenance must be a part of the overall stormwater management program. The potential for major downstream damage and degraded water quality from uncontrolled stormwater makes financing the maintenance of stormwater facilities as important to the community as road and bridge maintenance or sanitary and safety services.



STORMWATER REGULATORY PROGRAMS

In the past, the problems caused by increased stormwater runoff were borne by downstream property owners and governments. However, court decisions have established that the responsibility and cost for correcting stormwater problems rests with the developer who created the problem, or with the local government which permitted the development without appropriate stormwater management. Landowners, developers, contractors, and local governments must realize the consequences of development on the master stormwater system and provide appropriate controls.

Damages caused by stormwater are physical and visual, environmental and economic, and the cost of correcting the damage always is high. Since prevention of stormwater problems through sound site and watershed planning is far easier than correcting them, stormwater requirements have been implemented by several levels of government.

A. Federal NPDES Stormwater Permitting

Section 402(p) of the 1987 Federal Clean Water Act requires the U.S. Environmental Protection Agency (EPA) to establish National Pollutant Discharge Elimination System (NPDES) stormwater permits. This permitting program, to be administered in Florida by the EPA, is being phased in between 1989 and 1992. It will require certain local governments to obtain permits for their existing stormwater (drainage) systems and require permits for stormwater from certain industrial activities. This includes all construction projects that will disturb five or more acres of land, government owned landfills, power plants, airports, vehicle maintenance facilities and wastewater treatment plants (over 1 MGD flow). The greatest burden will be on local governments which are liable for the pollutants discharged from their stormwater systems into Florida waters and which will be responsible for developing a long term, comprehensive program to reduce the pollutant loading from their systems.

The EPA published final regulations for the NPDES stormwater permitting program on November 16, 1990. Recognizing the need to address stormwater on a watershed basis, the Department and EPA determined that all local governments within a county having a population over 100,000 must be included in the program to achieve the desired level of stormwater pollutant load reductions necessary to keep Florida's rivers, lakes and estuaries healthy. Table 2 lists counties which, together with their municipalities and the Florida Department of Transportation, must submit permit applications. In addition, once the 1990 census is certified, the counties (and their municipalities) listed in Table 3 will also have to apply for an NPDES stormwater permit.

Table 2

**Counties Required to Apply
for NPDES Stormwater
Permits at Present
(and all municipalities within)**

Broward	Orange
Dade	Palm Beach
Duval	Pinellas
Escambia	Polk
Hillsborough	Sarasota

Table 3

**Counties Required to Apply for NPDES Stormwater
Permits in Near Future
(and all municipalities within)**

Alachua	Collier	Leon	Pasco
Bay	Hernando	Manatee	Seminole
Brevard	Indian River	Martin	St. Lucie
Charlotte	Lee	Okaloosa	Volusia

Local governments should begin immediately to use their comprehensive plans to develop an inventory of their stormwater management systems and to determine their stormwater infrastructure deficiencies. This information will be needed to develop the stormwater master plan required under both this federal program and the state's growth management program.

B. State Stormwater Permitting

The state Stormwater Rule, Chapter 17-25 Florida Administrative Code, was implemented by the Department of Environmental Regulation in February 1982. The rule requires all new developments, redevelopment projects, and most

modifications of stormwater systems to use appropriate BMPs to treat the first flush of stormwater, and to remove at least 80% of the annual average pollutant load. Stormwater discharges to Outstanding Florida Waters must be treated to remove 95% of the annual pollutant load.

Since its adoption, the Stormwater Rule has been revised several times to keep pace with the rapidly changing state of the art in BMP design and effectiveness. However, the most significant change to the state stormwater program occurred with the passage of the 1989 stormwater legislation. **This bill recognized the importance of a**

comprehensive approach to stormwater management throughout an entire watershed and of the need for a coordinated watershed management team approach involving DER, the water management districts and local governments.

