

Broward County Board of County Commissioners

ENVIRONMENTAL BENCHMARKS REPORT



October 2008

ENVIRONMENTAL PROTECTION AND GROWTH MANAGEMENT DEPARTMENT

Broward County Board of County Commissioners

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EXECUTIVE SUMMARY

In 1999, Broward County began to annually review its efforts to protect the environment by creating the Environmental Benchmarks Report. A benchmark is a standard by which to judge or measure something. The Broward County Environmental Protection and Growth Management Department is using benchmarks to demonstrate environmental improvements and impacts. This document presents benchmarks which represent the state of the resource (Climate, Air, Water, Land, and Marine), the pressures on those resources and the responses that reflect how changes in natural resource management initiatives translate into improvements in the environment. Today and into the future, the Broward County Board of County Commissioners continues to recognize the importance of environmental quality as part of the Commission's Goal to have and maintain a pristine and healthy environment. The general trends in the benchmarks are shown in Table E1. A narrative is provided below.

Report Format

The report uses flow charts to help demonstrate how a given resource is impacted by a specific pressure and the responses that directly address those pressures. Narratives discuss resources where quantitative data is not available. The Endnotes section further explains the benchmark graphs and often provides web pages to visit for more information. We hope you find the 2008 Benchmarks Report user-friendly and valuable in understanding the status of Broward's environment and the efforts to protect it.

Climate

A section on climate change is included for the first time in this report. In response to well substantiated and compelling scientific evidence supporting the validity and urgency of climate change and the public's desire for action, a political environment has been created for local, state, and federal lawmakers to press for real changes in public policy related to energy consumption/climate change. On June 12, 2007, the Broward County Board of County Commissioners adopted Resolution 2007-391 to reduce greenhouse gas emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. On June 24, 2008 the Board approved resolution 2008-442 to create a Broward County Climate Change Task Force. These resolutions establish the Board's commitment to climate protection and create a framework to guide the planning and implementation of related measures. The benchmarks shown here reflect local actions impacting this global phenomenon.

Air

In calendar year 2007, the outdoor air quality was rated as "good" 83 percent of the time. Pressures on our air quality

from mobile source emissions represent more than 50% of total emissions. The total daily vehicle miles traveled decreased for the first time since the data tracking started in 1990, an indication of the decline in population. In 2007, the vehicle miles traveled per 1,000 people continued to increase. The increase in travel per capita is likely the result of an increase in people living in other counties that commute to work in Broward County. The federal and state governments are implementing regulations for cleaner vehicles and fuels. For further local improvements, county government and municipal fleets are increasingly using alternative fuel vehicles in response to the pressures on air quality. In addition, an average vehicle on the roadway generates lower emissions compared to the older model vehicles. This is a result of a combination of the phase-in of cleaner fuels, computerized onboard emissions diagnostic systems, and cleaner burning engines. Mass transit and community shuttle ridership increased compared to 2006. This increase is likely a result of the improvement in service frequency and the increases in fleet sizes through out the county. Residents are using more electricity thereby increasing our need for power generation. However, the use of new control equipment (i.e., electrostatic precipitators and low nitrogen oxide burners) lowered the emissions from power plants in 2007. Broward County values public education as a vital link in building local community support and advocacy for efforts that enhance the quality of life for its residents. Broward County continues to support public outreach events such as Clean Air Month and Car Care Month which increase public and individual awareness and empower citizens to take personal action to protect air quality.

Water

The state of our surface water resources is generally improving. While the phosphorus level measured at the S-9 pump station (which discharges to the Everglades) is up a couple of parts per billion (ppb) from last year, it is still below 15 ppb and lower than three years ago. The first Total Maximum Daily Load (TMDL) for an impaired water in Broward County was developed and adopted by the State this year for the Pompano Canal. The process has already begun to develop an action plan to meet the TMDL. The quality of urban stormwater runoff continues to improve, and the quality of fresh and estuarine waters in the C-13 and C-14 Canals is improving. The number of building licenses for new construction is down and the percentage of developed lands now subject to surface water management regulation is up from last year, all contributing to improved water quality. The Broward Everglades Working Group continued to meet regularly this year to monitor progress relating to implementation of the C-11 West Basin Pollution Reduction Action Plan and associated water quality improvements in urban stormwater runoff. A new educational program was begun in concert with the South Florida Water Management District to reduce runoff from basins that discharge directly to the Everglades. Water conservation efforts also moved ahead. A total of 539 properties were NatureScape Broward certified, a 30% increase over last year, bringing the cumulative total to 2,026. Twice as many educational programs were delivered on water conservation in 2007 than in 2006, and Broward County and the Broward School District completed landscape makeovers at four middle schools as part of an environmental partnership to integrate NatureScape Broward program principles into classroom education

and landscape maintenance practices at Broward schools. The NatureScape Irrigation Service completed 236 irrigation system evaluations and saved 102 million gallons of water. The fewer gallons saved this year over last year is partly explained by mandatory landscape irrigation restrictions in place through most of 2007. Consumptive use pressures on the Biscayne Aquifer decreased in 2007 with potable wellfield withdrawals significantly lower and water consumption dropping in response to conservation efforts during a regional water shortage. Local rainfall was greater in 2007 than in 2006 as well, which served to further reduce the amount of water withdrawn from the Aquifer for irrigation. The County is undertaking a comprehensive study to help identify water supply projects that can provide for future water supply needs while meeting diverse water resource goals. The percentage of participation by local water managers in this coordinated effort increased in 2007. The percentage of potable water wells meeting drinking water standards remained at 100% in 2007. The chloride concentration in ground water monitoring wells, which is indicative of saltwater intrusion, held steady for the past two years, but it is higher than three years ago. To better understand the effects of various climatologic stresses and water management operations on saltwater intrusion, Broward County is working with the United States Geological Survey to develop a saltwater intrusion model. This model will be used in conjunction with the County's existing surface and ground water model to help guide management decisions in support of resource sustainability. An increasing percent of the County now has domestic sewer service available resulting in a net reduction of septic systems.

Solid waste production and solid waste production per capita are showing an increasing trend. These trends are accompanied by a decrease in the percent of solid waste recycled. The number of licensed hazardous material and storage tank facilities increased slightly over the past year, but has generally leveled from the larger historic increases. Progress continues on completing cleanup of known potential contaminated sites (now at 48% of known contaminated sites cleaned up), continuing an upward trend. Due largely in part to the continuing maturation of the department's e-inspection program and the necessity of completing 650 unscheduled inspections to confirm the status of service stations required to have emergency generator connections, the number of hazardous materials facilities inspected this year continues an upward trend. The rate of those facilities determined to be in compliance has decreased slightly to 72%, from 76% the previous year. Finally, this year brings to close the wellfield sweep program, whereby inspections were completed at all businesses located within any Broward County Wellfield Protection Zone. Information obtained from these sweeps will be used to refine Broward County's Wellfield Protection program.

Land

Land is the physical underpinning for most biological function as well as human development. Prior to development, Broward County was a rich mixture of uplands and wetlands. Approximately two thirds of western Broward County have been set off as Water Conservation Areas and are in the process of being restored through the Comprehensive Everglades Restoration Plan. The eastern portion of Broward County, approximately 440 square miles, currently support

approximately 1.7 million people and may accommodate up to another 800,000 in the next several decades. Infrastructure needed to support this population will place tremendous stress on remaining natural lands and pervious areas which currently provide for biological function.

For the purpose of looking at the environmental features of our land resources we are approaching them in two ways. One is the quantity and quality of our natural lands which are those lands that preserve habitat for indigenous plants and animals in historically existing community types. The other significant land resource is in our urban landscape. These resources are under significant pressure from a variety of sources including physical development, hydrologic stress, exotic plants and animals, fire suppression, littering, dumping and contamination and even weather events. The County, as well as many other organizations, has taken a variety of steps to respond to these pressures and maintain the value of our land resources as high as possible.

Marine

Broward County's marine resources are fundamental to the area's economy, environment, and quality of life. For the purposes of these benchmarks, our marine resources include a variety of nearshore and offshore coral reefs, 24 miles of sandy ocean beach, and the presence of endangered and threatened sea turtles and manatees. In order to track the quality and quantity of our marine resources, and to enable actions in support of protection, restoration, and enhancement of the resources, the County monitors and actively manages the reefs, beaches, and listed wildlife. High population density, resource use, and coastal build-out result in a number of pressures on the marine resources. These include over-fishing and large numbers of boaters; commercial maritime traffic; inlet-caused beach erosion; beachfront and waterfront development and redevelopment; nutrient-laden runoff and treated wastewater effects on ecosystems in coastal waters; and increasing numbers of residents and visitors. Add to these anthropogenic impacts the naturally occurring cycles of storms, temperature extremes, water quality fluctuations, and harmful algae blooms, and it is clear that these fragile marine resources are at risk. Quantitative trends with respect to these impacts are sometimes difficult to discern due to natural variability and the confounding effects of large-scale events, and in some cases, it may also be difficult to clearly define a single cause of damage to a particular resource. In response to these real and potential risks and damages, the County undertakes a multitude of actions intended to ascertain trends and causes; to mitigate existing impacts to reefs, beaches, and listed wildlife; to prevent future impacts; and to restore resources which have been damaged.

These benchmarks are used to identify areas of concern and to determine the effectiveness of environmental protection programs and regulations. For other aspects of the quality of life in Broward County and public perceptions of the environment, please see the Coordination Council of Broward's survey (<http://www.sfrpc.com/ccb/PRC2008Report.pdf>).

TABLE E1. BENCHMARK TRENDS

<p>TABLE E1.a. CLIMATE BENCHMARKS. This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Decreasing ■ No trend ■ Increasing ■</p>
Climate			
Deviation of the annual average temperature in Fort Lauderdale from the 1950-1970 baseline			
Change of annual average sea level in Key West from the 1920 baseline			
Pressures on Climate			
Greenhouse gas (GHG) emissions generated in Broward County		Narrative	
Responses to Climate			
Broward County government operations GHG emission reduction			
Climate Change Task Force			Narrative

<p>TABLE E1.b. AIR RESOURCES BENCHMARKS. This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Decreasing ■ No trend ■ Increasing ■</p>
Air Quality			
Percentage of days when outdoor air quality was good			
Average annual ozone concentration, ppm			
Average annual particulate matter concentration, ug/m ³	▲		

TABLE E1.b. AIR RESOURCES BENCHMARKS. This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Decreasing ■ No trend ■ Increasing ■
Mobile Sources Pressures			
Mobile source emissions, thousands of tons/year		▲	
Percentage of over-capacity roadway segments		▼	
Thousands of vehicle miles traveled/day/1000 people			
Vehicle miles traveled per day, millions		▼	
Mobile Sources Responses			
Number of air quality outreach events			▼
Number of mass transit passenger trips, million of trips/year			▲
Community shuttle ridership, thousands of trips/year			
Regulated Stationary Sources Pressures			
Number of regulated stationary sources			
Emissions from power plants, tons/year			
Total electricity consumption, billions of kilowatt hours/year			
Per capita power consumption, kilowatt hours/year		▼	
Regulated Stationary Sources Responses			
Number of compliance inspections of regulated stationary sources			
Changes in stationary source regulations			Narrative
Florida Power and Light's alternative fuel program			Narrative

<p>TABLE E1.b. AIR RESOURCES BENCHMARKS. This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Decreasing ■ No trend ■ Increasing ■</p>
	Other Sources Pressures		
Days air quality was impacted by an unusual event			
Other Sources Responses			
Open burning regulations			Narrative

<p>TABLE E1.c. WATER RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Declining ■ No trend ■ Improving ■</p>
	Surface Water Quality		
Everglades water quality - phosphorus at the S-9 pump station, ppb	▲		
Urban freshwater quality in the C-13 Canal - percent improvement over 1995 baseline			
Estuarine water quality: C-13 & C-14 Canals - percent improvement over 1995 baseline	▲		
Surface Water Quality Pressures			
Urban storm water runoff		Narrative	
Building permits - new structure/non-residential addition approvals issued			
Percentage of developed land not subject to surface water management regulation			
Surface Water Quality Responses			
Miles of streets swept			▲

TABLE E1.c. WATER RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Total number of certified Naturescape sites			
Number of educational programs delivered			▲
C-11 Canal Basin/ Broward Everglades Working Group Activities			Narrative
Clean Water Act – Total Maximum Daily Loads			Narrative
Active construction sites within BC jurisdiction with surface water management licenses			
Total surface water management construction licenses issued since 1989			
Ground Water Quality			
Percent of potable water wells meeting drinking water standards			
Ground Water Quality Pressures			
Percent saltwater monitoring wells with changing chloride concentrations, 2000 baseline			No change
Percent Broward County where central domestic sewer service is not available			
Total solid waste produced, millions tons/year			▼
Solid waste produced, tons/year/person			
Number of contaminated sites			
Number of hazardous material and storage tank licenses			
Amount hazardous materials hauled, million gallons			
Number of new reported discharges			▲
Ground Water Quality Responses			
Local surface water management			Narrative
Net gain/loss in septic system wastewater flow, thousands of gallons/day			▼

TABLE E1.c. WATER RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Percent of solid waste recycled			▼
Percentage of contaminated sites cleaned up to state standards			■
Number of licensed hazardous material sites inspected			■
Percent licensed hazardous material sites inspected and found to be in compliance			■
Ground Water Quantity			
Percentage of monitoring wells with changing ground water levels	■		
Ground Water Quantity Pressures			
Inches of annual rainfall			▲
Potable wellfield withdrawals from the Biscayne Aquifer, million gallons/day			▼
Broward County Water and Wastewater Services water consumption, gallons/day/person			▼
Regional surface water management			Narrative
Ground Water Quantity Responses			
Maintenance of urban ground water levels			Narrative
Alternative water supply development			Narrative
Percent participation of local water managers in County-wide planning efforts			▲
Naturescape irrigation service, million gallons saved/year			▼
Water Matters Day attendance			▼

TABLE E1.d. LAND RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Natural Land Quantity			
Acres of protected land, thousands	▲		
Acres of unprotected (developable) land	■		
Everglades Water Conservation Areas	Narrative		
Natural Land Quantity Pressure			
Broward County population, millions		■	
Building permits - new structure/non-residential addition approvals issued		■	
Wetlands impacted by development, acres		■	
Mitigation leaving Broward County, acres		▼	
Natural Land Quantity Responses			
Public dollars spent to preserve natural land, millions			▲
Environmental review			Narrative
Acres of mitigation licensed			■
Mitigation on public lands			Narrative
Natural Land Quality			
Natural land quality	Narrative		
Natural Land Quality Pressure			
Invasive exotic vegetation		Narrative	
Natural lands under hydrologic stress		Narrative	
Fire suppression on natural land		Narrative	

TABLE E1.d. LAND RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Natural Land Quality Responses			
Percent of municipal natural land sites with management plans			
Land Stewardship			Narrative
Comprehensive Everglades Restoration Plan			Narrative
Restoring hydrologic function to natural land			Narrative
Controlled burn or alternative management methods			Narrative
Urban Landscape			
Urban landscape	Narrative		
Urban Landscape Pressure			
Number of tropical storms			
Reduction of wildlife habitat			Narrative
Pest Problems			Narrative
Number of tree related complaints			
Number of trees licensed for removal			
Urban Landscape Responses			
Public education			Narrative
Trees planted in Broward County parks after storm events			Narrative
Storm preparedness and response			Narrative
Broward Beautiful Projects, thousands of dollars spent			
Certified Naturescape sites, total			

TABLE E1.d. LAND RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Greater Ft. Lauderdale Flyways Cities Coalition			Narrative
Educational events to reduce pest problems			
Active tree trimmer licenses			
Tree related enforcement actions			▲
Replacement trees required by licensing			▼
Trees funded for planting thru the Tree Trust Fund			

TABLE E1.e. MARINE RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Reef Quality			
Percent healthy corals			
Number of fish species observed on reef	▲		
Reef Quantity			
Percent live coral coverage	▲		
Octocoral and sponge density			
Number of fish surveyed on the reef			

<p>TABLE E1.e. MARINE RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Declining ■ No trend ■ Improving ■</p>
Reef Resources Pressures			
Saltwater fishing licenses issued in Broward County, thousands			
Number of days when water temperature was not optimal for corals		▼	
Percent of reef monitoring sites impacted by algae			
Number of times ship damage impacted Broward's reefs		▼	
Cumulative acres of reef impacted by destructive activities			
Reef Resources Responses			
Marine protected areas			Narrative
Coastal water quality monitoring			Narrative
Algal bloom monitoring efforts			Narrative
Acres of constructed habitat			No change
Number of shipwreck reefs			No change
Acres of reef mitigation for coastal construction activities			
Anchorage regulatory review			Narrative
Marine debris clean-up campaigns, pounds of litter collected/participant/event			▲
Number of mooring buoys			No change
Number of tires removed from the reef zone			

<p>TABLE E1.e. MARINE RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p>RESOURCES Declining ■ No trend ■ Improving ■</p>	<p>PRESSURES Increasing ■ No trend ■ Decreasing ■</p>	<p>RESPONSES Declining ■ No trend ■ Improving ■</p>
Beach Quality			
Percent of beach water quality results rated “Good”	■		
Beach Quantity			
Average beach width at high tide, feet	■		
Percent of non-critically eroded beaches	■		
Beach Resources Pressures			
Presence of inlets		Narrative	
Days of small craft advisories		■	
Number of visitors to Broward County, millions		■	
Over development		Narrative	
Trash on the beach		Narrative	
Beach Resources Responses			
Sand bypass		Narrative	
Beach nourishment		Narrative	
Monitoring the condition of the beach		Narrative	
Regulatory comment on beach resources		Narrative	

TABLE E1.e. MARINE RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on “narrative” benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Beach clean-up campaigns, pounds of litter collected/participant/event			
Marine Wildlife - Sea Turtles			
Number of sea turtle nests			
Percent of sea turtle nesting success	▲		
Marine Wildlife - Pressures on Sea Turtles			
Beaches without turtle-friendly lighting		Narrative	
Number of sea turtle nests destroyed by predators		▲	
Obstructed nesting attempts		Narrative	
Number of sea turtle hatchling disorientation events		▼	
Number of juvenile and adult sea turtles found injured or dead		▼	
Marine Wildlife - Sea Turtle Responses			
Percent of sea turtle nests relocated			
Percent of surveyed nests left in place			
Linear feet of beach with dimmed lighting		No change	
Beach nourishment		Narrative	
Regulatory comment on beach resources		Narrative	
Marine Wildlife - Manatees			
Florida West Indian manatee population			

TABLE E1.e. MARINE RESOURCES BENCHMARKS. Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	RESOURCES Declining ■ No trend ■ Improving ■	PRESSURES Increasing ■ No trend ■ Decreasing ■	RESPONSES Declining ■ No trend ■ Improving ■
Marine Wildlife - Pressures on Manatees			
Number of vessels registered in Broward County			
Manatee mortality in Broward County			
Number of boat slips in Broward County		No change	
Marine Wildlife - Manatee Responses			
Manatee protection		Narrative	

INTRODUCTION

PROGRAM PURPOSE

In 1999, one of the County Commission's *New Vision* goals was to review efforts to protect the environment and develop a comprehensive environmental strategy. The Broward County Environmental Protection and Growth Management Department (formerly the Environmental Protection Department) initiated the Benchmarks Program to demonstrate environmental trends. A benchmark is a standard by which to judge or measure something. The benchmarks program strives to judge how the environmental quality of life in Broward County has changed over the years. These benchmarks measure how changes in natural resource management initiatives today and in the future translate into changes in the environment. These benchmarks reflect the Broward County Board of County Commissioners' commitment to a pristine and healthy environment.

INDICATORS AND PERFORMANCE MEASURES

A variety of "indicators" have been selected to evaluate the state of the environment. For instance, we selected "ambient air quality" as an indicator of the health of our air resources. For each indicator, we developed one or more "performance measures" to assess changes in the indicator. In this example, "the percentage of days when the air quality was rated as 'good'," is the performance measure.

RESOURCE-PRESSURE-RESPONSE CONCEPT

The example performance measure above is useful for tracking the condition of the air *resource*. From a resource management perspective, however, we must be aware of the *pressures* or driving forces that influence air quality. By maintaining awareness of the pressures that influence the resource and how they are changing, we can strive to formulate *responses* to help mitigate adverse impacts on the state of the resource. Continuing with the example, the performance measure "number of vehicle miles traveled" would be an example of a pressure performance measure; vehicle emissions are one of the most significant sources of air pollution. Then we might strive to promote the use of mass transit or use of vehicles that run on cleaner fuels such as electricity or propane to mitigate this impact. This leads to response-type performance measures such as "the number of mass transit trips per year" or the "number of public outreach events".

NATURAL RESOURCE CATEGORIES

The Benchmarks Program concentrates on four primary natural resource categories: *air*, *water*, *land* and *marine* with the *climate* section being introduced for the first time this year. For each of these resources, we have identified one

or more resource, pressure and response benchmark measures. If historical data is available, we will chart it to show trends. For newly-formulated performance measures, historical data may not be available. In these cases, we plot first year baseline data and trends will become evident in future reports. Narratives explain trends in policies, regulation or issues that cannot currently be quantified to give a broader perspective on the status of the resources. The flow charts at the top of each benchmark's page and shown here, provide a visual representation of how the responses and pressures are connected to a specific resource.

DATA COLLECTION INTERVALS

When it is available, we will present new data annually noting whether the data is collected for the calendar year, County fiscal year (ending September 30) or State fiscal year (ending June 30). Some data, however, is not available on an annual basis.

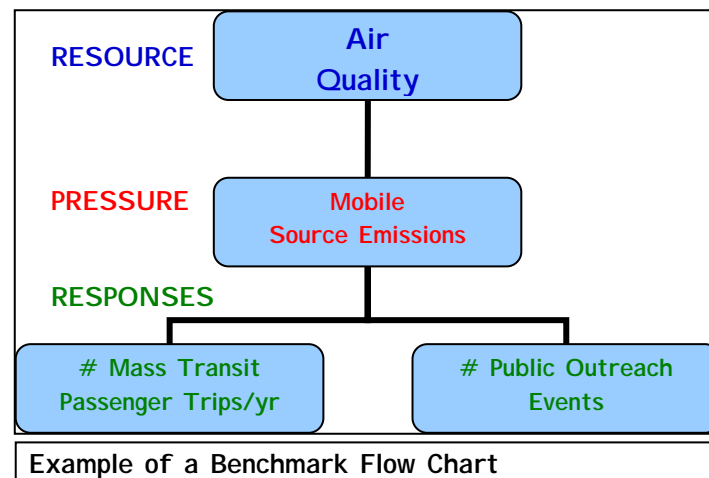
INDICATOR OVERLAP

Sometimes an indicator may reflect upon more than one resource. For instance, development pressure as measured by the number of building permits, affects both land and water resources. When such overlap occurs, we show the indicator in both sections.