As a result, State Water Policy (Chapter 17-40, F.A.C.) was revised in December, 1990 to establish within Section 17-40.420, the overall goals and institutional framework for the state's stormwater management program. These goals include retaining sediment onsite during construction; trying to assure that the stormwater peak discharge rate, volume and pollutant loading from a site are no greater after development than before the land use change; and reducing the stormwater pollutant loading from older drainage systems so that receiving waters will maintain or be restored to good water quality levels.

Each of the water management districts (except the Northwest Florida Water Management District which is currently developing rules in Chapters 40A and 40A-40) has implemented Management and Storage of Surface Waters rules to assure that stormwater is properly managed to prevent flooding problems and other negative effects on water resources. These rules can be

found in Chapter 40B-4 (Suwannee River Water Management District), Chapters 40C-4, 40C-40 and 40C-42 (St. Johns River Water Management District), Chapters 40D-4 and 40D-40 (Southwest Florida Water Management District) and Chapters 40E-4 and 40E-40 (South Florida Water Management District). These rules must be consistent with the goals set forth in State Water Policy. This ensures consistent and equitable administration of the stormwater program throughout Florida.

To provide for permitting efficiency and to assure comprehensive stormwater management, the Department is delegating its stormwater quality permitting program to the water management districts. To date, the South Florida Water Management District and St. Johns River Water Management District have received full delegation, and the Southwest Florida Water Management District and the Suwannee River Water Management District have received partial delegation. In the Florida panhandle, all stormwater quality permitting currently is conducted by the Department. For further information on the delegation of stormwater permitting to the water management districts or to learn which projects are permitted by the Department or by a District, call the Stormwater Management Section of the Department of Environmental Regulation in Tallahassee (904/488-0782).

C. Local Government Stormwater Permitting

Many local governments have adopted stormwater regulations to protect their citizens from flood damage, and to protect local water quality. Local regulations must be consistent with State Water Policy and the state and water management district rules and should not duplicate state permitting programs.

As a minimum, local government land development codes should ensure that all projects that will create and discharge stormwater, especially to state waters or to local government stormwater systems, have received a state stormwater permit or exemption before a local building permit is issued. This will help to assure that the stormwater is properly treated before discharge to the local government system and will reduce the local government liability for polluting receiving waters. Hopefully, these regulations integrate stormwater, landscaping and tree protection requirements and coordinate onsite stormwater controls with the local government stormwater master plan and level of service. The City of Tallahassee's Environmental Management Act is an excellent example of such an ordinance.

Table 4

Watershed Management: A Step by Step Guide

1. Delineate and map watershed boundary and the sub-basins within the watershed 2. Inventory and map natural stormwater conveyance and storage systems 3. Inventory and map man-made stormwater conveyance and storage system. This includes all ditches, swales, storm sewers, detention ponds, retention areas, and includes information such as size, storage capacity, and age. 4. Inventory and map land use by sub-basin 5. Inventory and map detailed soils by sub-basin 6. Establish a clear understanding of water resources in the watershed Analyze water quality, sediment, and biological data Analyze subjective information on problems (such as citizen complaints) Evaluate water body use impairment—frequency, timing, seasonality of problem Conduct water quantity assessment—low flows, seasonality 7. Inventory pollution sources in the watershed Point sources—location, pollutants, loadings, flow, capacity, etc. Nonpoint Sources—type, location, pollutants, loading, etc. -land use/loading rate analysis for stormwater -sanitary survey for septic tanks -dry flow monitoring to locate illicit discharges 8. Identify and map future land use by sub-basin Conduct land use loading rate analyses to assess potential effects of various land use scenarios	9. Identify planned Infrastructure Improvements—5 year, 20 year Stormwater management deficiencies should be coordinated and scheduled with other infrastructure or development projects. 10. Analysis Determine infrastructure and natural resources management needs within each watershed 11. Set resource management goals and objectives Before corrective actions can be taken, a resource management target must be set. The target can be defined in terms of water quality standards; attainment and preservation of beneficial uses; or other local resource management objectives. 12. Determine pollutant reduction (for existing and future land uses) needed to achieve water quality goals. 13. Select appropriate management practices (point source, nonpoint source) that can be used to achieve the goal Evaluate pollutant removal effectiveness, land owner acceptance, financial incentives and costs, availability of land operation and maintenance needs, feasibility, and availability of technical assistance 14. Develop Watershed Management Plan Since the problems in each watershed will be unique, each watershed management plan will be specific. However, all watershed plans will include elements such as: Existing and future land use plan Master stormwater management plan that addresses existing and future needs Wastewater management plan including septic tank maintenance programs Infrastructure and Capital Improvements Plan
--	--

WHAT LOCAL GOVERNMENTS CAN DO

Local governments are the key to solving Florida's stormwater management problems because of the intimate relationship between land use, infrastructure, and stormwater management. Since local governments determine land use, zone property, and issue building permits, their commitment to sound watershed management is essential. Watershed Management involves coordination between land use, infrastructure, and water resources management in a well-planned, integrated program that protects the quality of life in the most economical fashion. The stormwater management liability borne by local government strongly implies a need to develop comprehensive stormwater management programs that will help to prevent problems in a cost effective manner. It is important to remember that successful watershed management requires an integration of nonstructural, preventive approaches (e.g., land use management, source controls) with structural approaches (e.g., BMP implementation).

A. Develop a Watershed Management Plan

The Local Government Comprehensive Planning Process offers a unique opportunity to obtain much of the information that is needed for a local government to develop and implement **Watershed Management Plans**. As shown in *Table 4*, the steps taken to develop a watershed plan are similar to those undertaken in the comprehensive planning process. In fact, a thorough, well done comprehensive plan can be a watershed management plan. In their planning process local governments should inventory their existing infrastructure, develop appropriate maps and atlases (such as maps of storm sewer systems), conduct level of service analyses, determine needs and problem areas and then, based on future land use, develop and implement their master plan to meet their needs for infrastructure.

B. Implementation of the Watershed Management Plan

The implementation of a watershed management plan, especially recommendations about reconstruction of infrastructure such as the modification of existing stormwater systems to reduce their pollutant loads, requires a stable funding source over as much as 25 years. Frequently, stormwater management can be integrated with other infrastructure improvements such as road widening or urban redevelopment while water quality improvements can be coordinated with modified flood protection for the existing stormwater system. Even the development of new parks or recreation areas can be used to address stormwater management needs. The watershed management program should include the following elements to help assure successful implementation.

Local Ordinances

Implementation of the watershed management plan (or Comprehensive Plan) will be achieved primarily by the adoption of **Land Development Regulations**. These will include administrative procedures, concurrency management systems, zoning classifications and requirements, subdivision regulations, and supplemental regulations that are needed to assure that the objectives of the watershed management plan are met. Supplemental regulations typically include stormwater management, well-head protection,

landscaping, tree protection, septic tank siting and maintenance. These supplemental regulations also should include requirements for various source controls such as open space, natural areas, buffer zones, and even nutrient and pesticide management. Parking requirements represent an area where significant benefits can be realized by minimizing the number of parking spaces or the amount of impervious surface by promoting the use of alternatives such as pervious concrete, turf block or even grass parking using special subgrade materials that provide bearing strength. **It must be stressed that maximum benefits are realized only if these ordinances are integrated, allowing maximum use of nonstructural preventive controls and promoting use of the BMP treatment train throughout the site planning process.**

The Land Development Regulations should not duplicate state permitting requirements but should ensure that appropriate state and federal permits are obtained before a building permit is issued. Specific criteria which complement but are more restrictive than state requirements should be included, if needed, to meet Comprehensive Plan or local resource management objectives. For example, a local government in a karst area should adopt stormwater criteria that help prevent contamination of ground water