ENDNOTES

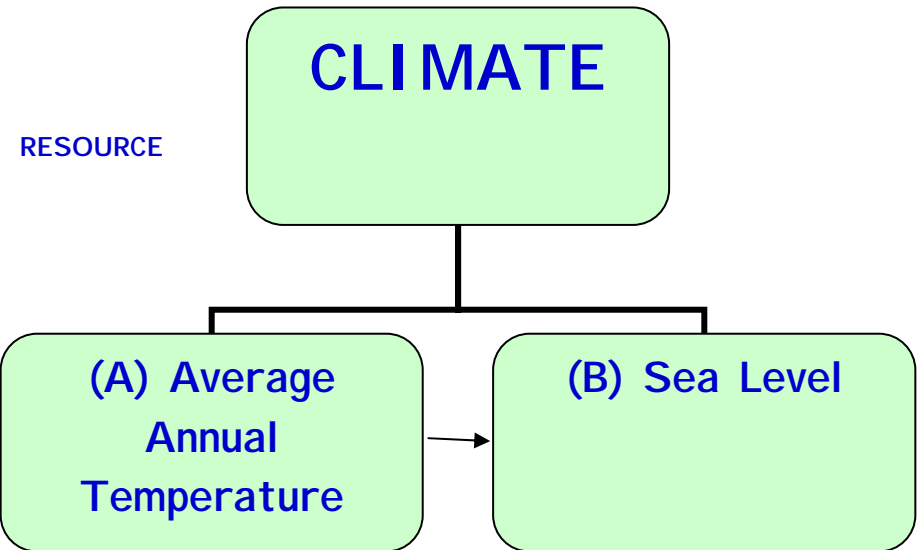
The last section of the report is *Endnotes*. Each benchmark has an associated set of endnotes. Each endnote is comprised of four sections: (1) *measurement or narrative*, (2) *explanation*, (3) *trends* and (4) *data source*. The *measurement* provides some detail on how we calculated the specific performance measure or why it is included as a narrative. The *explanation* describes the significance of the performance measure with respect to how it might impact the resource. The *trends* section comments on how and why the benchmark has changed over time. Finally, the *data source* provides identification of a contact with telephone number for readers wanting additional information on the performance measure. You may contact the Director of the Environmental Monitoring and Enforcement Division at (954) 519-1240 to obtain the data for any of the charts in this document.

We hope you find the report interesting and informative. This document may also be found on the Broward County web page under Environmental Protection and Growth Management Department (www.broward.org/environment/).

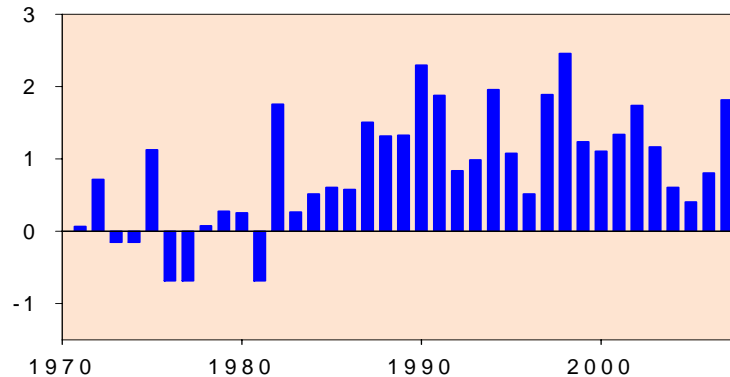


CLIMATE

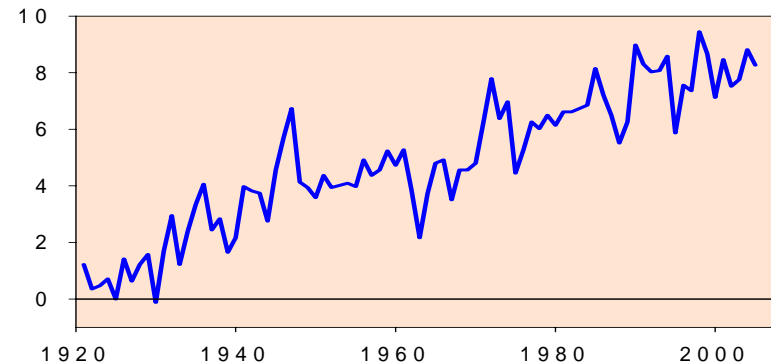
Climate. Global climate change has emerged as a phenomenon of critical concern worldwide. According to the Intergovernmental Panel on Climate Change: warming of the climate system is unequivocal; global concentrations of greenhouse gases (GHG) have increased markedly as a result of human activities; global air and ocean temperatures are increasing; and average sea level is rising globally. Climate change is very much a part of any current discussion regarding the environment. Climate change is a global phenomenon with significant regional impacts. This section describes local indicators of the climate change, local contributors of greenhouse gases and ways that Broward County Government is responding to this growing environmental concern.



(A) Deviation of the Annual Avg Temperature (°F) in Ft. Lauderdale from the 1950-70 Baseline



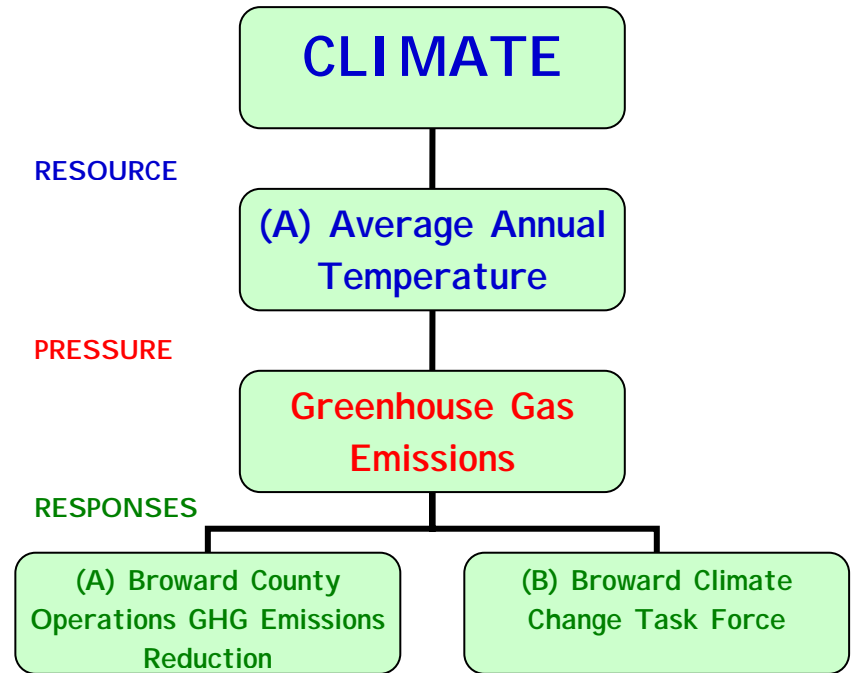
(B) Change of Annual Average Sea Level (inches) in Key West from the 1920 Baseline



Endnotes for the Climate Resource Benchmarks are on page 58.

PRESSURES ON CLIMATE

Greenhouse Gas (GHG) Emissions Generated in Broward County - Emissions from a variety of sources create carbon dioxide and other so called "greenhouse" gases (GHG). The ratio of these gases in the atmosphere is changing in such a way as to increase global temperature. GHG emissions in Broward County come from a variety of sources including vehicles, energy consumption, and waste generation. Currently a GHG emissions inventory for Broward County is not available. To learn more, see the endnotes on page 58.



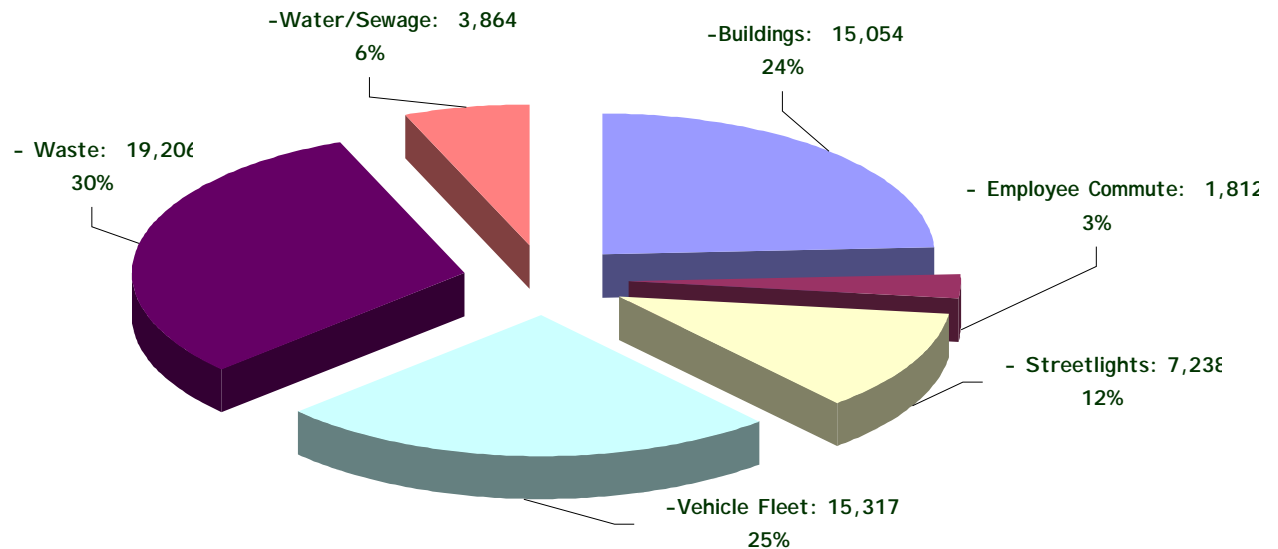
* Does not include carbon dioxide from public transportation and air travel.

RESPONSES TO THE PRESSURES ON CLIMATE

(A) Broward County Government Operations GHG Emissions Reduction - On June 12, 2007, the Broward County Board of County Commissioners adopted Resolution 2007-391 to reduce emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. The first action was to develop an action plan and provide recommendations on Broward County government operations greenhouse gas (GHG) reduction strategies (Broward County Government Operations Climate Change Report available at www.broward.org/air/broward_county_climate_change_report.htm). Values of GHG emissions are reported in metric tons (tonnes) of carbon dioxide equivalent (eCO₂). Since 1997, Broward County has implemented measures that resulted in a reduction of 114,278,355 kilowatt-hours annually and 62,491 tonnes eCO₂ emissions annually. The most significant reductions were achieved in some of the categories with the higher GHG emissions which are Vehicle Fleet Operations, Buildings Operation and Maintenance, and Waste. To learn more, see the endnote on page 59.

(B) Broward County Climate Change Task Force - On June 24, 2008, the Broward County Board of County Commissioners approved Resolution 2008-442 to create a Broward County Climate Change Task Force with the purpose of developing a countywide Climate Change Mitigation and Adaptation Program. The Task Force will recommend a coordinated countywide strategy in mitigating the causes, and addressing the local implications, of global climate change. To learn more, see the endnote on page 59.

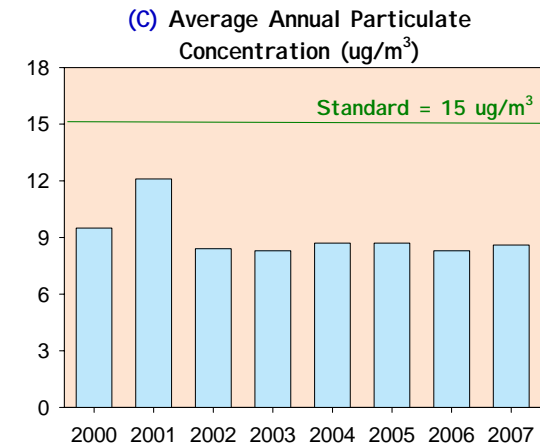
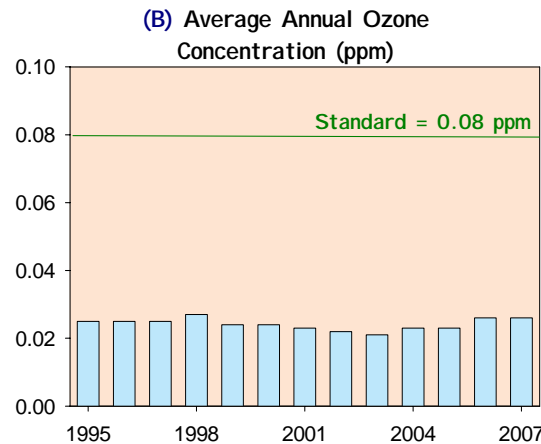
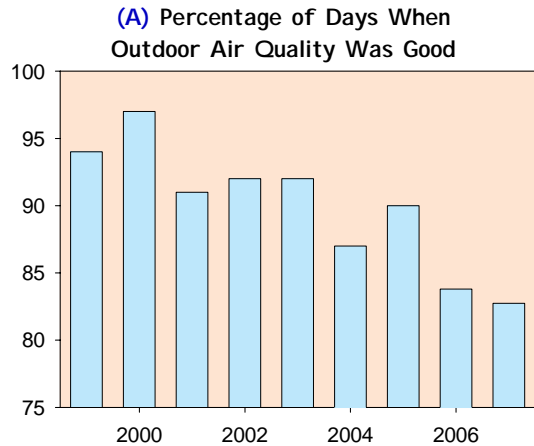
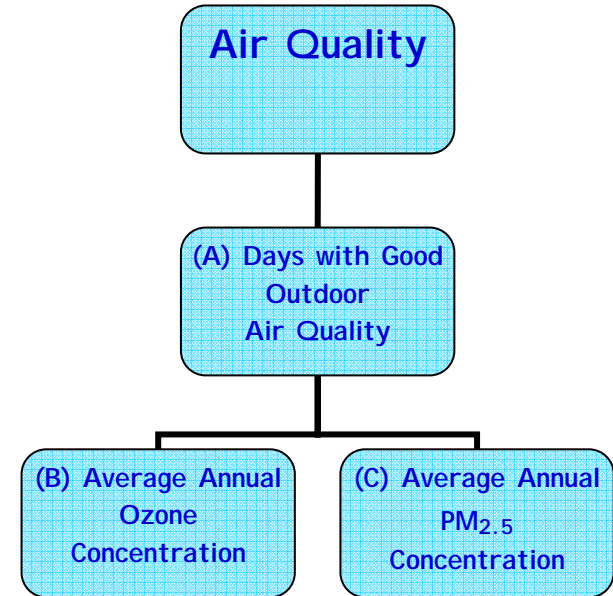
(A) Broward County Government Operations GHG Emissions Reduction (tonnes eCO₂/yr)



Endnotes for the Climate Response benchmarks are on page 59.

AIR RESOURCES

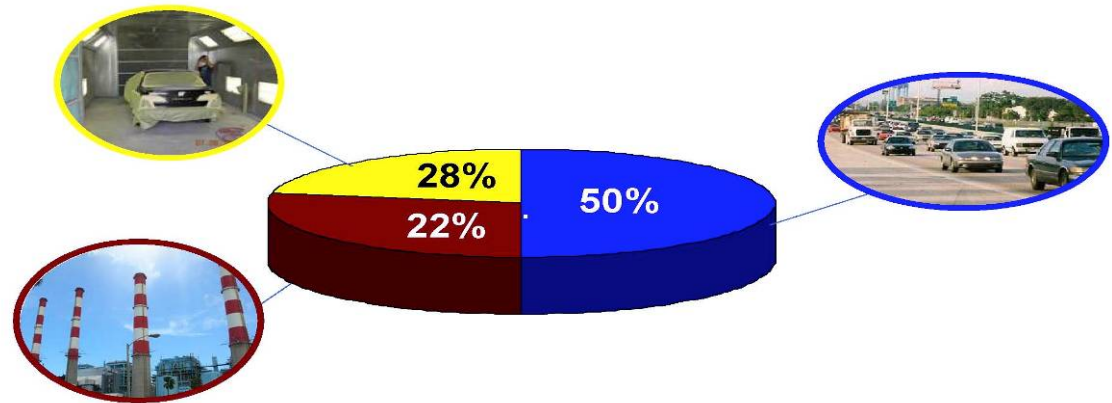
Air is essential for life. In South Florida, we depend on clean air to allow residents and visitors to enjoy the warm weather and many natural resources the area has to offer. The Air Quality Program determines the air quality by measuring parameters which have the potential to impact human health and the ecosystem around us. A number of different parameters are used to generate an air quality index reading - a single number which tells us if the air quality is healthy or not. Two of the major parameters which impact the air quality index are the ambient concentrations of ozone gas (a byproduct of emissions, sunlight, and heat) and PM_{2.5} (particulate matter of aerodynamic diameters less than 2.5 mm which can travel deep into the lungs).



Endnotes for the Air Quality Resource Benchmarks are on pages 60-61.

PRESSURES ON AIR QUALITY

What influences air quality? In Broward County, the main culprits are emissions from both on-road and non-road mobile sources (i.e., motor vehicles, trucks, construction equipment, and lawn equipment). However emissions from major industries (i.e., large industries, power plants, and petroleum terminals) and small facilities (i.e., gas stations, dry cleaners, and auto body shops) also add to the pollution burden of the air over Broward County. Infrequently occurring extraordinary natural and anthropogenic events (i.e., Saharan dust, wild fires, and vegetative debris burning) can also have significant effects as well. We have a number of benchmarks for mobile sources and for regulated stationary sources. We also have benchmarks for other sources, such as unusual events.



■ Mobile Sources

A moving source of pollution.

On-road

Examples: cars, trucks, motorcycles

Non-road

Examples: boats, trains, lawn-mowers, construction equipment

■ Stationary Sources

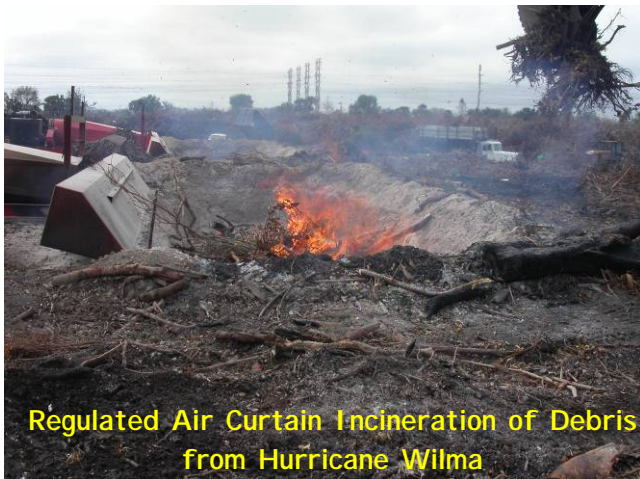
A place or object from which pollutants are released and which does not move around.

■ **Major Industry:** A stationary source that emits or has the potential to emit any pollutant regulated under the Clean Air Act at a significant emission rate.

Examples: power plants, petroleum terminals

■ **Small Operations:** A stationary source that emits small amounts of air pollution.

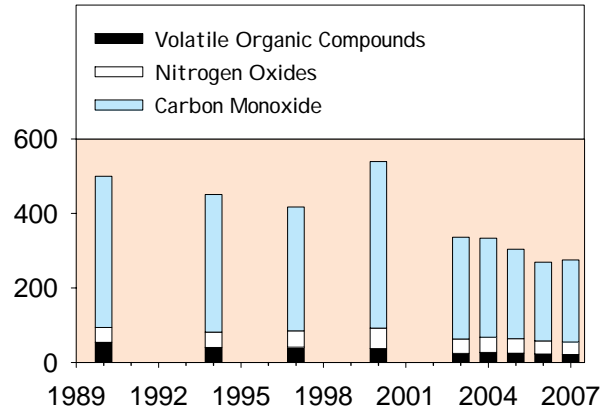
Examples: dry cleaners, paint spray booths



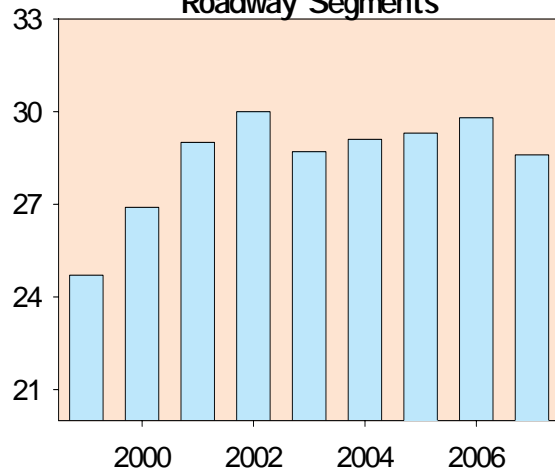
Regulated Air Curtain Incineration of Debris from Hurricane Wilma

PRESSURES ON AIR QUALITY - Mobile Sources

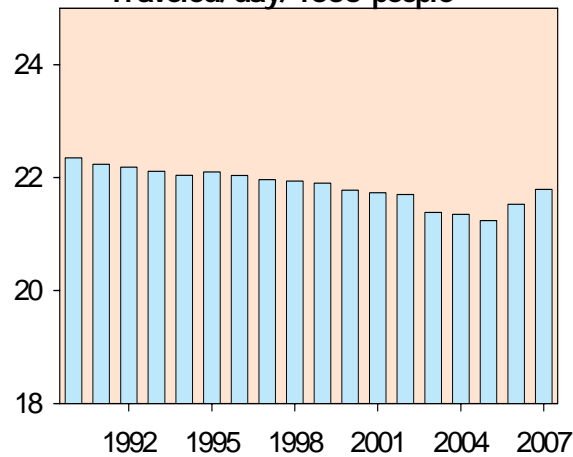
(A) Mobile Source Emissions
Thousands of Tons/Year



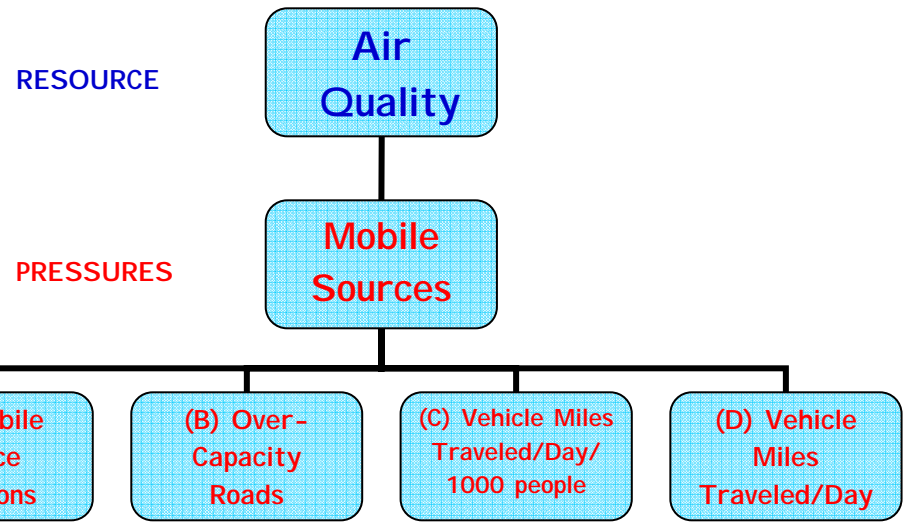
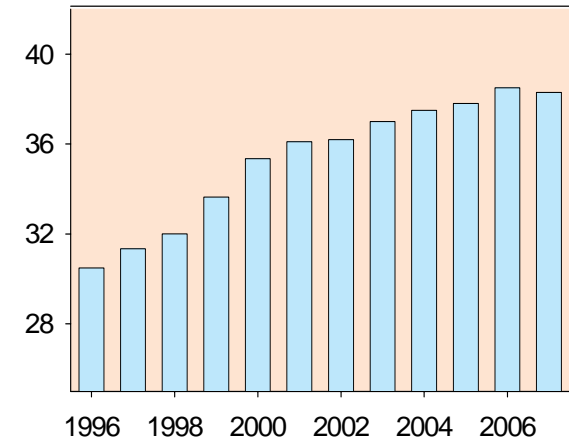
(B) Percentage of Over-Capacity Roadway Segments



(C) Thousands of Vehicle Miles Traveled/day/1000 people



(D) Vehicle Miles Traveled per Day, Millions



Endnotes for the Air Quality Mobile Sources Pressure benchmarks are on pages 62-63.