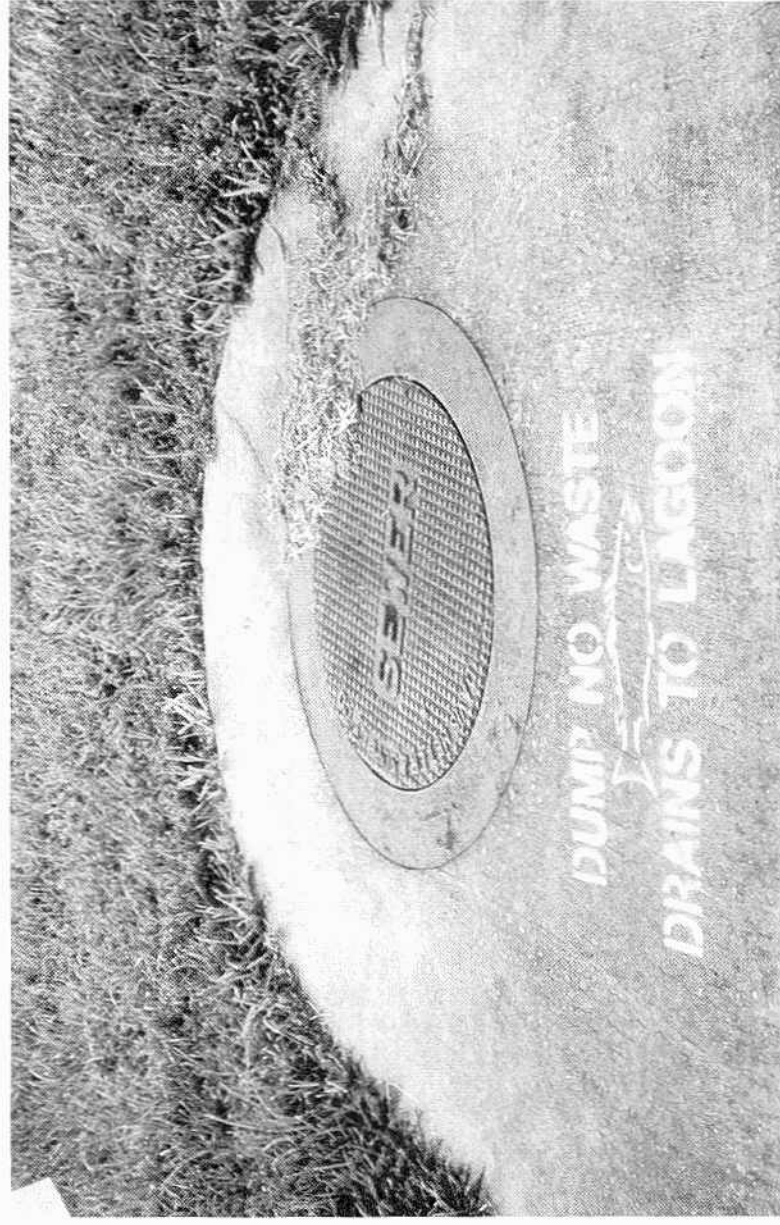
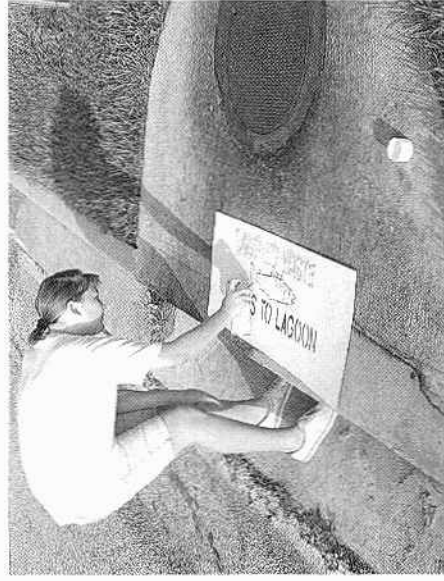
through the porous soils and rock or sinkholes characteristic of such regions.

Public Education

Educating the public about stormwater, BMPs, and how our everyday activities can add to the nonpoint source and stormwater problem is a continuous need, not only to reduce the effects of these pollution sources, but to gain citizen support for local environmental management programs.

The public should understand that fertilizing lawns and then heavily watering the lawn causes the fertilizer to run off, creating nutrient problems in local waters as well as losing the benefits of the fertilization. They also should know how a swale works, and what benefits it provides. They need to understand that swales and storm sewers are not receptacles for grass clippings, tree limbs or other debris, and that used oil and debris should not be dumped into these conveyances since these materials are soon carried to nearby lakes or rivers. Programs can be undertaken to stencil storm drains "DUMP NO WASTES--DRAINS TO LAKE (RIVER, ESTUARY)" to alert the public to the relationship of these drains to water quality problems.

Pamphlets can be inserted into utility bills to help educate citizens about stormwater management. Informative materials have been developed by the Department, water management districts and local governments to help educate the public. Slide shows and other technical assistance is available from the Department and the water management districts.



Funding - The Stormwater Utility - An Innovative Source of Money to Get the Job Done

The largest obstacle to solving Florida's stormwater management problems is the lack of adequate financial resources.

To effectively implement a stormwater management program, local governments need money that is dedicated exclusively to stormwater. An innovative alternative for stormwater management financing is the creation of a **stormwater utility** which relies on user fees rather than the government's limited general tax revenues. The utility system is user-oriented, with costs allocated according to the services received. Parcels of land are assessed a charge based on runoff characteristics. Charges typically are determined according to a parcel's size and its percent of impervious (paved) area. Adjustments can be built into the system for properties which use appropriate BMPs to manage their runoff. Thus, user charges are related to a given parcel's stormwater contribution in excess of that contributed in the natural state.

The stormwater utility concept is not new. It has been used by several communities in the western United States since 1969. In Florida, the City of Tallahassee implemented the state's first stormwater utility in 1986, with single family residents paying \$1.00 per month. Today, over thirty-five other communities have implemented stormwater utilities, and many others are in the process of adopting one (Table 5). Recognizing

the need for integrated stormwater management throughout a watershed, Dade County recently

enacted the first county-wide stormwater utility that also includes twelve of its municipalities.

Table 5
Florida Stormwater Utilities

IMPLEMENTED		ERU RATE	UNDER CONSIDERATION	
1	TALLAHASSEE	\$5.00	1	ESCAMBIA CO./PENSACOLA
2	GAINESVILLE	\$3.75	2	PALM BAY
3	OCALA	\$2.00	3	SANIBEL
4	DAYTONA BEACH	\$1.75	4	GULF PORT
5	PORT ORANGE	\$3.00	5	VOLUSIA COUNTY
6	PORT ST. LUCIE	\$3.33	6	MANATEE COUNTY
7	MIAMI	\$2.50	7	PINELLAS COUNTY
8	OAKLAND PARK	\$1.00	8	EUSTIS
9	ORLANDO	\$3.00	9	NEW SMYRNA BEACH
10	ALTAMONTE SPRINGS	\$2.25	10	CASSELBERRY
11	WINTER PARK	\$3.50	11	ST. CLOUD
12	MOUNT DORA	\$3.00	12	BAY COUNTY/PANAMA CITY
13	EDGEWATER	\$3.00	13	COCOA
14	ST. PETERSBURG	\$4.50	14	ROCKLEDGE
15	TAVARES	\$3.00	15	ORANGE CITY
16	DUNEDIN	\$3.00	16	SEMINOLE COUNTY
17	KISSIMEE	\$2.00	17	ORANGE COUNTY
18	HOLLY HILL	\$0.50	18	NAPLES
19	S. DAYTONA	\$1.00	19	MELBOURNE
20	ORMOND BEACH	\$2.50	20	MARTIN COUNTY
21	LARGO	\$1.50	21	PALM BEACH COUNTY
22	DELAND	\$2.00	22	HOLLYWOOD
23	CAPE CORAL	\$2.50	23	NEW PORT RICHEY
24	SARASOTA COUNTY	\$3.50	24	ATLANTIC BEACH
25	BREVARD COUNTY	\$3.00	25	BROOKSVILLE
26	HILLSBOROUGH COUNTY	\$1.00		
27	CLEARWATER	\$3.00		
28	W. PALM BEACH	\$3.50		
29	JACKSONVILLE BCH.	\$3.00		
30	DELRAY BEACH	\$2.25		
31	CLERMONT	\$3.00		
32	TITUSVILLE	\$3.00		
33	COLLIER COUNTY	\$3.50		
34	DADE COUNTY	\$2.50		
35	FT. MYERS	\$3.00		
36	LEON COUNTY	\$1.68		
37	LAKE MARY	\$3.00		
38	SANFORD	\$3.00		
			26	DUVAL COUNTY
			27	LAKE COUNTY
			28	VERO BEACH
			29	BOCA RATON
			30	HIALEAH
			31	BROWARD COUNTY
			32	FT. LAUDERDALE
			33	LEESBURG
			34	BELLE GLADE
			35	CITRUS COUNTY
			36	POLK COUNTY
			37	WINTER HAVEN
			38	LAKE WALES
			39	OVIDO
			40	MAITLAND
			41	FT. MEADE
			42	MADISON
			43	LAKELAND
			44	LEE COUNTY
			45	APOPKA
			46	BOYNTON BEACH
			47	TARPON SPRINGS
			48	TAMPA