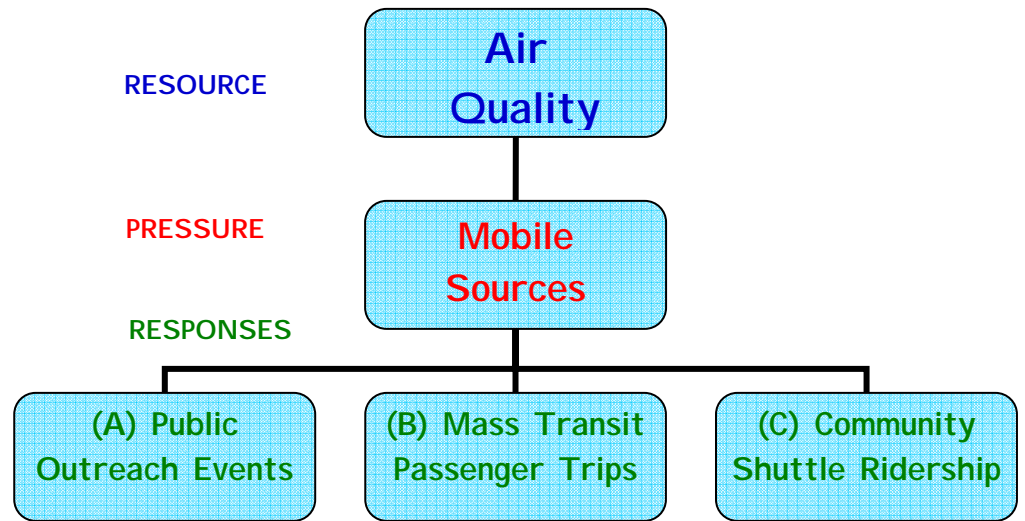
RESPONSES TO PRESSURES ON AIR QUALITY – Mobile Sources

Mobile Sources - To reduce the impacts of mobile sources on air quality, development and implementation of strategies to reduce the number of vehicles on the road and their associated emissions are important to protect air quality. The Air Quality Program recommends pro-active long term planning methods that will result in the prevention of any further deterioration of our air quality and quality of life. In addition, the Air Quality Program recommends plans for future development that include air quality measures or provisions

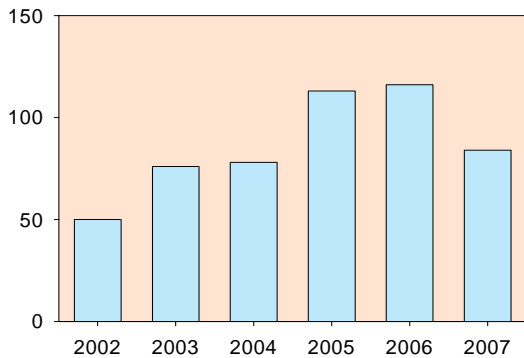


that will support alternative methods of

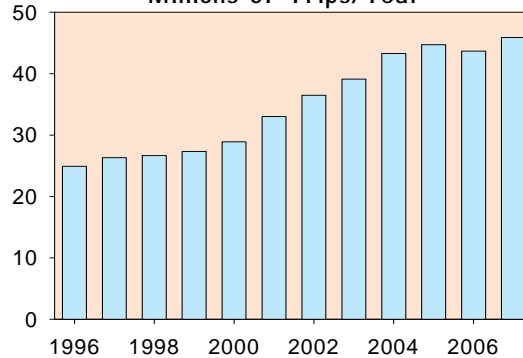
transportation. These measures include educating the public about air quality issues and promoting the use of mass transit (i.e. buses and Tri-Rail), carpooling, vanpooling, ridesharing and the use of alternative fueled vehicles.



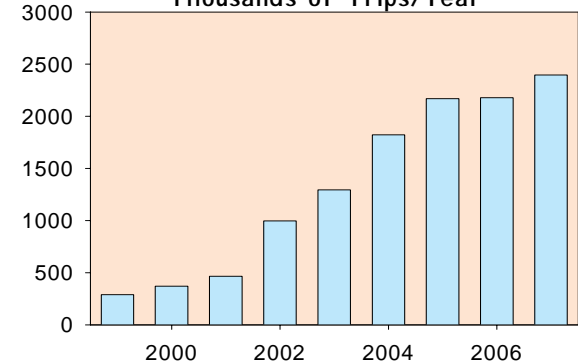
(A) Number of Air Quality Outreach Events



(B) Number of Mass Transit Passenger Trips
Millions of Trips/Year



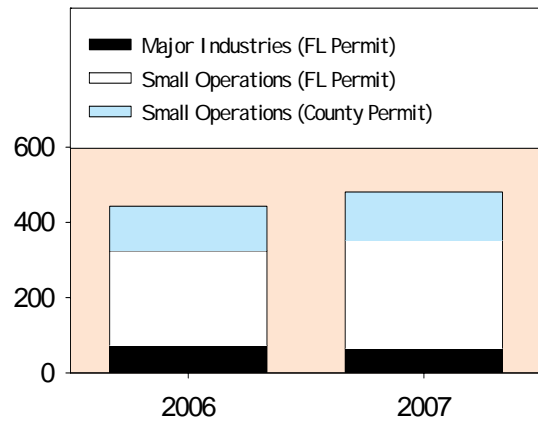
(C) Community Shuttle Ridership
Thousands of Trips/Year



Endnotes for the Air Quality Mobile Sources Response benchmarks are on pages 63-64.

PRESSURES ON AIR QUALITY – Regulated Stationary Sources

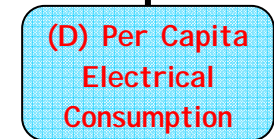
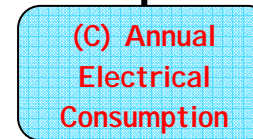
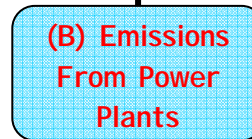
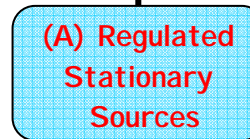
(A) Number of Regulated Stationary Sources



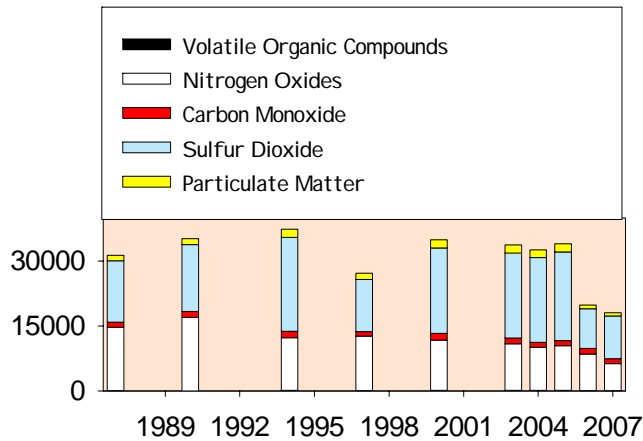
RESOURCE



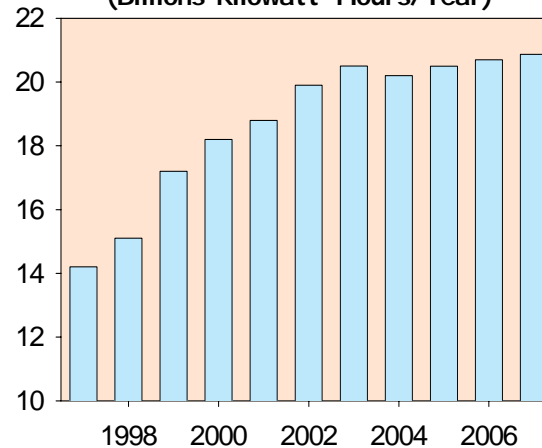
PRESSURES



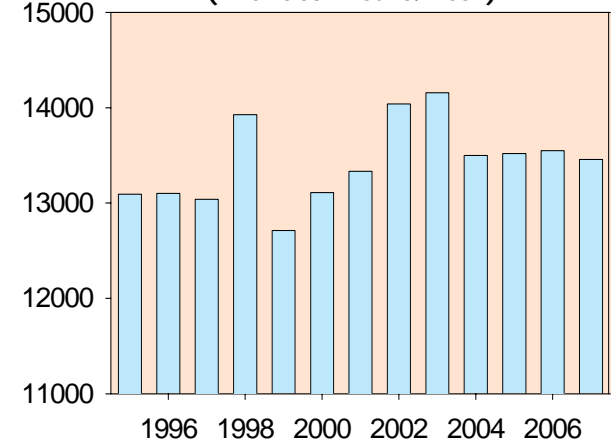
(B) Emissions From Power Plants (Tons/Year)



(C) Total Electrical Consumption (Billions Kilowatt-Hours/Year)

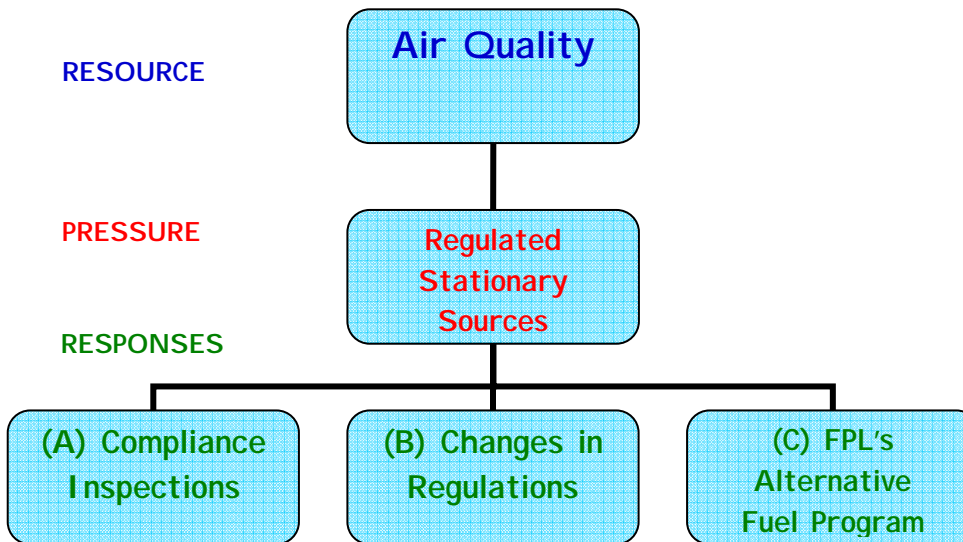


(D) Per Capita Power Consumption (Kilowatt-Hours/Year)

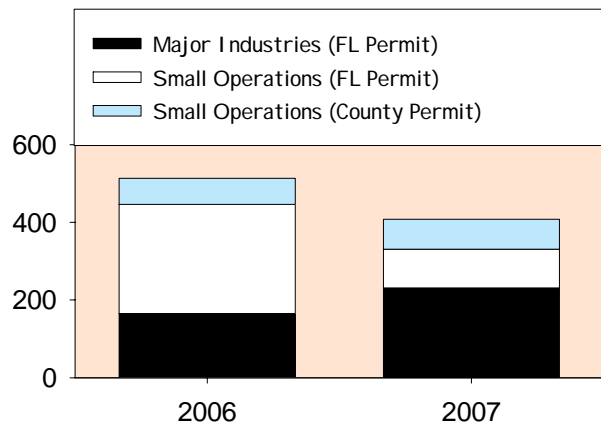


Endnotes for the Air Quality Regulated Stationary Sources Pressure benchmarks are on pages 65-66.

RESPONSES TO PRESSURES ON AIR QUALITY - Regulated Stationary Sources



(A) Number of Compliance Inspections of Regulated Stationary Sources



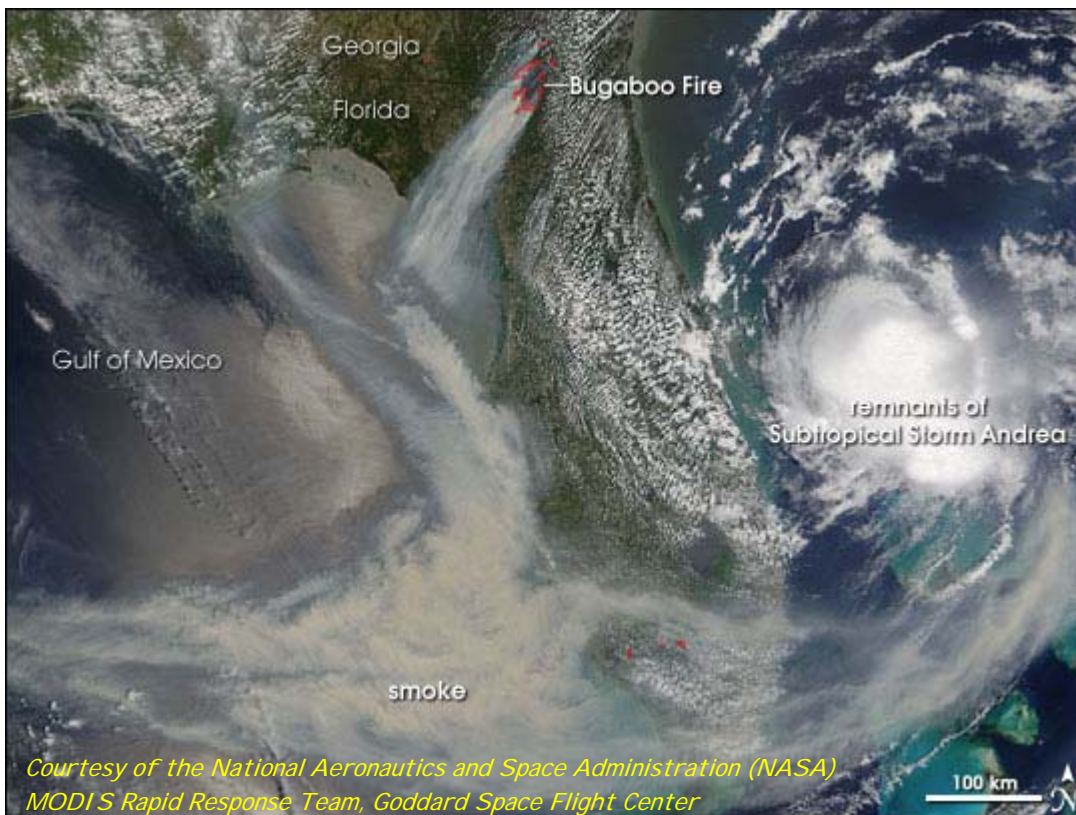
(B) Changes in Stationary Source Regulations - The Federal, State, and local regulations governing air quality are frequently updated as needs change. To learn more, read the endnotes on page 67.

(C) Florida Power and Light's Alternative Fuel Program - In 2007, FPL offered its customers an option to pay an additional fee each Month to support "green power" as part of the Sunshine Energy® Program. Green power refers to "electricity supplied in whole or in part from renewable energy sources, such as wind, solar power, and bioenergy." Customers supporting the program funded the development of solar energy facilities in Florida. The Public Service Commission voted to terminate the program on July 29, 2008. To learn more, read the endnotes on page 67.

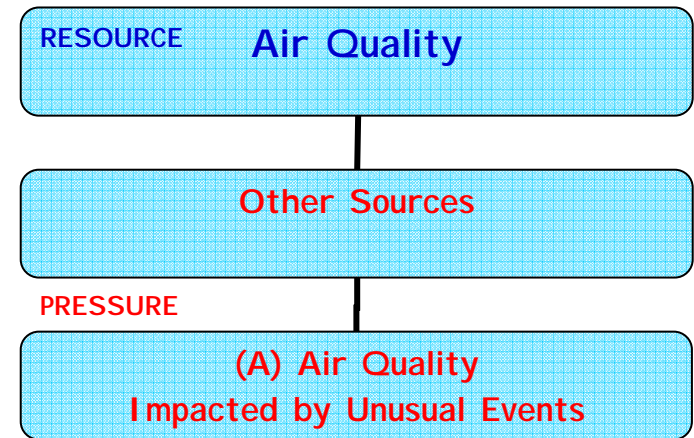
Endnotes for the Air Quality Regulated Stationary Sources Response benchmarks are on page 67.

PRESSURES ON AIR QUALITY – Other Sources

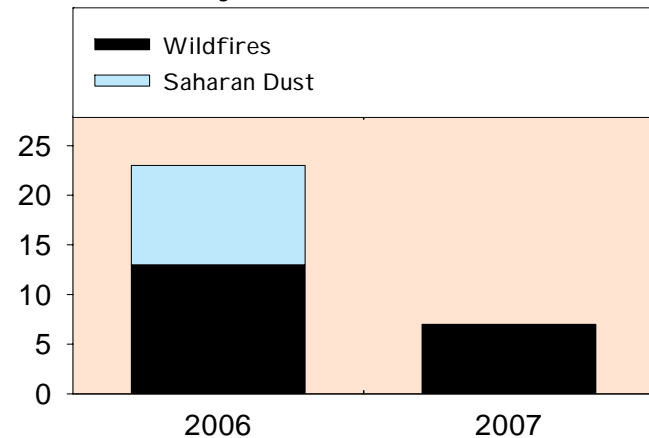
Air Quality Impacted by Unusual Events - Large quantities of dust, originating in the African Sahara desert, are periodically blown across the Atlantic Ocean and can, on certain days, impact air quality. Other factors, such as fireworks, wildfires, and open burning, can also have an effect on the air quality in Broward County. Tracking of these events began in 2006. To learn more, see the endnote on page 68.



Courtesy of the National Aeronautics and Space Administration (NASA)
 MODIS Rapid Response Team, Goddard Space Flight Center
http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17645



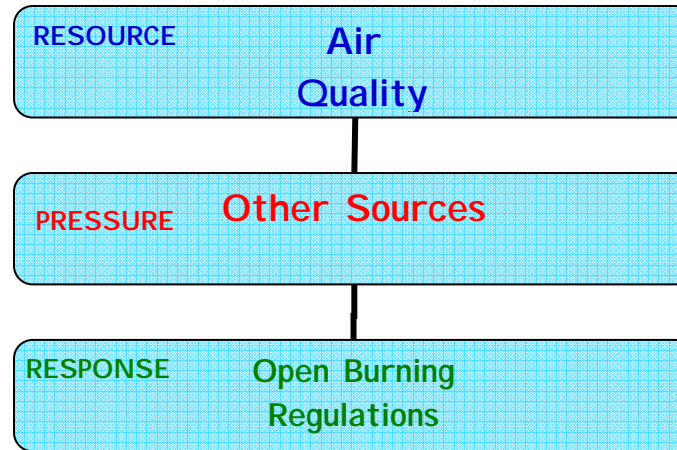
(A) Days Air Quality Was Impacted by an Unusual Event



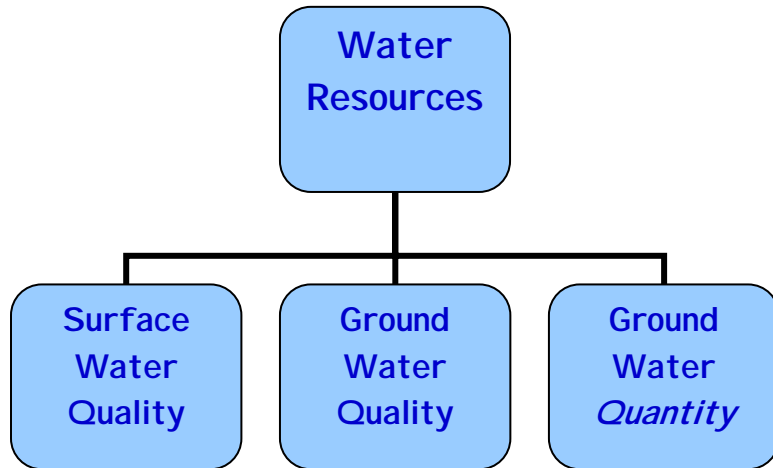
Endnotes for the Air Quality Other Sources Pressure benchmark is on page 68.

RESPONSES TO PRESSURES ON AIR QUALITY - Other Sources

Open Burning Regulations: In Broward County, open burning is regulated under Broward County Code Chapter 27, Article IX. To reduce the impact of smoke from open burning operations in Broward County, open burning is subject to required operational practices including minimum set-back distances and prohibitions on certain materials. Broward County also coordinates with local officials and agencies to ensure comprehensive compliance with all open burning regulations. In the unusual event of a nearby large-scale fire (e.g. wildfires, forest fires, burning of sugar cane fields) that affects air quality in Broward County, the Broward County Air Quality Program issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases. For more information please see the endnotes on page 68.



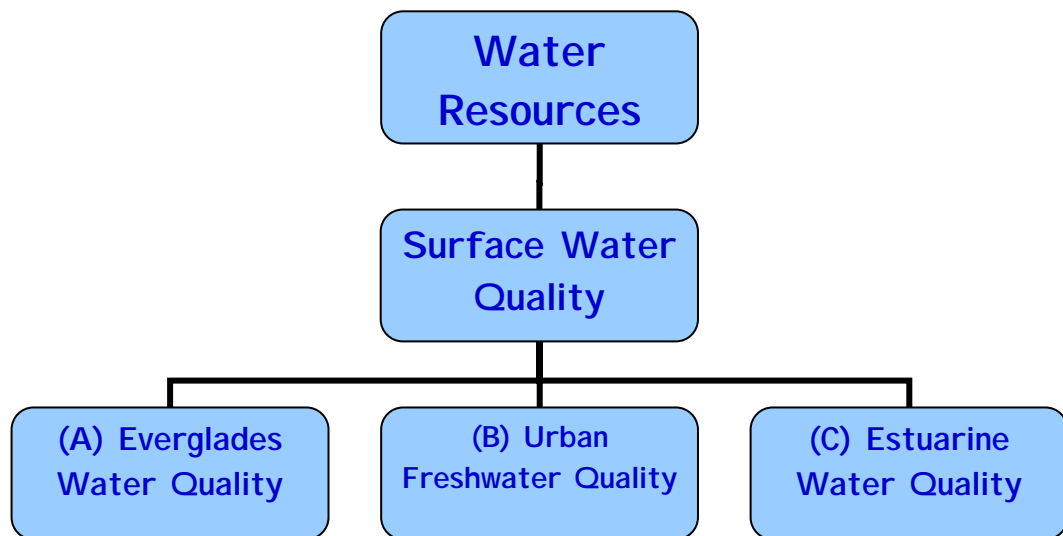
WATER RESOURCES



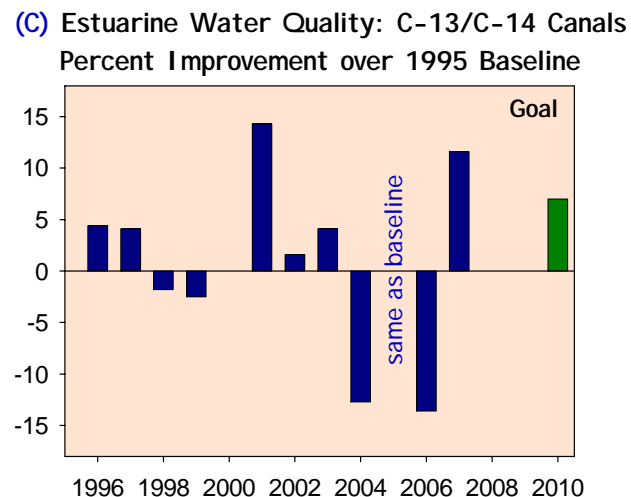
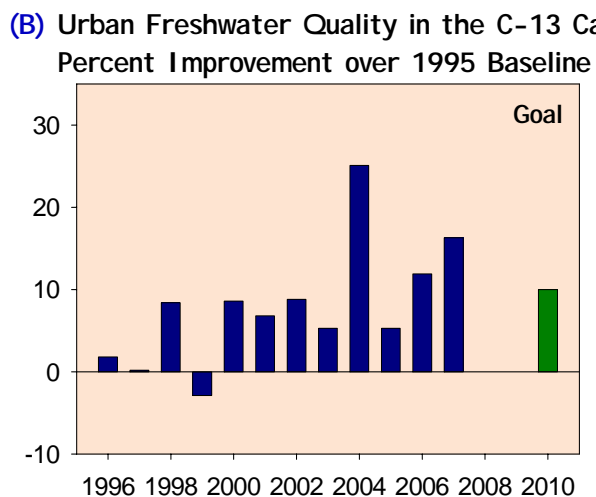
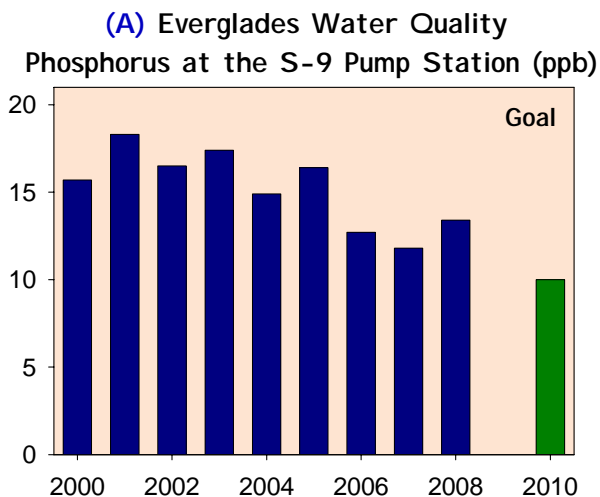
Water is what makes our planet unique. The availability of an adequate supply of clean water is one of the primary criteria that allow human and ecological communities to exist in a given location. South Florida hosts a network of canals, an underground source of drinking water called the Biscayne Aquifer, and distinct cycles of seasonal and annual rainfall. A growing human population is competing with the Everglades and urban wetland, upland and coastal ecosystems to use these resources for drinking water, recreation and irrigation, and has the potential to greatly influence the quality of water reaching these natural areas.



WATER RESOURCES – Surface Water

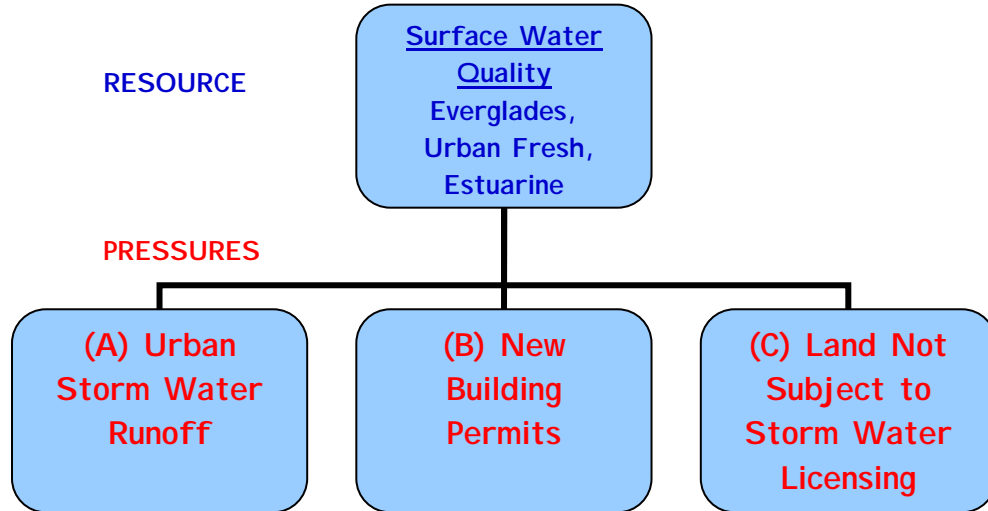


Surface Water - Surface water includes our vast network of urban canals and lakes, the brackish estuarine waters of tidal rivers, the Intracoastal Waterway, and the natural areas that encompass the Everglades ecosystem. The water quality requirements and standards differ among these different environments. In this section, we see how the existing water quality compares to the 2010 goal.



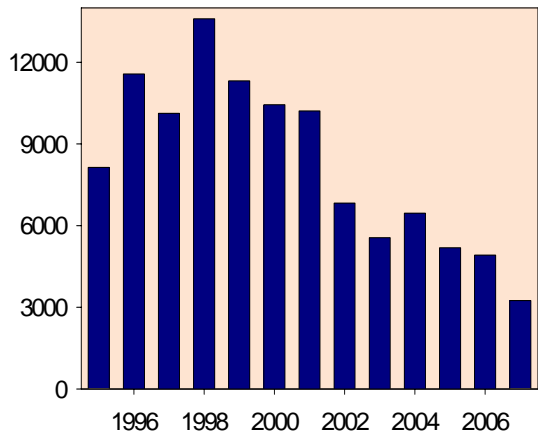
Endnotes for the Surface Water Resource benchmarks are on pages 69-70.

PRESSURES ON WATER QUALITY – Surface Water

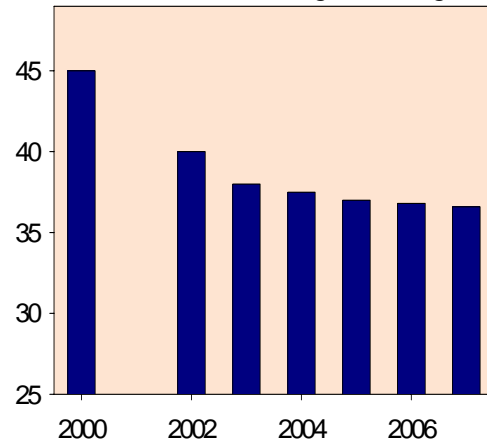


(A) Urban Storm Water Runoff - Urban storm water is a major contributor of pollutants to our waterways. Fertilizers, pet waste, roadways, and poorly managed construction sites are part of the problem. In addition, older areas of the County were built without the infrastructure to clean up the runoff before it enters our waterways. For more information, read the endnote on page 70.

(B) Building Permits - New Structures/ Non-Residential Addition Approvals Issued

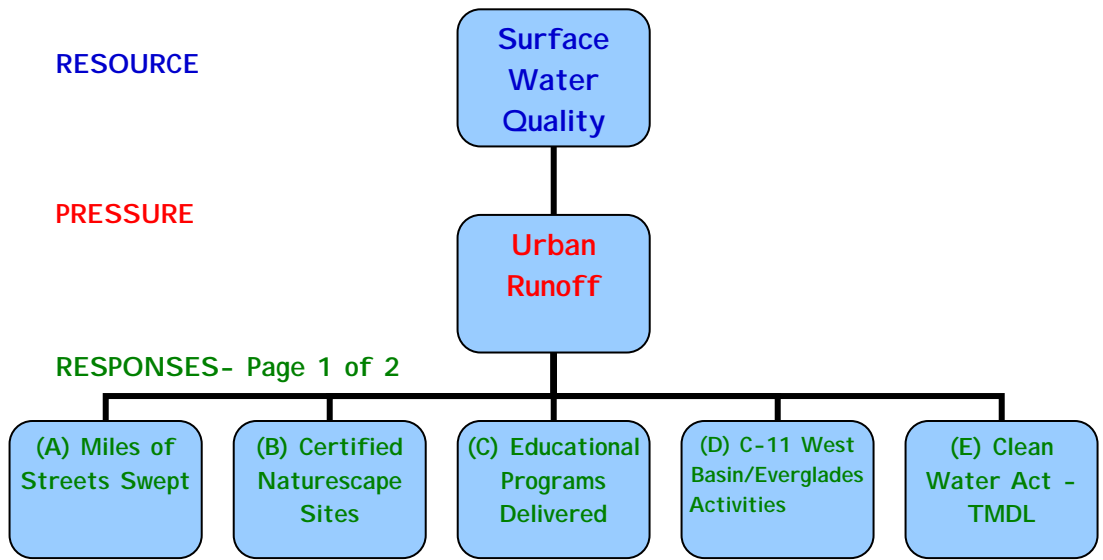


(C) Percentage of Developed Land Not Subject to Surface Water Management Regulation



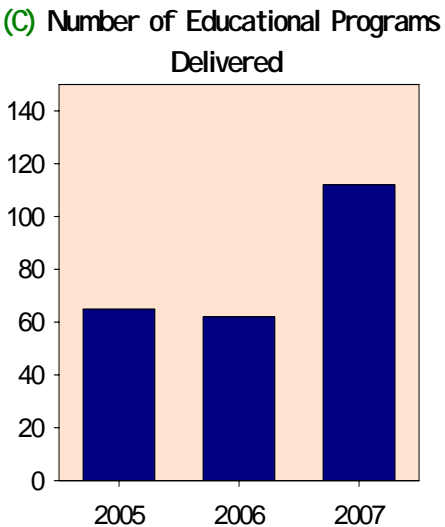
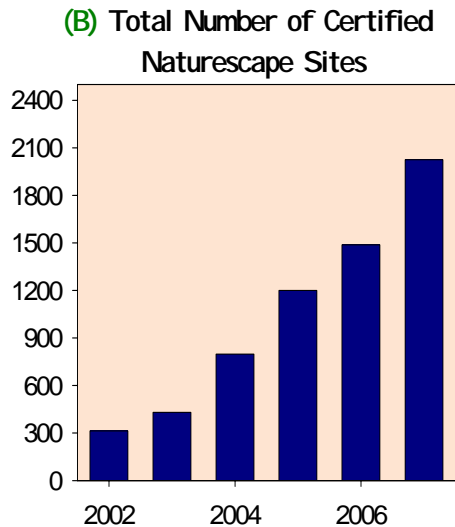
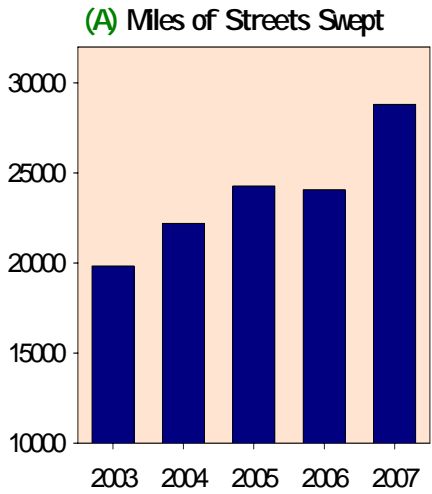
Endnotes for the Surface Water Pressures benchmarks are on pages 71-72.

RESPONSES TO PRESSURES ON WATER QUALITY - Surface Water



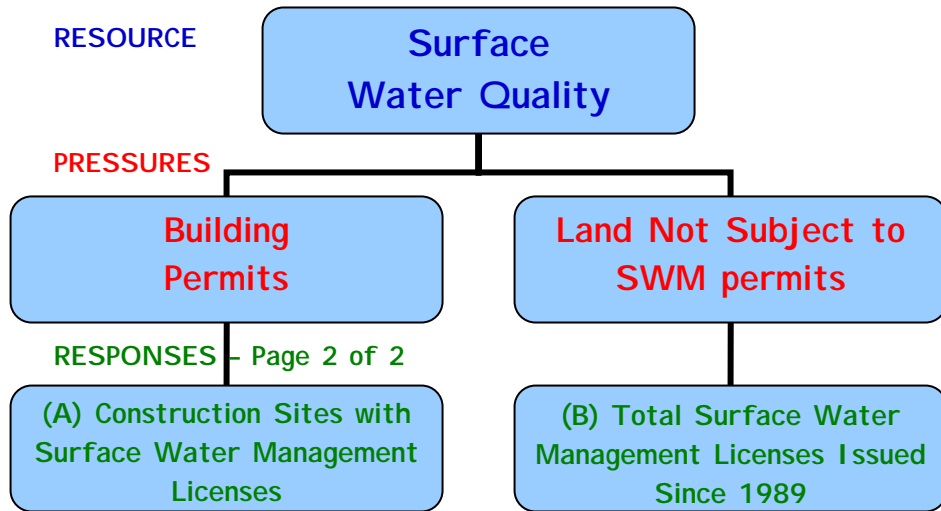
(D) C-11 West Basin/ Broward Everglades Working Group Activities -
 This group (BEWG) was convened in 2004 to bring greater focus to pollution reduction efforts in the C-11 West Canal Basin in support of Everglades Restoration. The BEWG has developed a plan to reduce phosphorus entering the Everglades. To learn more, see the endnotes on page 74.

(E) Clean Water Act - TMDL A Total Maximum Daily Load, or TMDL, is the amount of a pollutant a surface water body can assimilate and still meet water quality standards. TMDLs are established by the State for all waters designated as impaired for one or more pollutants. The goal is to reduce pollutant loads to impaired waters to allow the water body to recover and meet its designated use. To learn more, see the endnotes on page 75.



Endnotes for Surface Water Quality Response benchmarks may be found on pages 72-75.

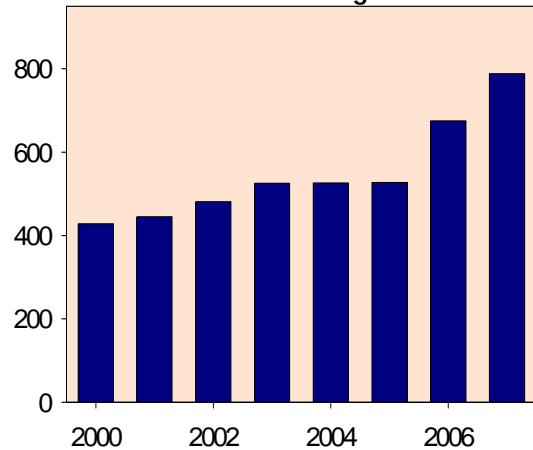
RESPONSES TO PRESSURES ON WATER QUALITY - Surface Water



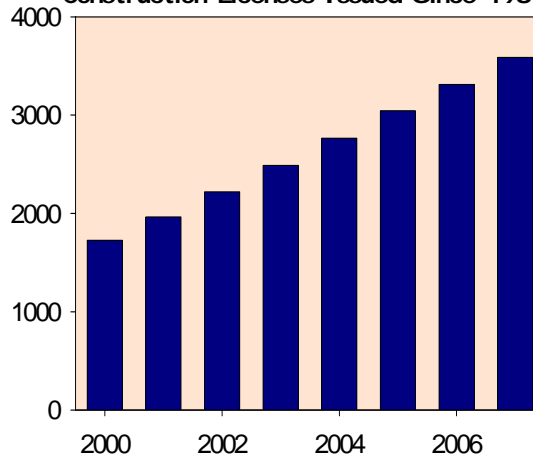
Construction Activities and Surface Water Management (SWM) Licenses

- Inspection of sites during construction ensures that muddy runoff does not end up in our waterways. The SWM license ensures that only pre-treated storm water leaves the site after construction.

(A) Active Construction Sites within BC Jurisdiction with Surface Water Management Licenses

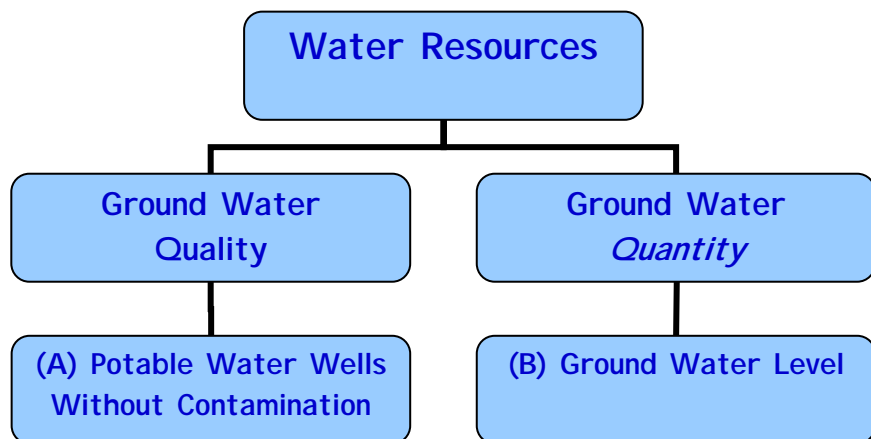


(B) Total Surface Water Management Construction Licenses Issued Since 1989



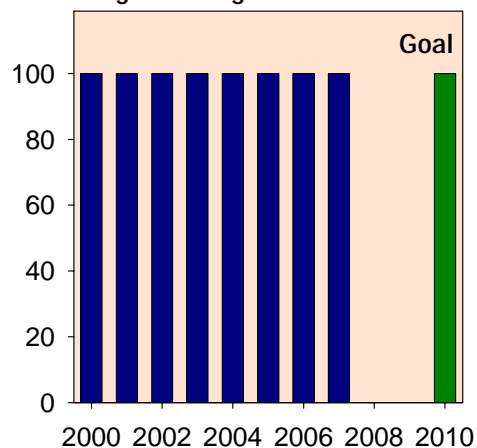
Endnotes for Surface Water Quality Response benchmarks may be found on page 76.

WATER RESOURCES – Ground Water

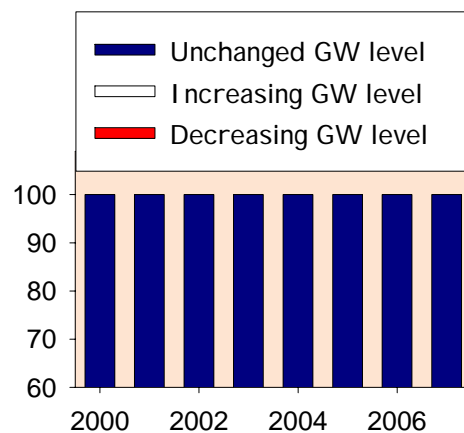


Ground Water - The overwhelming majority of our drinking water comes from the Biscayne Aquifer. Protecting the quality of that drinking source from hazardous materials and other pollutants is paramount. Ground water levels must be maintained to prevent impacts to wetlands, to hold back salt water intrusion and to meet design elevation for canals and lakes.

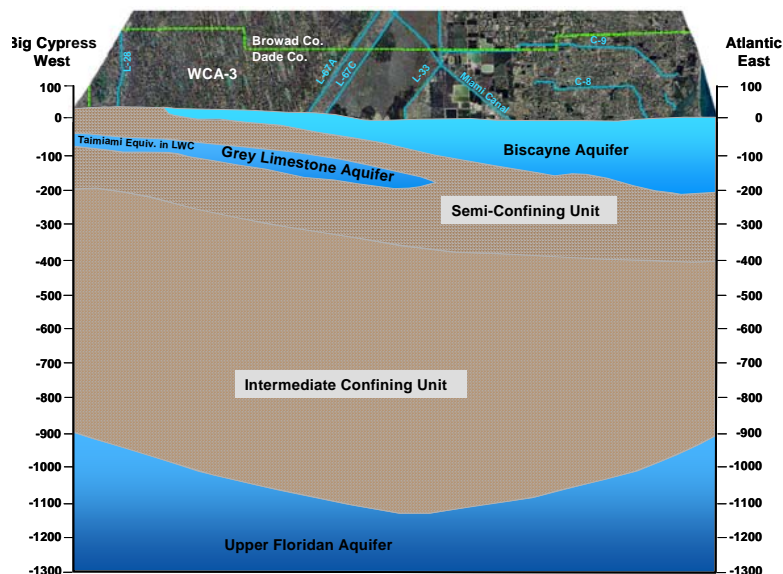
(A) Percent of Potable Water Wells Meeting Drinking Water Standards



(B) Percentage of Monitoring Wells With Changing Ground Water Levels

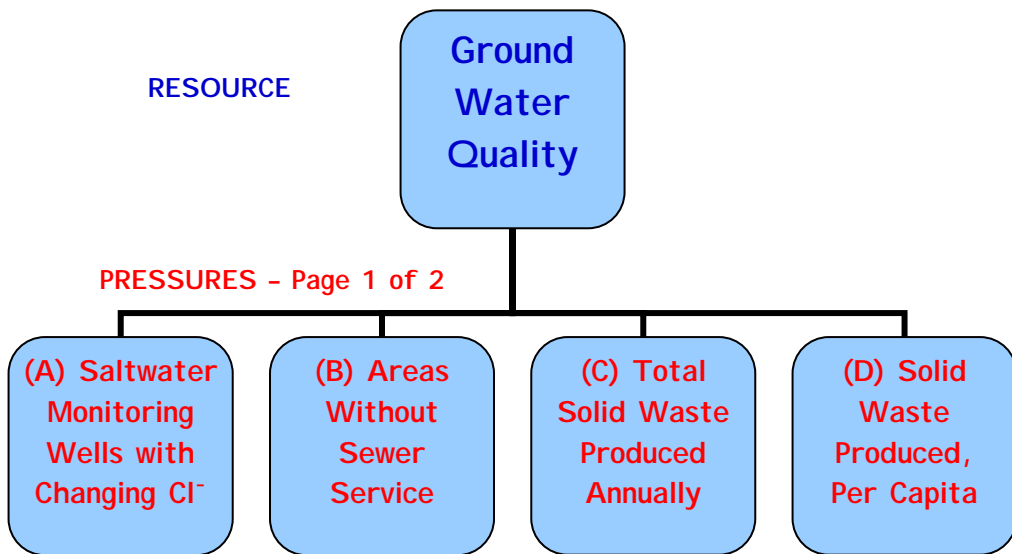


Generalized Cross Section of Our Geology

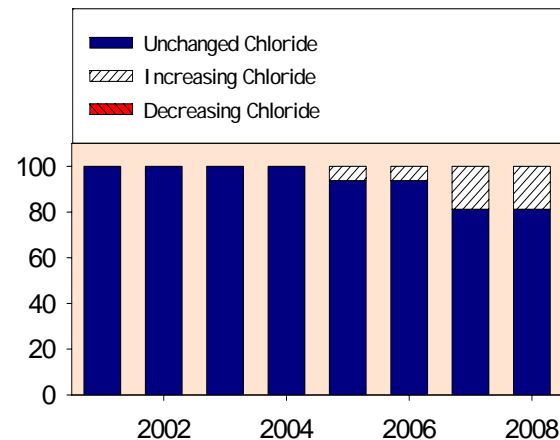


Endnotes for the Ground Water Resource benchmarks are on pages 77 and 83, respectively.