A successful financing program for each community must be based on that community's needs. However, a high degree of public acceptance and government confidence has been demonstrated for establishing a stormwater utility program which integrates the following components:

Phase Out General Fund Contributions - Allows a gradual transition to a full utility, usually over a five-year period.

Adopt a Stormwater Ordinance - The ordinance identifies the duties of the local government, the users and developers; establishes the legal framework and fee structure; establishes the stormwater management goals, policies and standards, and sets up an operating permit system to assure that privately owned facilities continue to function properly.

Prepare Stormwater Master Plan - A comprehensive stormwater master plan is needed to guide near-term and long-term stormwater system improvements and determine costs.

Establish a User Fee System - User charges are set at rates sufficient to cover the utility's annual operation, maintenance, capital and debt service requirements.

Establish a Developer Contribution System - Developer contributions represent a source of capital for constructing new stormwater management facilities. Methods include:

Subdivision dedications that require the developer to construct stormwater management facilities and dedicate them to local government,

Fees-in-lieu-of that require developers to pay an impact fee for the capital improvements needed to serve the development or pay a portion of the cost for a regional facility that will serve the development,

Availability charge that recover a debt service charge on a previously constructed facility which will serve the new development.

Establish a Permit Fee System - While revenue from a permit fee is minimal, the system establishes control on all proposed stormwater projects, thus facilitating compliance with the master stormwater plan.

C. Operation and Maintenance of the Stormwater System

While Florida's stormwater regulatory program has helped to minimize adverse effects of stormwater and has led to the construction of stormwater management facilities, a major problem is how to assure that the facilities, once they are properly constructed, are being maintained. Staffing limitations have prevented the Department of Environmental Regulation or delegated water management districts from conducting inspections and emphasizing compliance and long-term maintenance. Local government assistance is needed to help assure that the tremendous investment in stormwater management infrastructure continues to provide benefits. Since most of these systems discharge into local government stormwater system, it is imperative to make sure that they function properly to minimize liabilities to the local government.

Local governments can help to inspect stormwater systems during construction. They already have building inspectors who travel to development projects to conduct various inspections. If properly trained, these inspectors could greatly improve the effectiveness of Florida's stormwater program. Training programs for local government inspectors hopefully will be developed by the Department and water management districts in the near future.