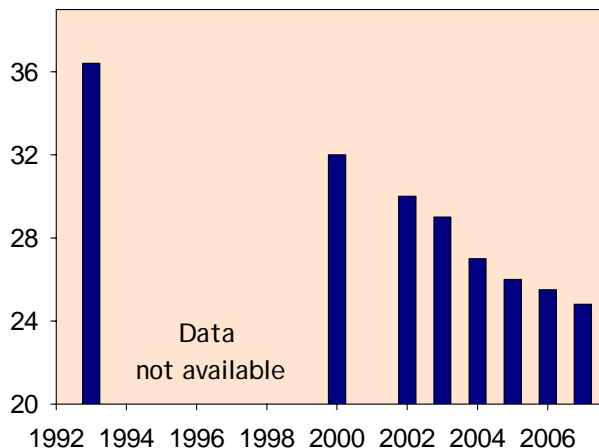
PRESSURES ON WATER QUALITY - Ground Water



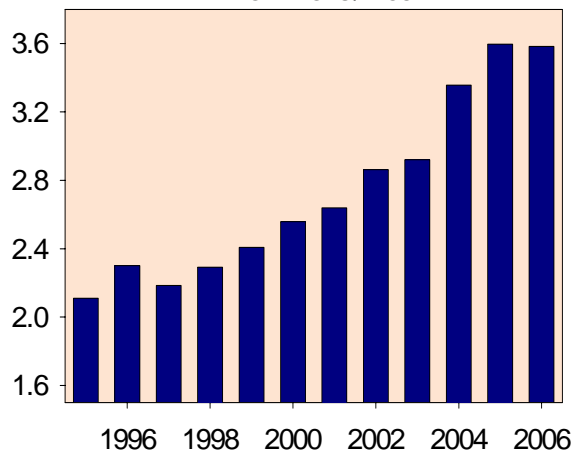
(A) Percent Saltwater Monitoring Wells with Changing Chloride Concentrations, 2000 baseline



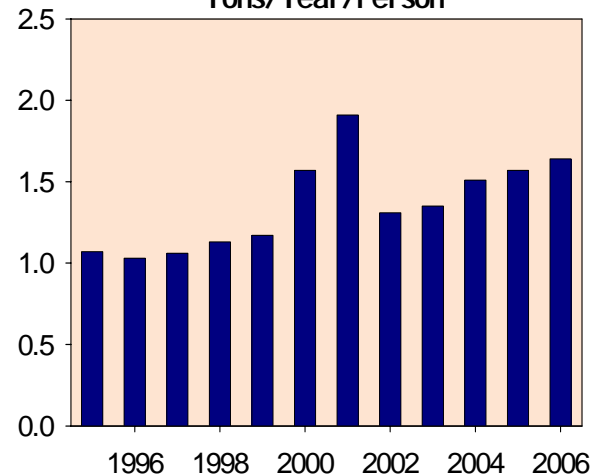
(B) Percent Broward County Where Central Domestic Sewer Service is Not Available



(C) Total Solid Waste Produced, Million Tons/Year

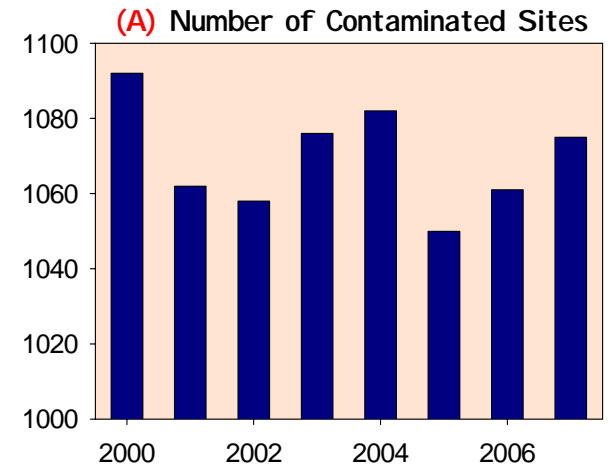
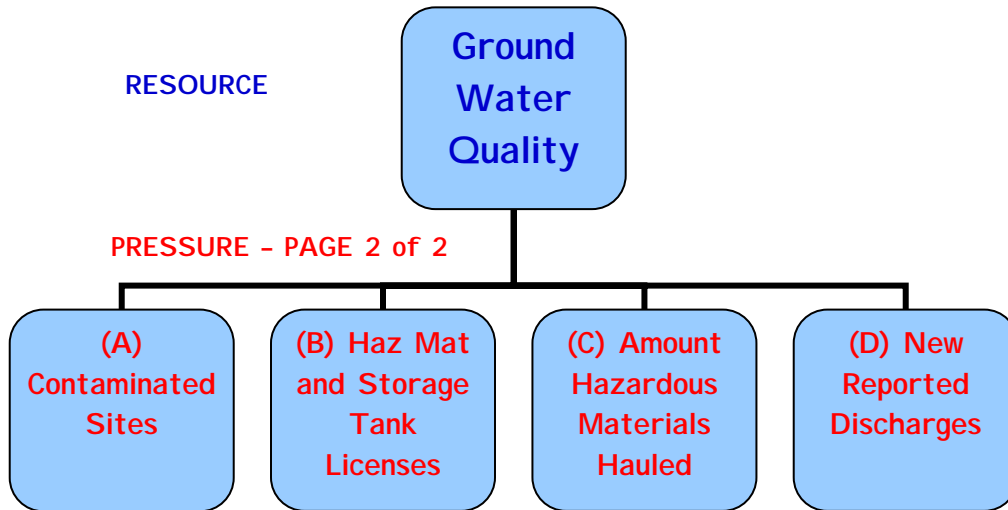


(D) Solid Waste Produced, Tons/Year/Person

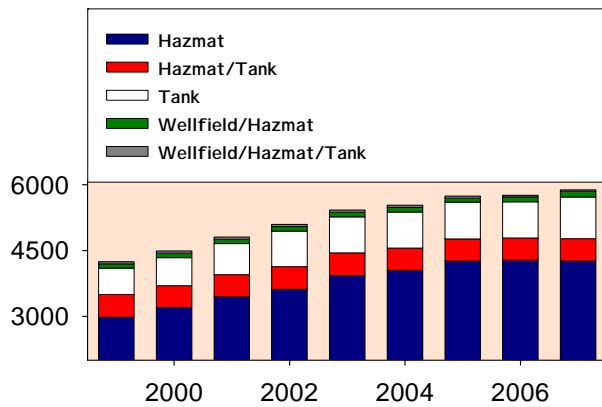


Endnotes for the Ground Water Quality Pressures benchmarks are on pages 77-78.

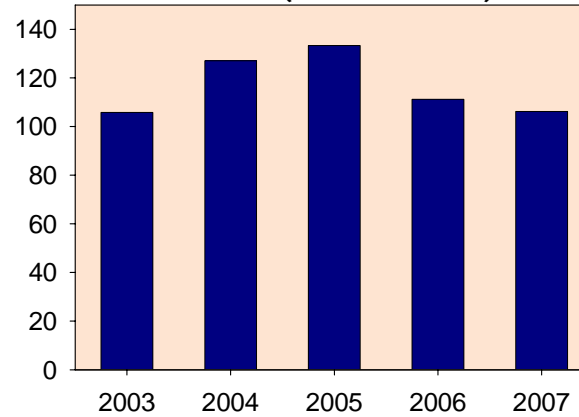
PRESSURES ON WATER QUALITY - Ground Water



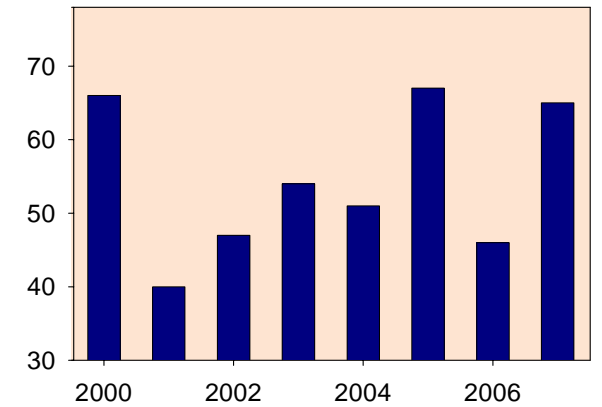
(B) Number of Hazardous Materials and Storage Tank Licenses



(C) Amount Hazardous Materials Hauled (Million Gallons)

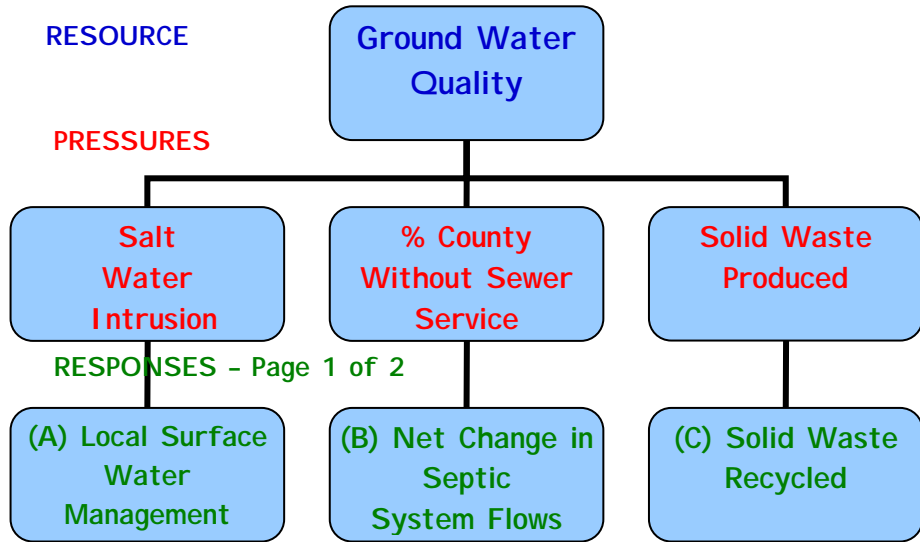


(D) Number of New Reported Discharges



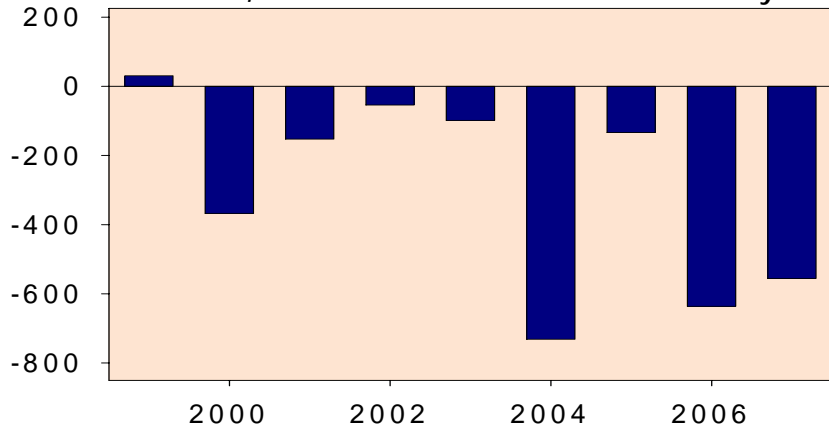
Endnotes for the Ground Water Quality Pressures benchmarks are on pages 79-80.

RESPONSES TO PRESSURES ON WATER QUALITY - Ground Water

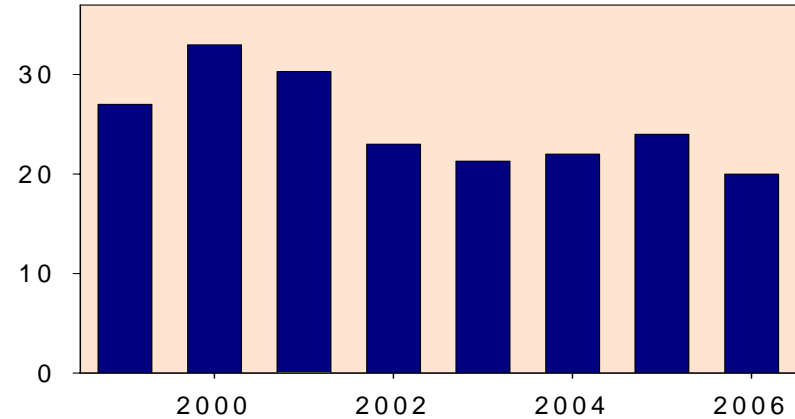


(A) Local Surface Water Management - Broward County has been investigating innovative ways to improve surface water management to increase storage and water quality treatment within the secondary canal system. Such improvements reduce pollutant loads to the Everglades and coastal ecosystems and serve to increase aquifer recharge. To learn more, read the endnote on page 80.

(B) Net Gain/Loss in Septic System Wastewater Flow, Thousands of Gallons/Day

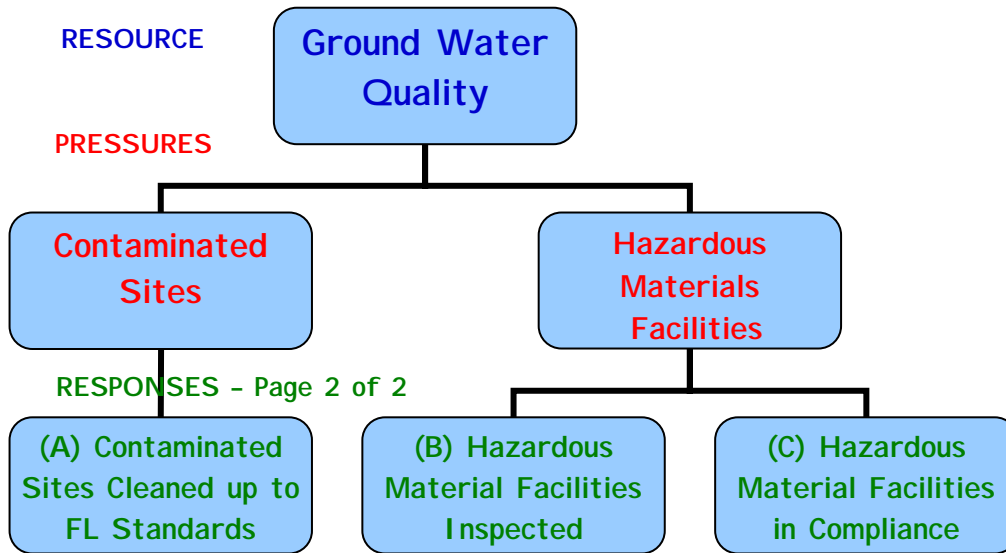


(C) Percent of Solid Waste Recycled

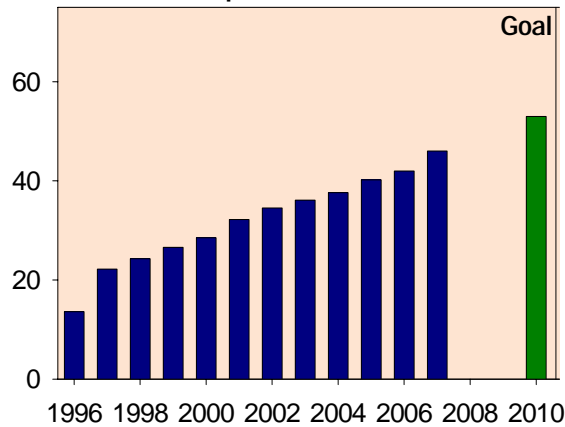


Endnotes for Ground Water Quality Response benchmarks may be found on pages 80-81.

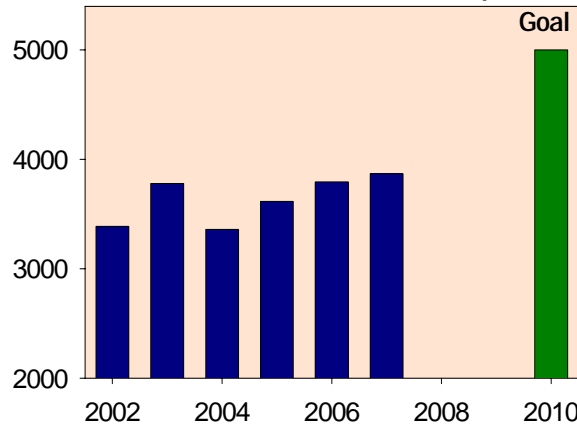
RESPONSES TO PRESSURES ON GROUND WATER QUALITY



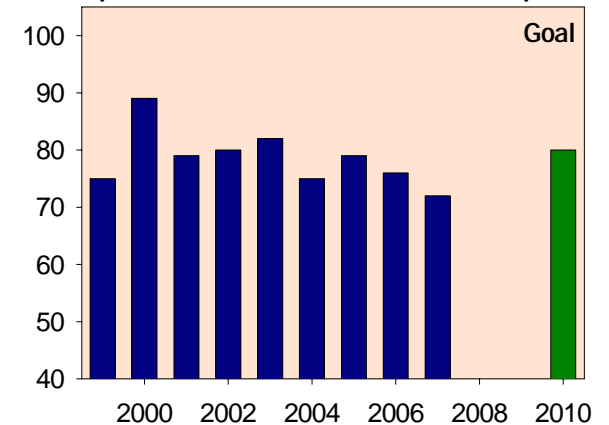
(A) Percentage of Contaminated Sites Cleaned Up to State Standards



(B) Number of Licensed Hazardous Material Sites Inspected

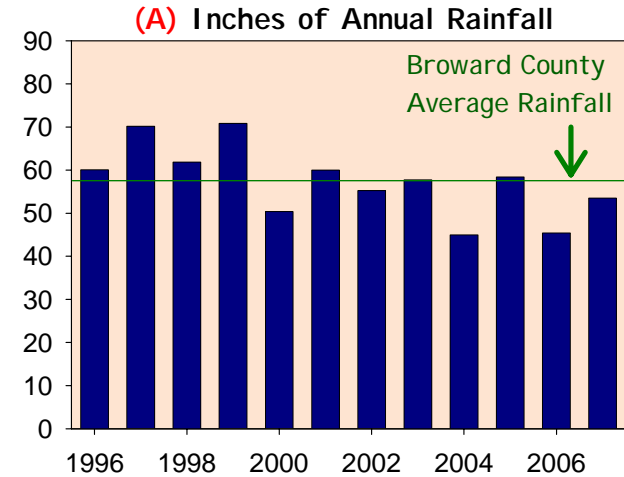
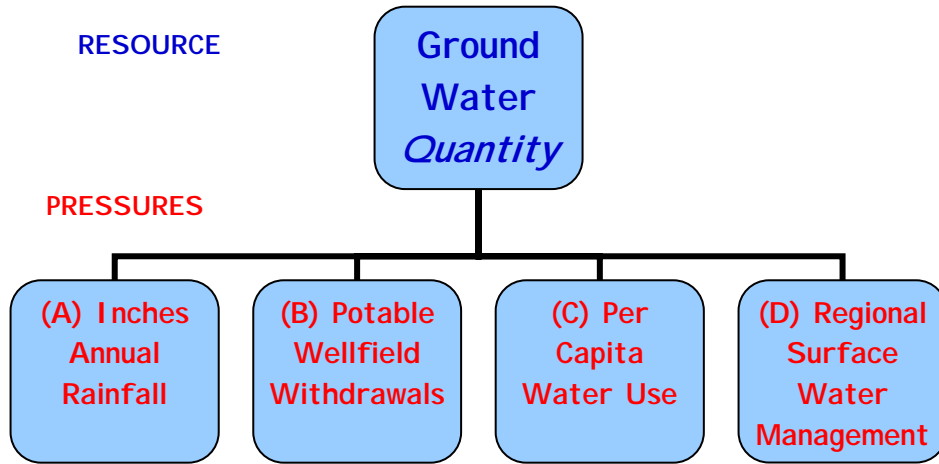


(C) Percent Licensed Hazardous Material Sites Inspected and Found to Be in Compliance

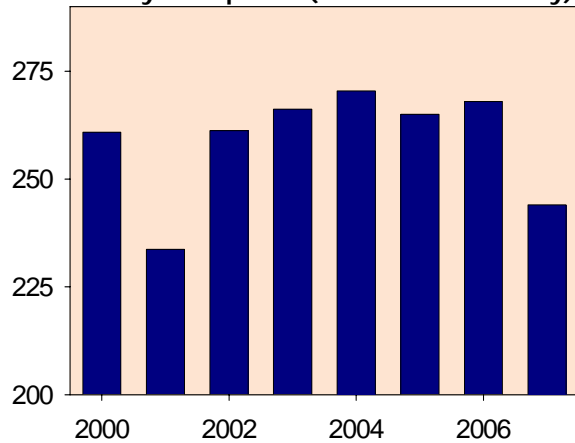


Endnotes for Ground Water Quality Response benchmarks may be found on page 82.