Local governments can also help to assure that stormwater systems are properly maintained. Stormwater systems need to be thought of as part of the community's infrastructure just like its roads, water and wastewater systems. The City of Orlando uses its code enforcement powers to assure that needed maintenance is performed. The City of Altamonte Springs has considered using Occupation License renewal as a means of



assuring that stormwater systems serving commercial properties are properly maintained. Before an Occupational License can be renewed the stormwater system is inspected by the City Engineer's Office which makes sure the system has been maintained and is operating properly. Most recently, as part of a thorough revision of its Environmental Management Ordinance and the implementation of its stormwater utility, the City of Tallahassee implemented a stormwater operation permit system that requires regular maintenance of the stormwater system and periodic renewal of the operating permit. Currently, the Department is working with the Florida Water and Pollution Control Operators Association to develop a standardized curriculum and certification program for local government stormwater maintenance staff.

D. Intergovernmental Coordination

Since stormwater does not recognize political boundaries it is essential that local governments within a watershed work together to develop and implement their stormwater master plan. Coordination with the Department, water management districts, and the Department of Transportation is also needed as is cooperation with the private sector. **THE WATERSHED MANAGEMENT TEAM NEEDS YOU!**

CONCLUSION

Proper stormwater management is vital to the health of Florida's economy and our quality of life. Properly designed stormwater management is a practical, feasible and desirable element in urban development and redevelopment. Stormwater can be controlled in conjunction with development of any site. The particular control strategy should be tailored to fit the needs of the individual project by sound selection of appropriate BMPs, good technical and aesthetic design, and quality construction and maintenance.

Effective watershed management programs must be based upon the big C's of watershed management:

1. **COMPREHENSIVE** management of land use, water resources and infrastructure throughout a watershed
2. **CONTINUITY** of stormwater and watershed management programs over a long period of time will be required to solve these problems
3. **COOPERATION** between state and local governments, cities and counties, the public and private sectors and all of our citizens is essential to prevent and solve problems

4. **COMMUNICATION** is essential to educate ourselves about how we are all part of the problem and how we can and must be part of the solution

5. **COORDINATION** of stormwater retrofitting to reduce pollutant loading with other infrastructure improvements or redevelopment is needed for cost-effective implementation and to maximize benefits

6. **CREATIVITY** in both BMP technology and in our approach to solving complex problems is vital

7. **COMMITMENT** to solving these problems so our children will have a bright future (JUST SAY NO TO STORMWATER POLLUTION) will depend upon putting our money where our mouths are.

This guidebook has presented a variety of approaches to control stormwater. We hope it will be a resource of ideas and will stimulate imaginative new solutions to our watershed management problems.

INFORMATION SOURCES

- The Florida Development Manual: A Guide to Sound Land and Water Management**, 1988
Stormwater/Nonpoint Source Management Section, Florida Department of Environmental Regulation,
Tallahassee, Florida
- Controlling Urban Runoff, A Practical Manual for Planning and Designing Urban BMPs**, 1987
Metropolitan Washington Council of Governments
- Ohio Stormwater Control Guidebook**, 1980, Ohio Department of Natural Resources
- A Guide to Protecting Coastal Waters Through Local Planning**, 1986, Division of Coastal
Management, North Carolina Department of Natural Resources and Community Development
- Principal Aquifers in Florida**, 1975, Florida Bureau of Geology, Map Series 16

ACKNOWLEDGMENTS

- Mr. Jim Lewis** - for his editorial excellence
- Ms. Cynthia Courson** - for her word processing expertise
- North Carolina Department of Natural Resources and Community Development** - for the figures
on pages 6, 12, 16, and 20
- LB Desktop Publishing and Graphic Design** - for the book layout
- Mr. Randy Hollingsworth**, Post, Buckley, Schuh & Jernigan - for preparation of the line drawings in
this booklet
- Photography courtesy of:
- Ohio Department of Natural Resources** (page 48)
 - Mr. Stephen Lienhart** (pages 28 and 49)
 - Ms. Carla Palmer** (page 40, 45, and 50)
 - Mr. Clark Hull** (page 52)
 - Mr. Robert Day** (page 67)
 - Mr. Gary Maddox** (page 13)
 - Mr. Eric Livingston** (others)