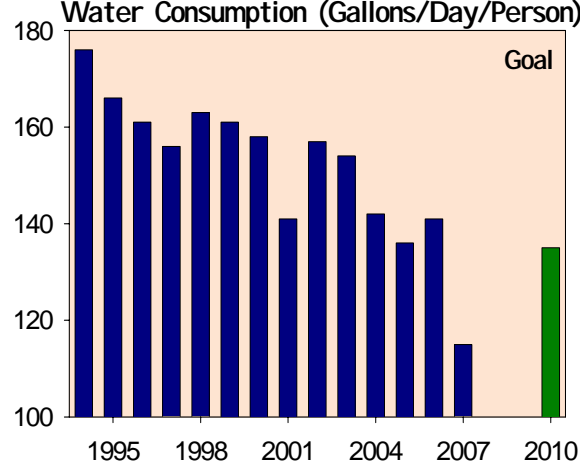
PRESSURES ON WATER QUANTITY - Ground Water



(B) Potable Wellfield Withdrawals from the Biscayne Aquifer (Million Gallons/Day)



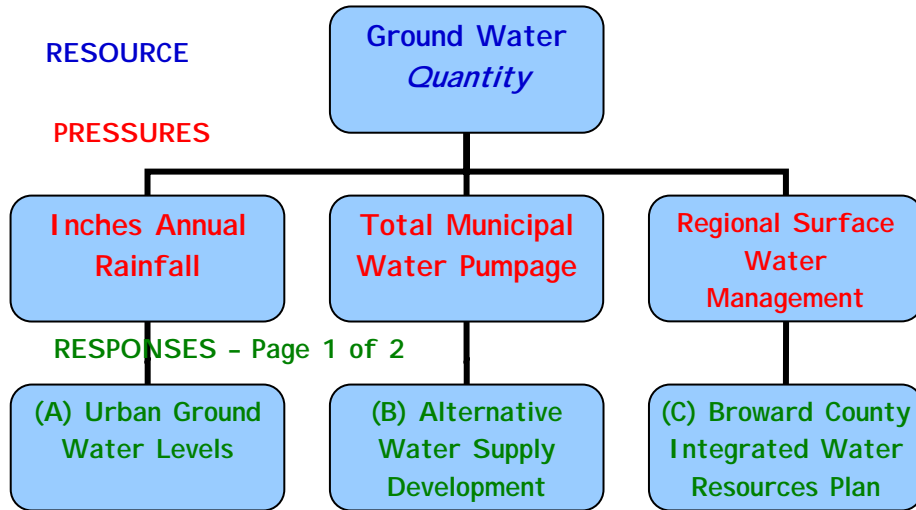
(C) Broward County Water and Wastewater Services Water Consumption (Gallons/Day/Person)



(D) Regional Surface Water Management - The Comprehensive Everglades Restoration Plan and recent policy changes at the SFWMD are reducing freshwater flows into urban Broward County. This may have impacts on local ground water levels, urban wetland systems and salt water intrusion. To learn more, read the endnote on page 85.

Endnotes for Ground Water Quantity Pressures may be found on pages 83-85.

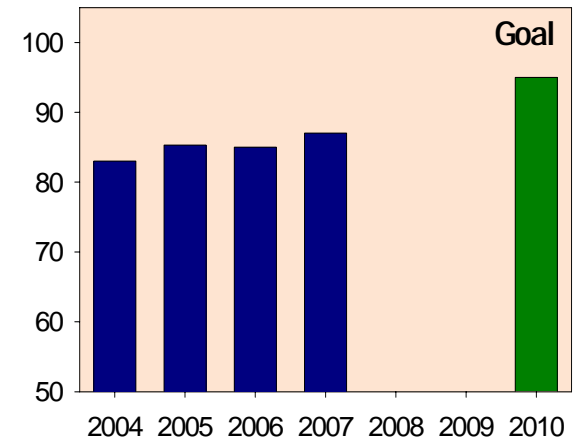
RESPONSES TO PRESSURES ON GROUND WATER QUANTITY



(A) Maintenance of Urban Ground Water Levels - Urban ground water levels are directly connected to the integrity of the Biscayne Aquifer, the health and function of urban wetlands, the operation of drainage infrastructure, and Everglades restoration. To learn more about efforts to maintain the ground water levels, read the endnote on page 86.

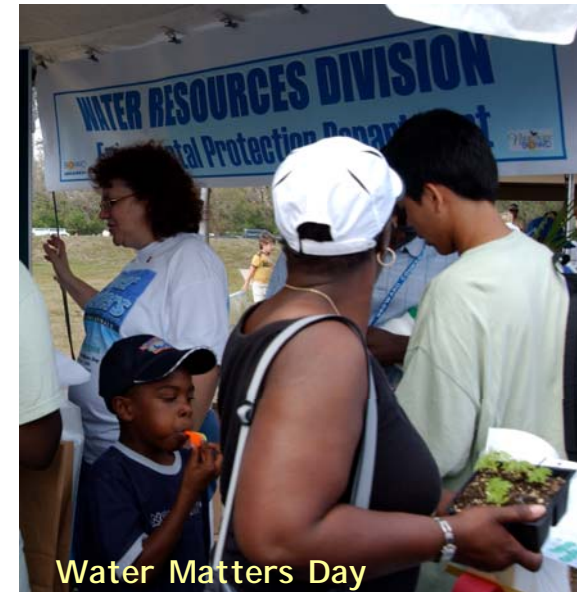
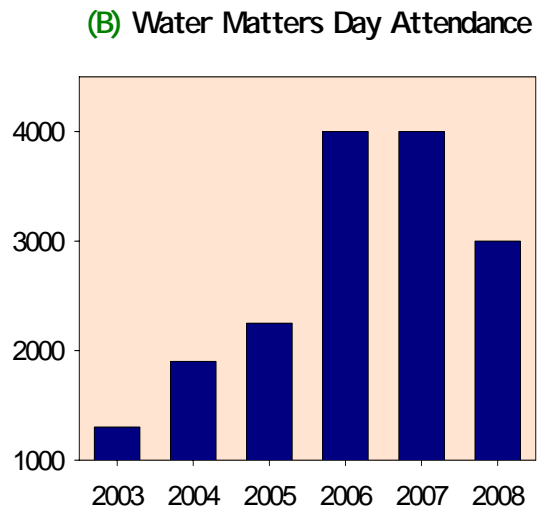
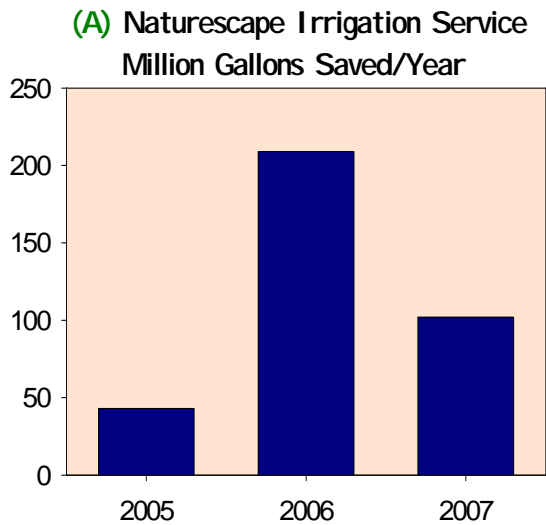
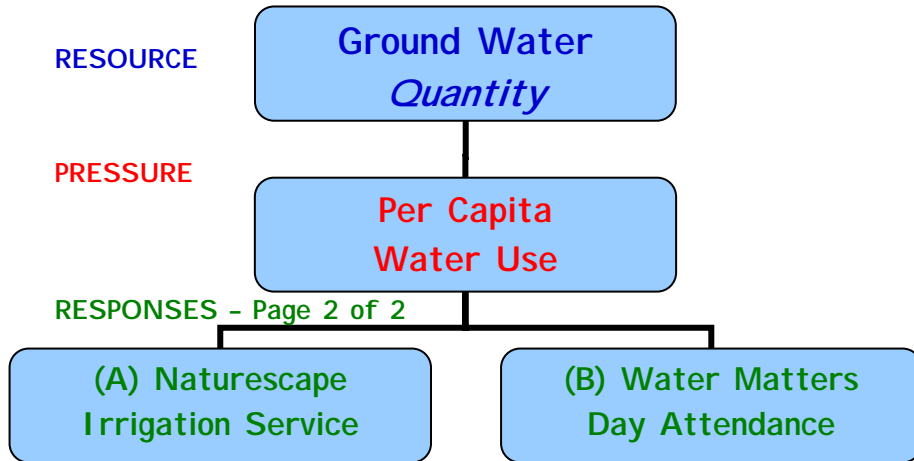
(B) Alternative Water Supply Development - Broward County will need a source of water to deliver an additional 100 million gallons of water each day to meet water demands projected for 2025. Due to the pressing need to reduce urban reliance on the Everglades system as a source of water, future water needs will not be met through traditional water supplies. As such, local water utilities are being urged to develop alternative water supplies, independent of the Biscayne Aquifer and the Everglades. To learn more, read the endnote on page 86.

(C) Percent Participation of Local Water Managers in County-wide Planning Efforts



Endnotes for Ground Water Quantity Response benchmarks may be found on pages 86-87.

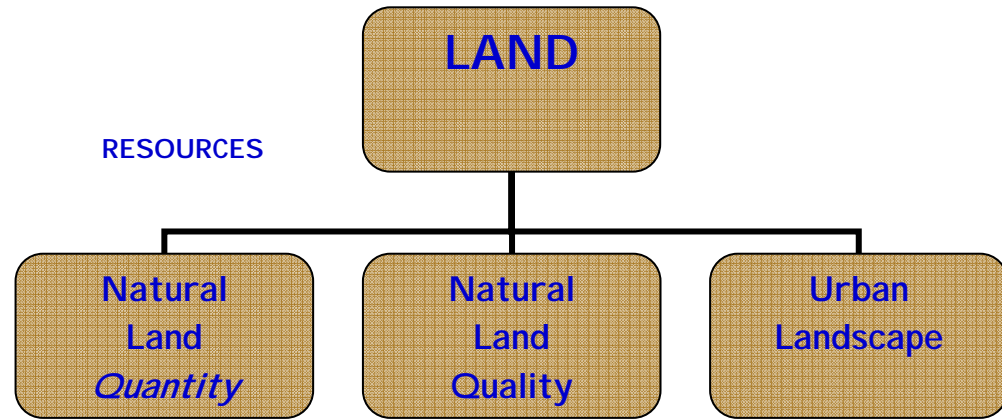
RESPONSES TO PRESSURES ON GROUND WATER QUANTITY



Endnotes for Ground Water Quantity Response benchmarks may be found on pages 88-89.

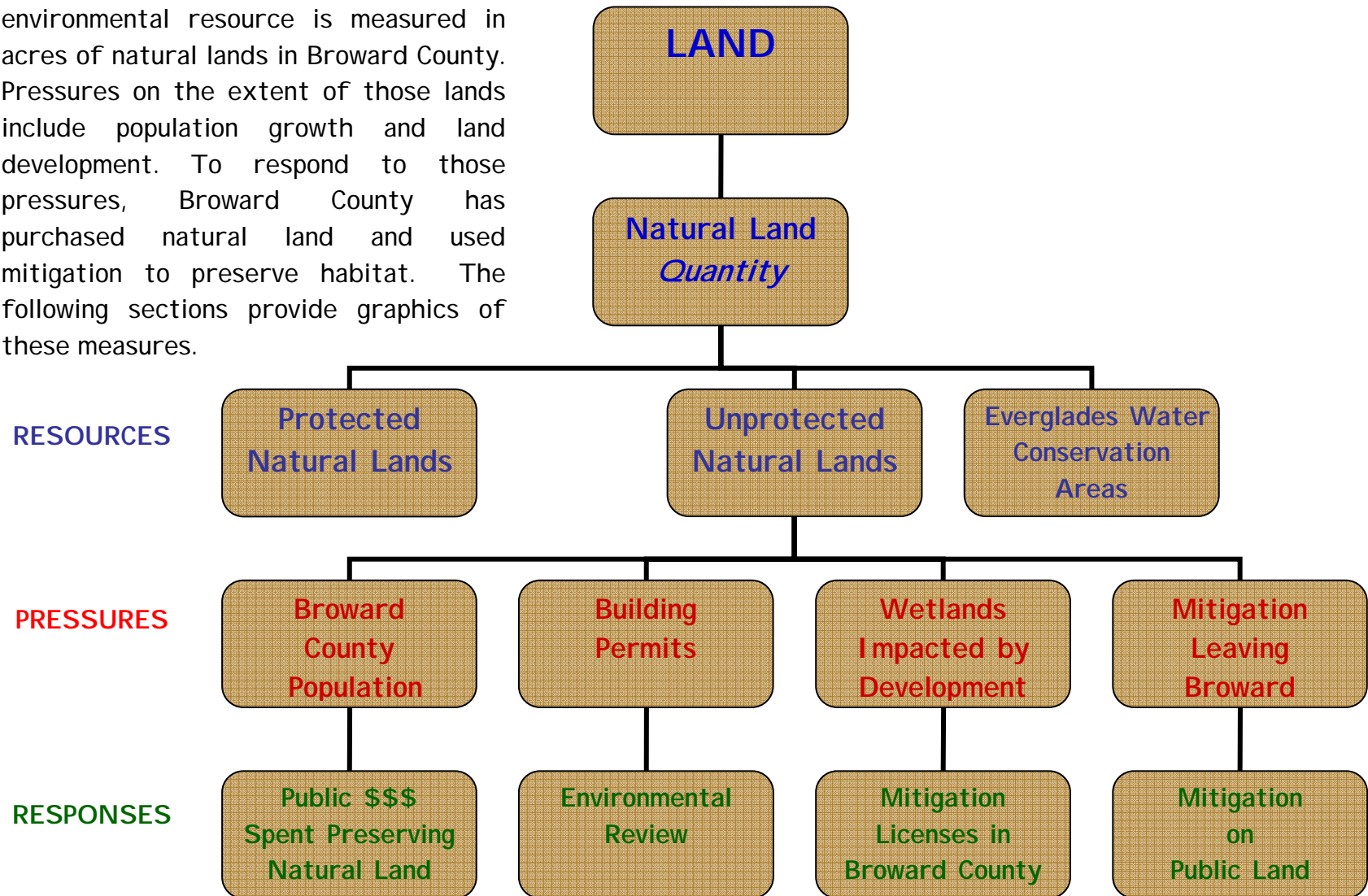
LAND

Land Resources – Our critical land resources include natural areas which preserve habitat (Quantity), the extent to which those lands reflect indigenous Florida plants and animals (Quality) and the Urban Landscape. This last resource encompasses how public and private entities create human and natural habitats integrated into the urban area.

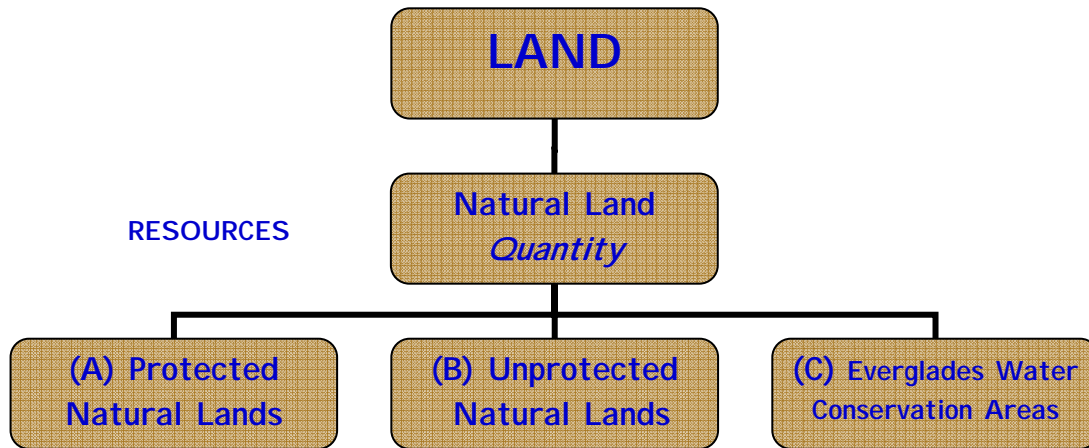


LAND RESOURCES - Natural Land *Quantity*

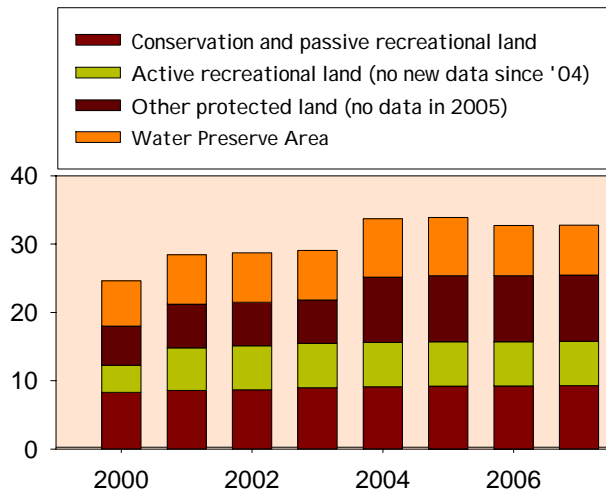
Natural Land Quantity - This environmental resource is measured in acres of natural lands in Broward County. Pressures on the extent of those lands include population growth and land development. To respond to those pressures, Broward County has purchased natural land and used mitigation to preserve habitat. The following sections provide graphics of these measures.



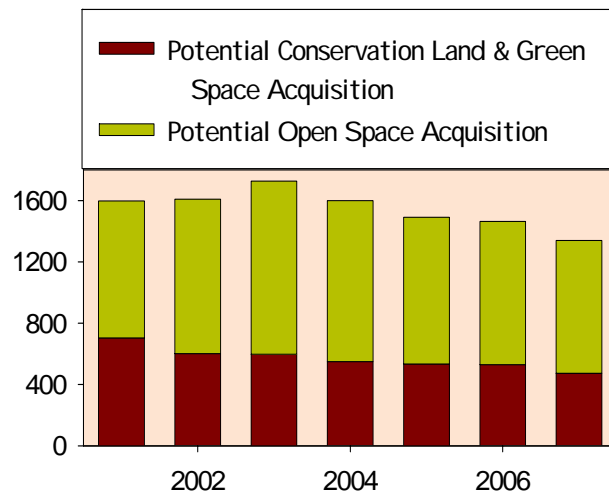
LAND RESOURCES - Natural Land *Quantity*



(A) Acres of Protected Lands, Thousands



(B) Acres of Unprotected (Developable) Land

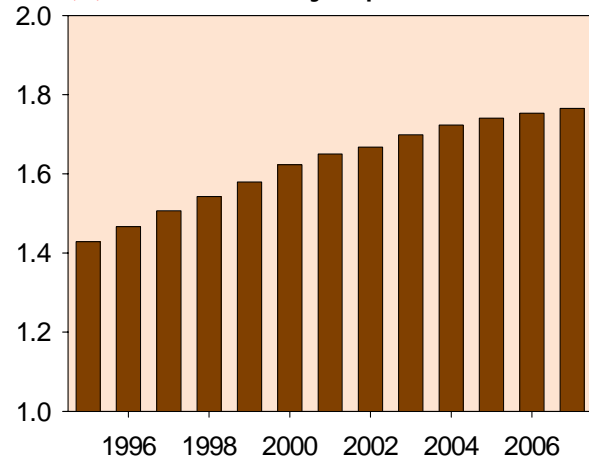


(C) Everglades Water Conservation Areas -
 Approximately two-thirds of Broward County lands exist as Water Conservation Areas (WCA's) in the Everglades. Four WCA's serve as a buffer between developed regions and the Everglades while providing wetland habitat. To learn more about WCAs, see the endnotes on page 91.

Endnotes for the Land Quantity Resource benchmarks are on pages 90-91.

PRESSURES ON NATURAL LAND QUANTITY

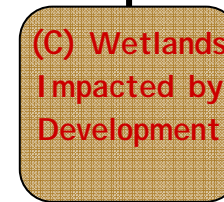
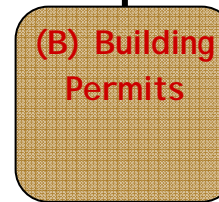
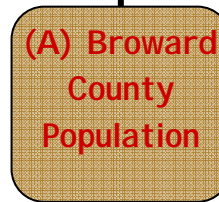
(A) Broward County Population, Millions



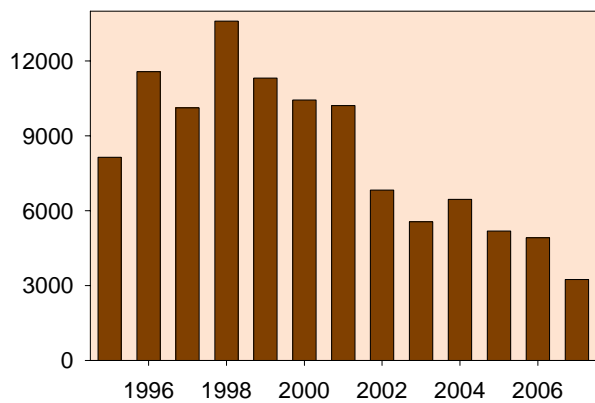
RESOURCE



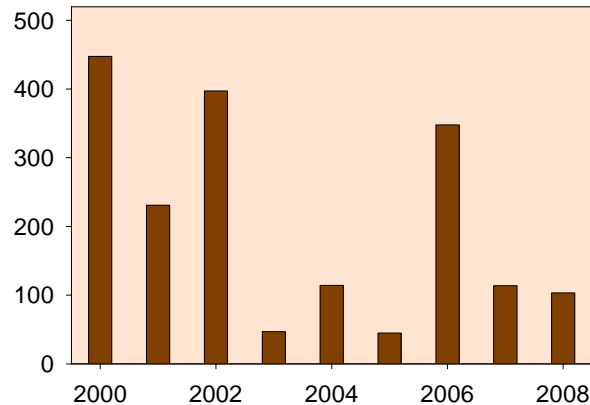
PRESSURES



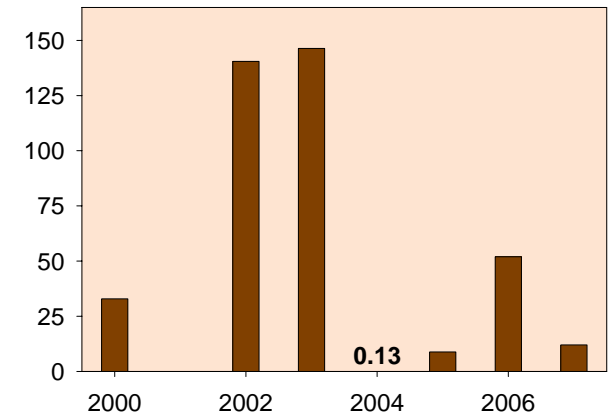
(B) Building Permits - New Structures/
Non-Residential Addition Approvals Issued



(C) Wetlands Impacted By Development, Acres

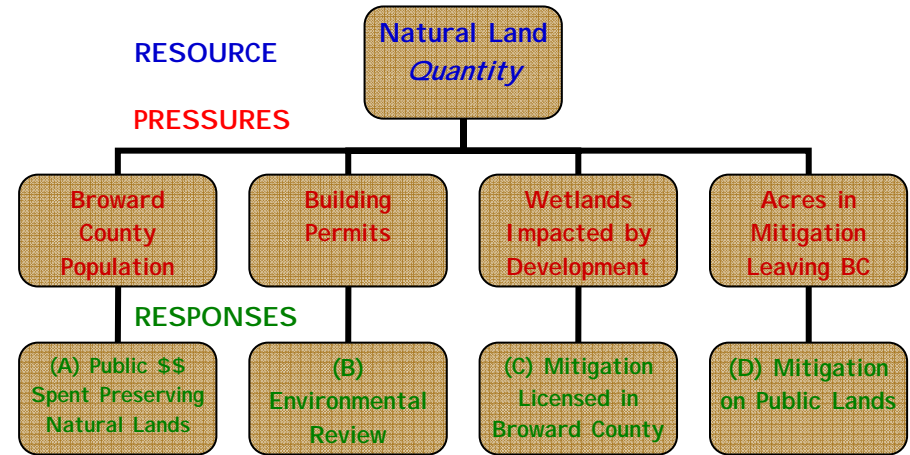
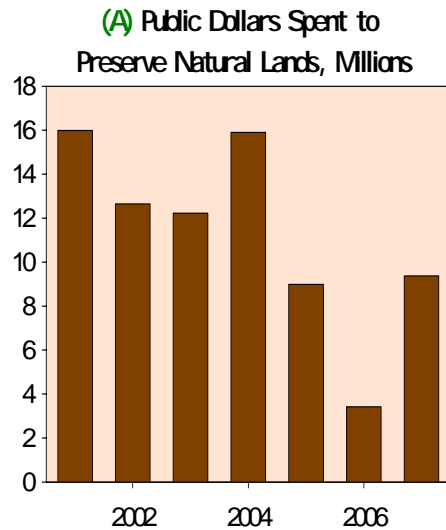


(D) Mitigation Leaving Broward County, Acres

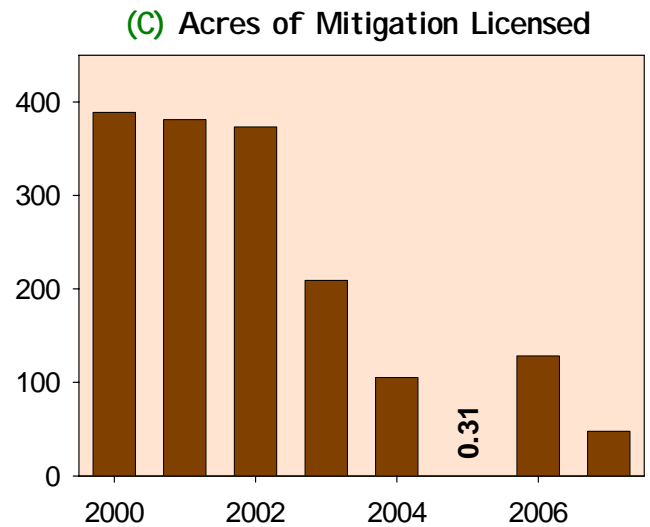


Endnotes for the Land Quantity Pressures benchmarks are on pages 92-93.

RESPONSES TO PRESSURES ON NATURAL LAND QUANTITY



(B) Environmental Review
 - All proposed developments are reviewed to ensure proper land use and to protect natural land resources from impacts. Wetland permitting ensures that mitigation for impacts is kept within Broward. For more information, see the endnotes on page 94.



(D) Mitigation on Public Lands - Wetlands provide recreation, habitat, water filtration and storage values that no other ecosystem can. Because of these values, Broward County tries to retain mitigation for impacts to wetlands as close to the impact as possible. Due to increasing limited mitigation areas, the County is attempting to utilize public lands as sites for wetland mitigation projects. For more information, see the endnotes on page 95.

Endnotes for the Land Quantity Response benchmarks are on pages 93-95.

LAND RESOURCES – Natural Land Quality

Natural Lands Quality – Broward County Parks and Recreation Division manages over 3,200 acres of lands preserved for their natural flora and fauna. Assessment of the “ecological health” of these natural areas is difficult. Many issues related to exotic species, hydrology and land management influence the quality of these lands. Broward County is protecting the natural land quality by implementing plans and programs designed to maintain or restore natural areas. To learn more about these issues, see the endnotes on page 95.



Photo by Eugene Breaux © 2002

RESOURCE

LAND

Natural Land Quality

PRESSURES

Invasive Exotic Vegetation

Natural Lands Under Hydrologic Stress

Fire Suppression on Natural Lands

RESPONSES

Resource Management Plans

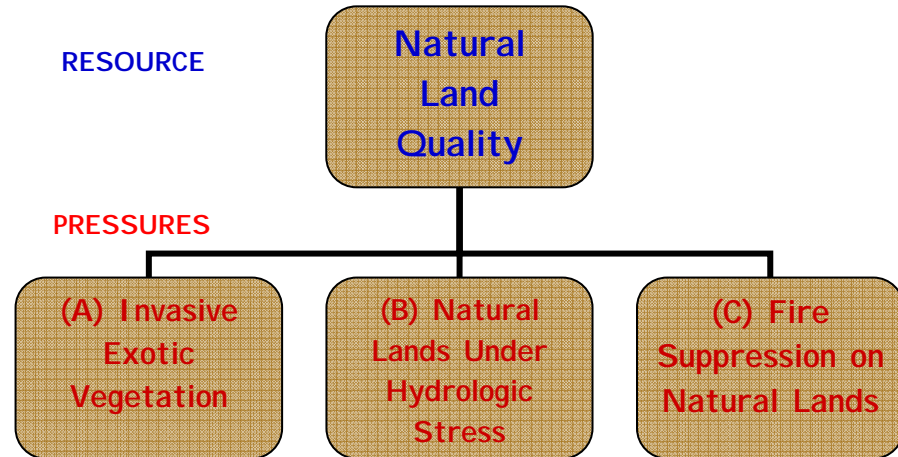
Land Stewardship

Comprehensive Everglades Restoration Plan

Restoring Hydrologic Function to Natural

Controlled Burn or Alternative Method

PRESSURES ON NATURAL LAND QUALITY



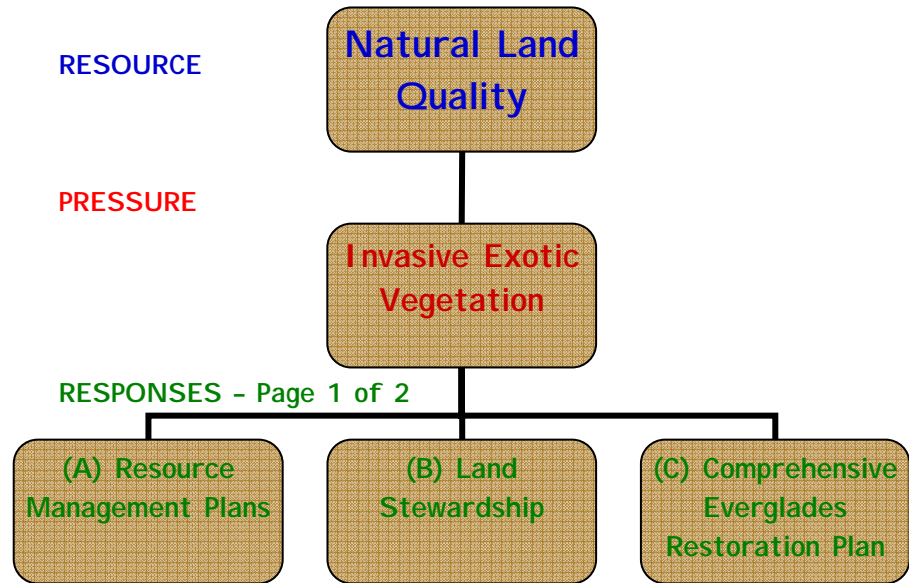
(A) Invasive Exotic Vegetation - Many species of plants from other countries have naturalized in Florida's subtropical climate. These non-native, invasive exotic plants provide less benefit to our ecosystem than do our native plants. The exotics have a high potential to crowd out indigenous vegetation that native Florida wildlife relies on for food and shelter. The problem is widespread from your backyard throughout the Everglades. To learn more, see the endnotes on page 96.

(B) Natural Lands Under Hydrologic Stress - Many natural wetland areas in Broward County have been altered by historical development and drainage practices. The construction of the canal systems altered the ground water level. While this provided flood protection for residents, it also impacted wetlands by depressing water levels necessary for maintaining wetland plant species. To learn more, see the endnotes on page 96.

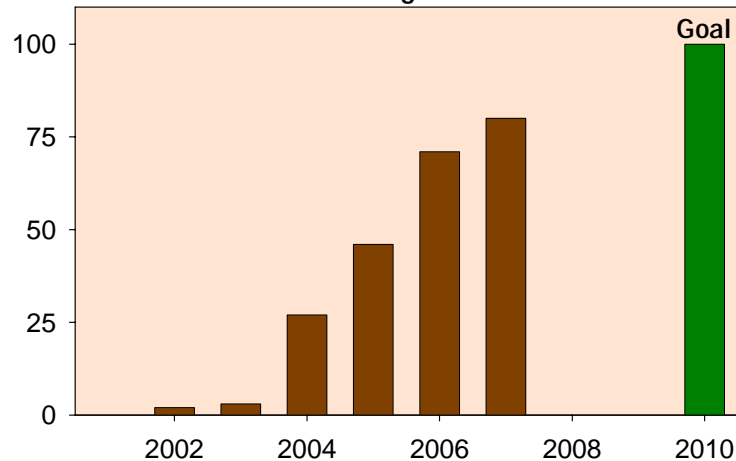
(C) Fire Suppression on Natural Lands - Fire has long been a factor in maintaining a healthy balance in certain South Florida ecosystems. However, prescribed burning in urban areas is difficult to accomplish without impacting local residents. Areas that have been without fire for long periods of time may accumulate a high fuel load and begin succession to a different type of habitat. To learn more about the need for prescribed burning, see the endnotes on page 97.

RESPONSES TO PRESSURES ON NATURAL LAND QUALITY

Resource Management Plans - For all acquired natural lands, Resource Management Plans are created to direct how the resources should be managed to ensure that they remain viable natural communities. These plans include securing the site, removing trash and debris, removing invasive exotic species, replanting native vegetation, and providing for public access. The resource management plans may include ecological restoration, re-watering of impacted wetland, or plans for burning fire dependent communities. Many sites already have plans in place (see graphic below). For more information, read the endnote on page 97.



(A) Percent of Municipal Natural Land Sites with Management Plans

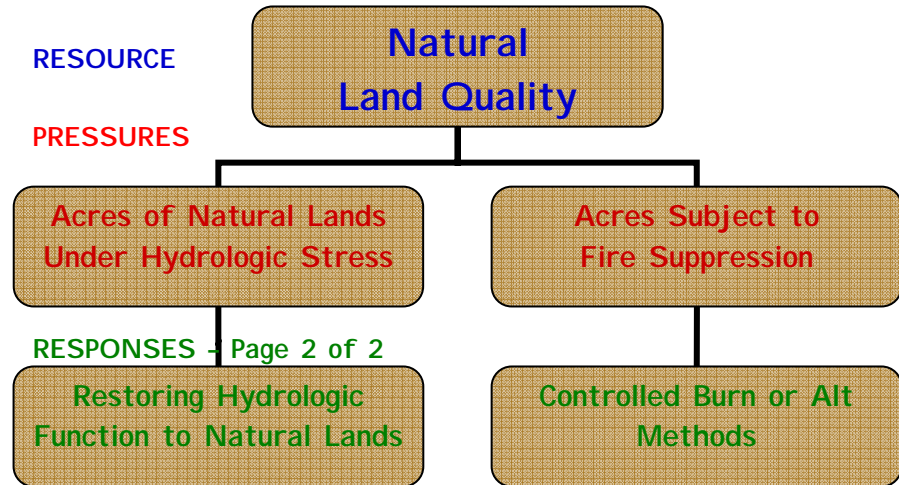


(B) Land Stewardship - Resource Management Plans are a small part of a larger effort to provide stewardship for the land. Other efforts include the initiation of two new grant programs "Parks for People" and "Partners in Preservation". The County recently created a land stewardship program. For more information, see the endnotes on page 97.

(C) Comprehensive Everglades Restoration Plan - While two-thirds represents a large quantity of Broward County lands established as conservation areas, the issue of quality must be considered. The function and water quality of WCA's are being addressed through projects undertaken as a part of the Comprehensive Everglades Restoration Plan. For more information, see the endnotes on page 98.

Endnotes for the Land Quality Response benchmarks are on pages 97-98.

RESPONSES TO PRESSURES ON NATURAL LAND QUALITY



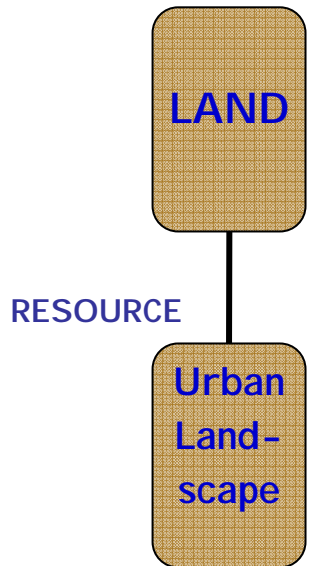
Restoring Hydrologic Function to Natural Lands - Many natural wetland areas in Broward County have been altered by historical development practices and other drainage alterations. Broward County has undertaken efforts to restore hydrologic function to some of the damaged wetlands. Pumps are being installed to increase water flow to the wetlands and raise ground water levels to support native wetland plants. To learn more, read the endnote on page 98.



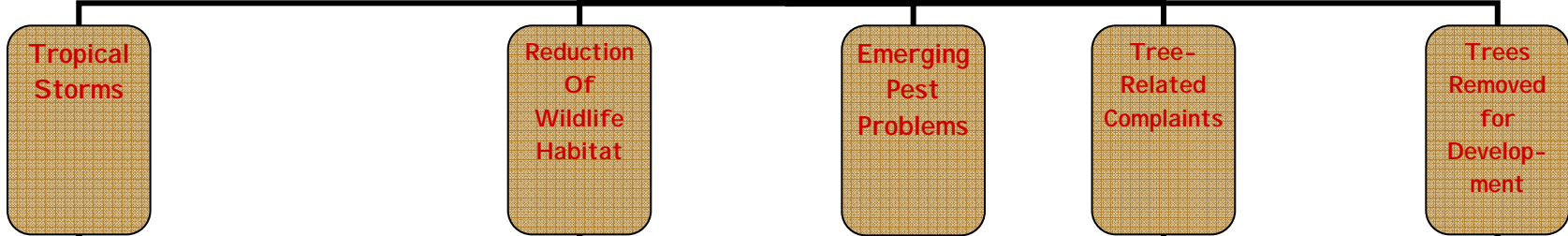
Controlled Burn or Alternative Management Methods - Prescribed burning accomplishes many land management objectives including reducing the risk of wildfires while recycling nutrients into the soil. Native fire-tolerant species, including wildflowers and grasses, become established in open areas created by fires thus increasing the overall diversity of the plant community. To learn more, read the endnote on page 99.

LAND RESOURCES – URBAN LANDSCAPE

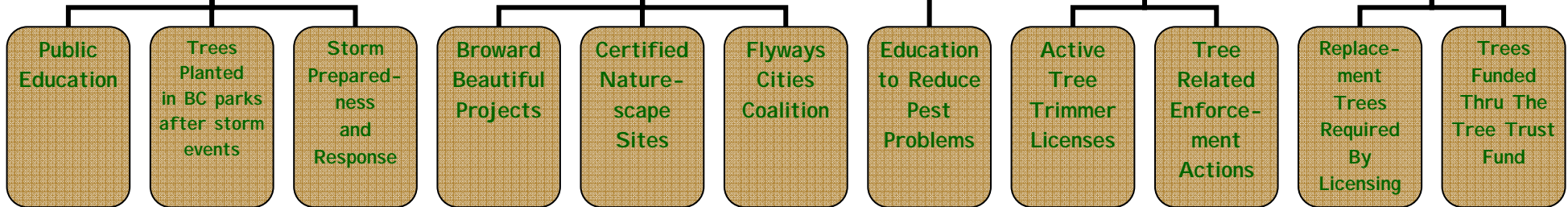
(A) **Urban Landscape** - The trees in the median, the sod in the swales, and the flowers in your garden all contribute to the urban landscape. Both natural and urban forces such as tropical storms, pests, habitat and tree loss impact the urban landscape. Broward County has many educational, regulatory and incentive programs to maintain the aesthetic and ecological value of the urban landscape. To learn more, see the endnotes on page 99.



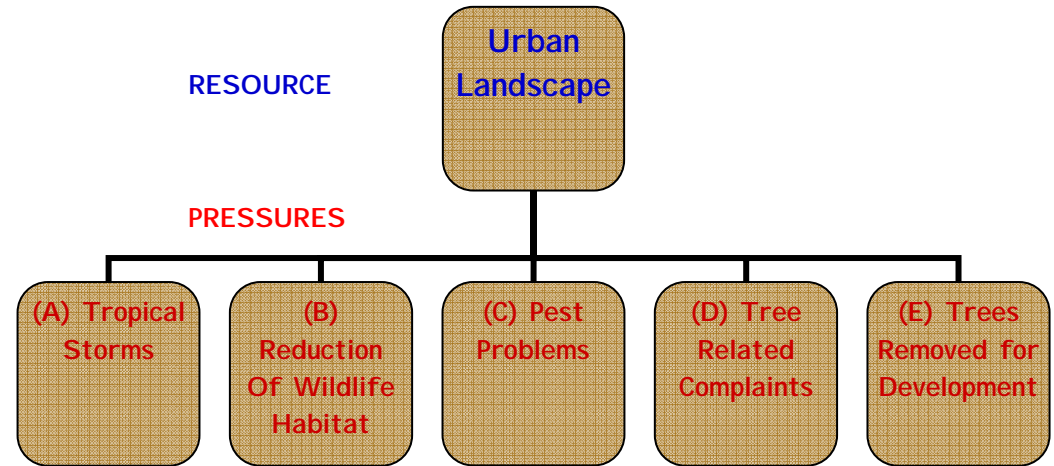
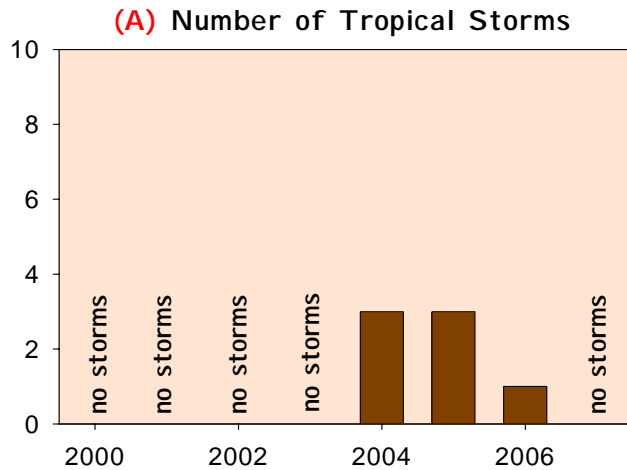
PRESSURES



RESPONSES



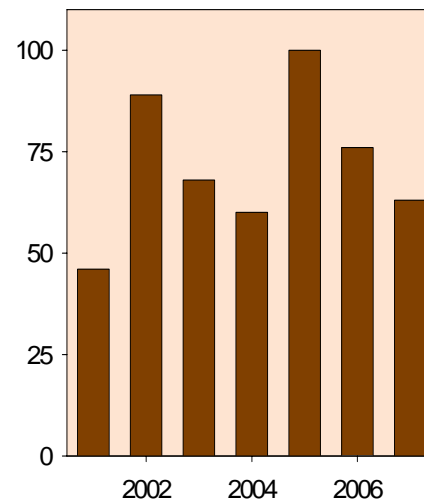
PRESSURES ON URBAN LANDSCAPE



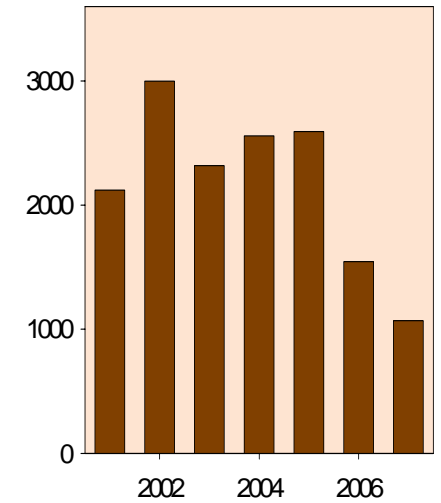
(B) Reduction of Wildlife Habitat - Continued development across Broward County reduces natural lands and vacant areas needed to provide habitat for wildlife. The indirect consequences of habitat loss and fragmentation may carry grave consequences for animal welfare and for conservation. For more information, read the endnotes on page 101.

(C) Emerging Pest Problems - Exotic insects, lac scale and other infestations upon the health of the urban landscape have been increasing in recent years. Native vegetation often has no natural defenses against these introduced pests. For more information, read the endnotes on page 101.

(D) Number of Tree Related Complaints



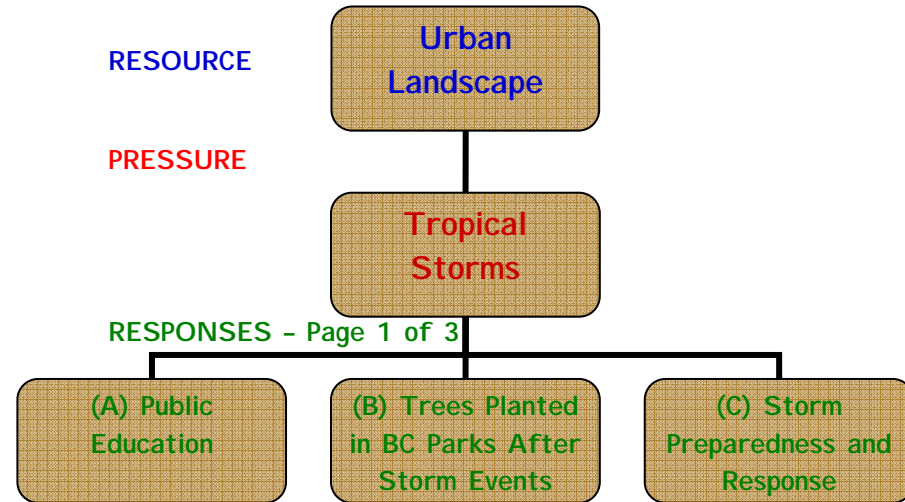
(E) Number of Trees Licensed for Removal



Endnotes for the Urban Landscape Pressure benchmarks are on pages 100-102.

RESPONSES TO PRESSURES ON URBAN LANDSCAPE

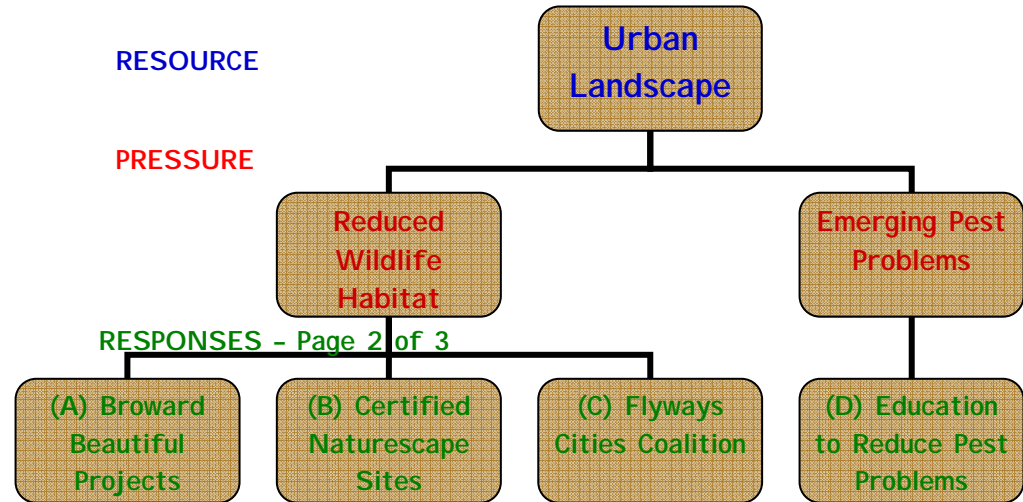
(A) Public Education - In response to urban forestry issues following Hurricane Wilma, the Broward County Environmental Protection Department (now the Environmental Protection and Growth Management Department) created the "Trees After the Storm - Replanting Storm-Safe Trees" web-site to answer frequently asked tree questions, sponsored the Broward Beautiful Trees & Hurricane Impact Summit, purchased and distributed 30,000 Florida Urban Forestry Council brochure posters Right Tree Right Place - Selecting and Planting Trees for the South Florida Urban Forest Brochures, and created the NatureScape publication "Gone With The Wind...Storm." For more information, see the endnote on page 103.



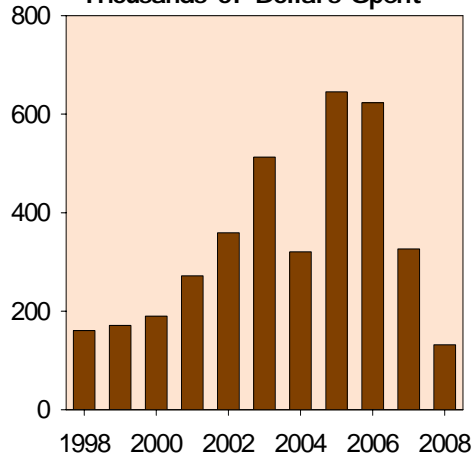
(B) Trees Planted in Broward County Parks After Storm Events - Many trees which provide shade and scenery for Broward County park users were lost due to recent tropical storms. Since 2005, the Parks and Recreation Division has replaced over 10,000 trees with species that can better withstand future storms. To learn more, read the endnote on page 103.

(C) Storm Preparedness and Response- Recent tropical storms had a large impact on the County's tree canopy. The County suspended the tree licensing program, provided public education and allocated funds to replace lost trees. To learn more, read the endnote on page 104.

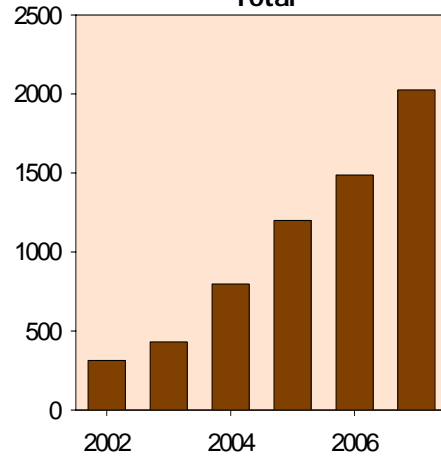
RESPONSES TO PRESSURES ON URBAN LANDSCAPE



(A) Broward Beautiful Projects, Thousands of Dollars Spent

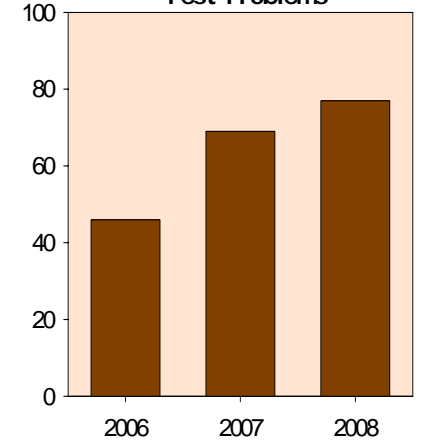


(B) Certified Naturescape Sites, Total



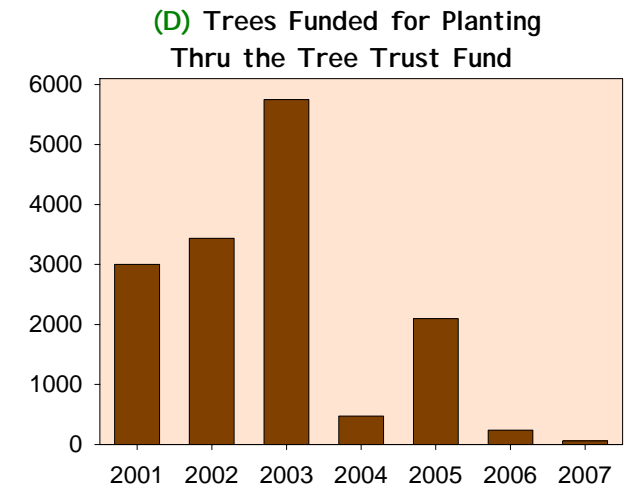
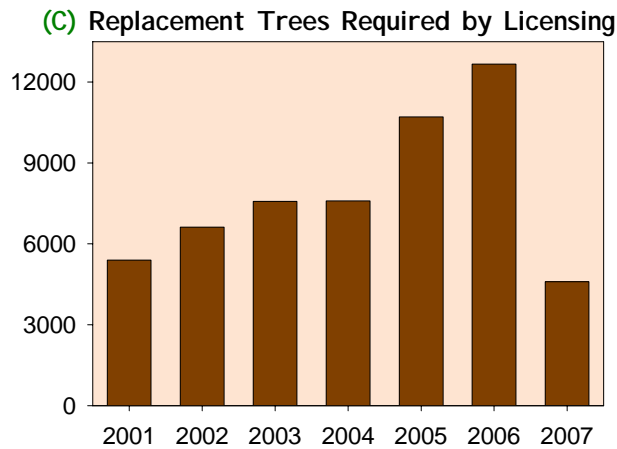
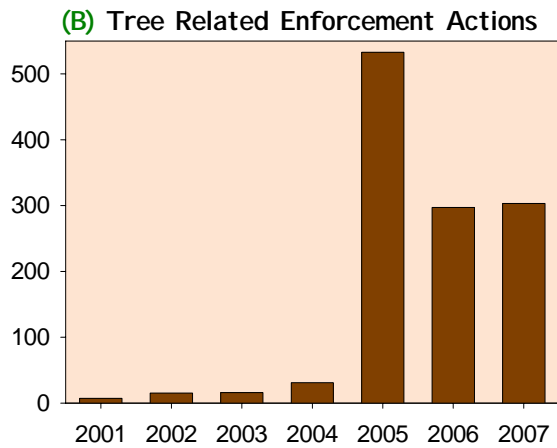
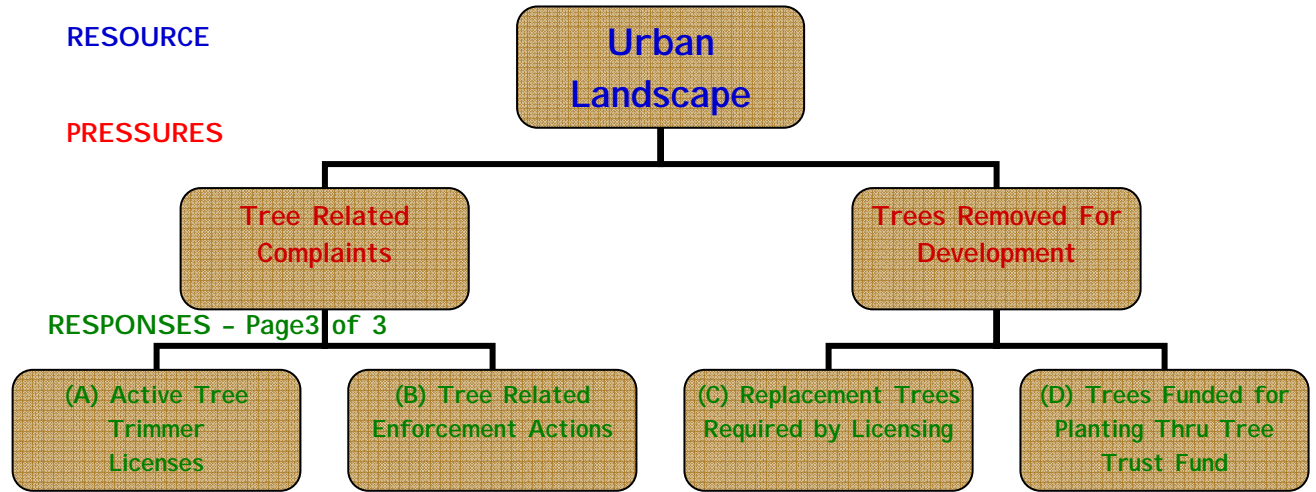
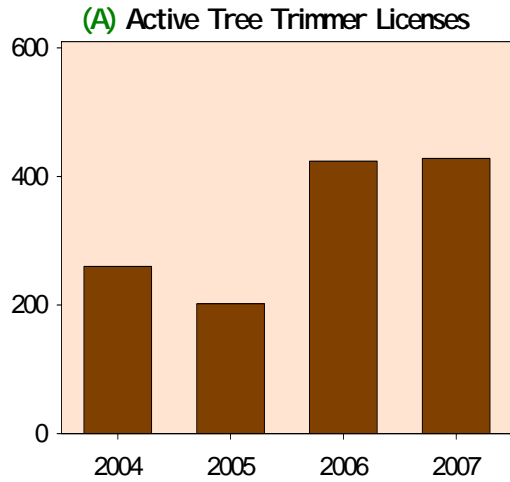
(C) Greater Ft. Lauderdale Flyways Cities Coalition- Flyways are corridors of bird migration. They feature sites that offer food, shelter, and areas for congregation. The Coalition goals include improving key habitats and encouraging community stewardship of flyways. To learn more, read the endnote on page 105.

(D) Educational Events to Reduce Pest Problems



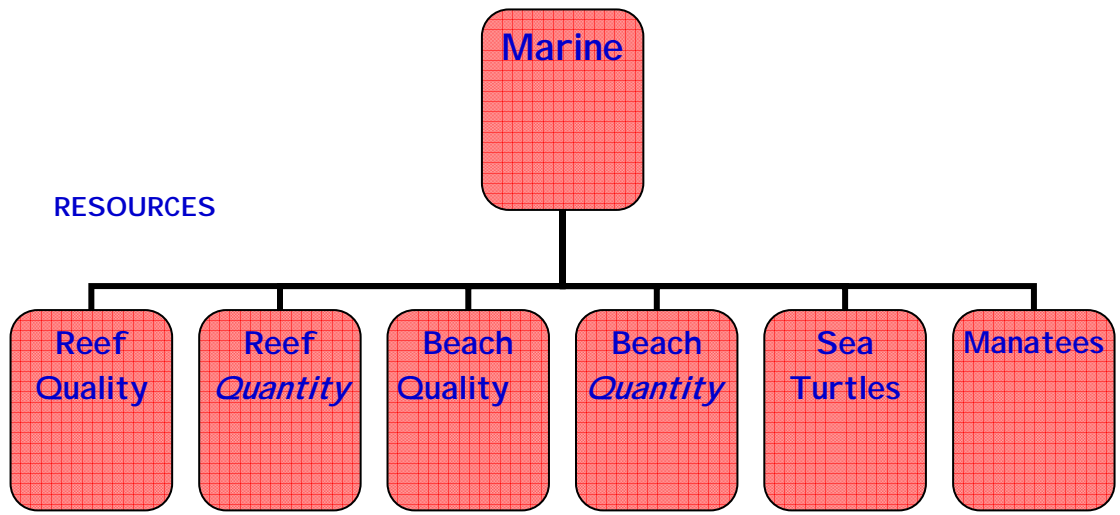
Endnotes for the Urban Landscape Response benchmarks are on pages 104-106.

RESPONSES TO PRESSURES ON URBAN LANDSCAPE



Endnotes for the Urban Landscape Response benchmarks are on pages 107-108.

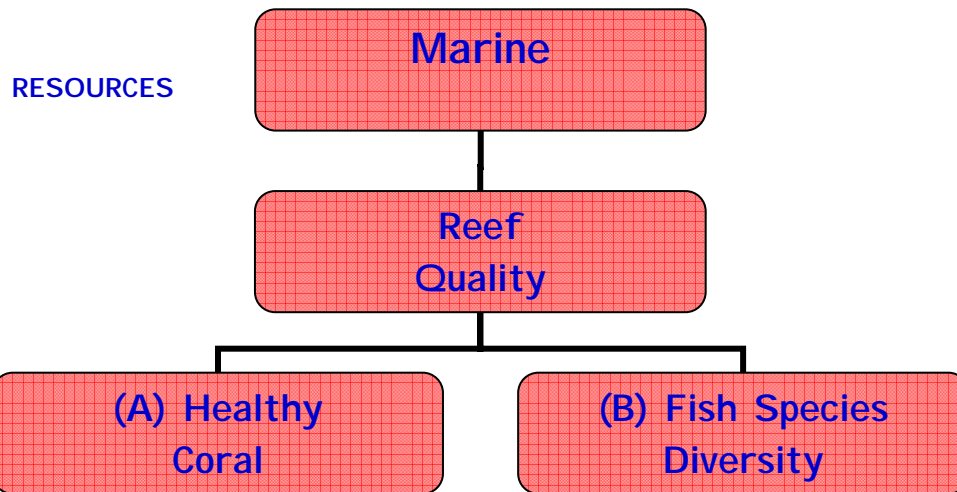
MARINE RESOURCES



Marine Resources - The coastal environmental of Broward County is a major contributor to our quality of life and our economy. The beach and coral reefs provide natural habitat, tourism destinations and protection from storms. These marine resources include endangered sea turtles and manatees.

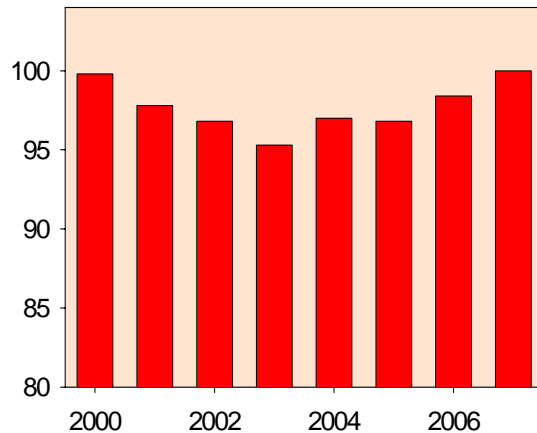


MARINE RESOURCES - Reef Quality

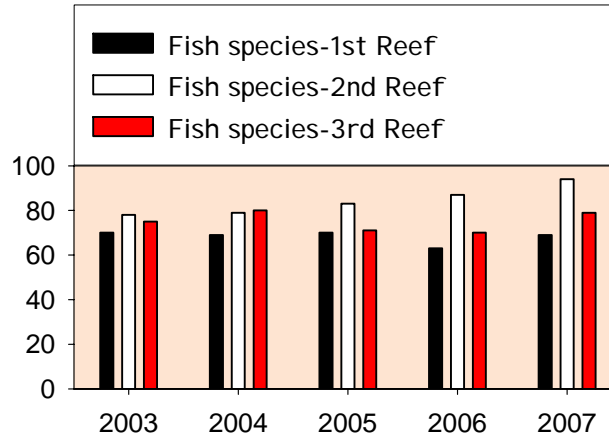


Coral Reefs - Coral reefs and their associated sea life are important natural resources for recreational fishing and diving industries in Broward County. The sound ecological condition of the reef community is a key indicator of the general condition of all marine resources of the Broward coastline.

(A) Percent Healthy Coral

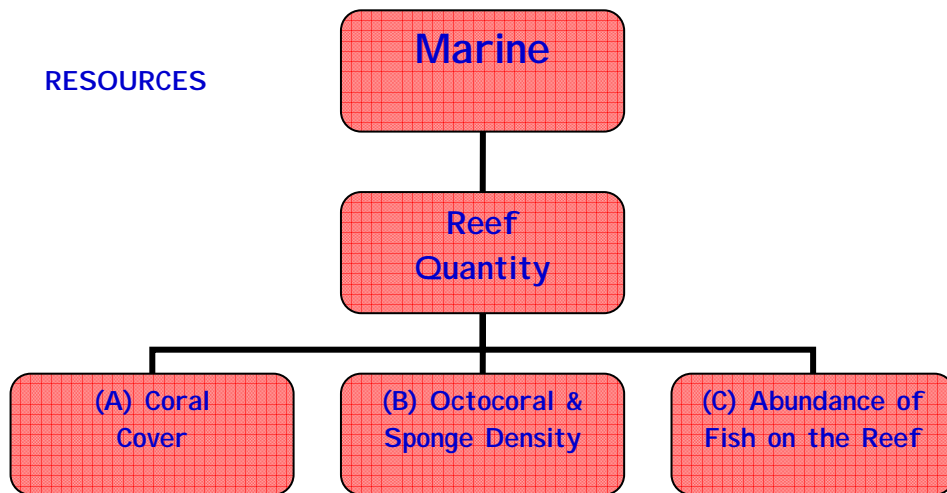


(B) Number of Fish Species Observed on the Reef

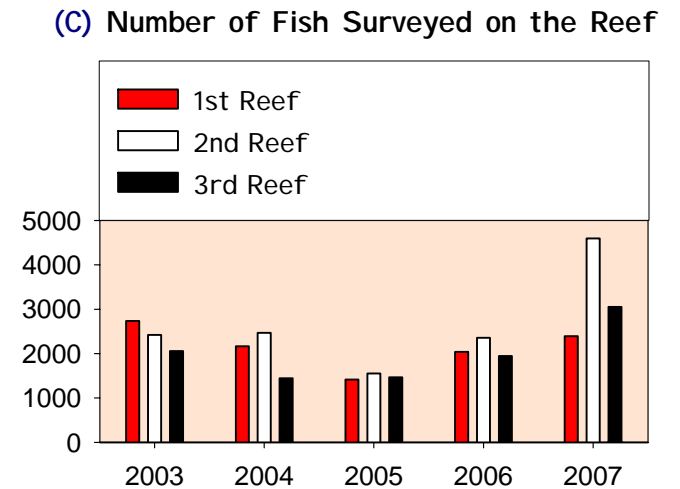
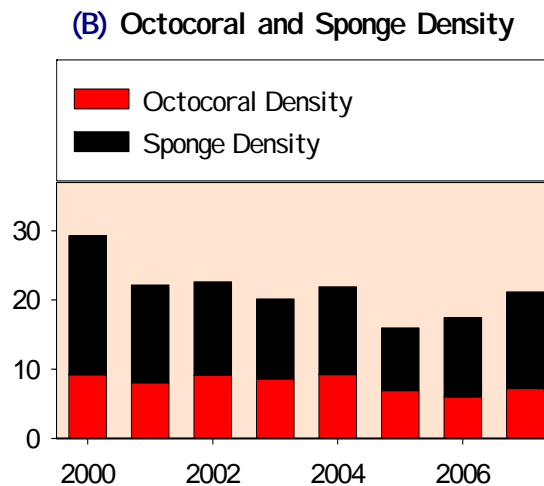
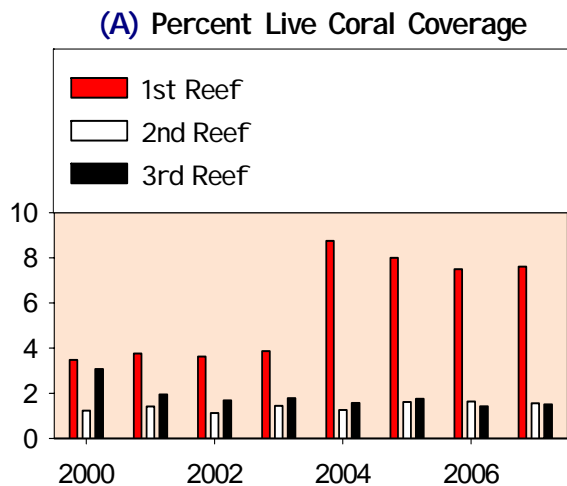


Endnotes for the Reef Resource benchmarks are on pages 108-109.

MARINE RESOURCES – Reef Quantity

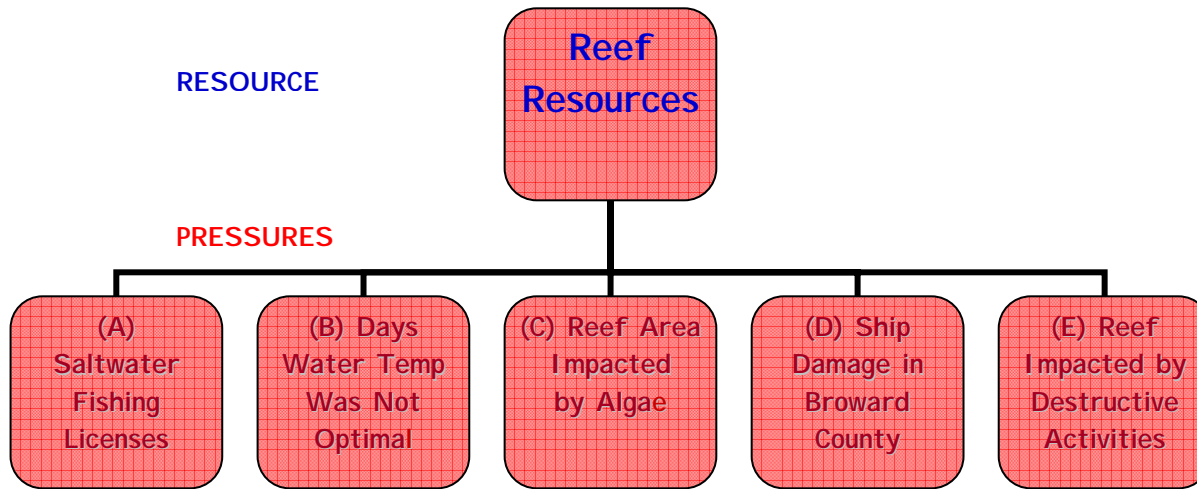


Coral Reefs - The abundance of corals, sponges, and fish are dependent upon the structure of the reef, the water quality and conditions around the reefs. All of these components are important to create a functional ecosystem. In Broward County, three reefs run parallel to the shoreline at various depths.

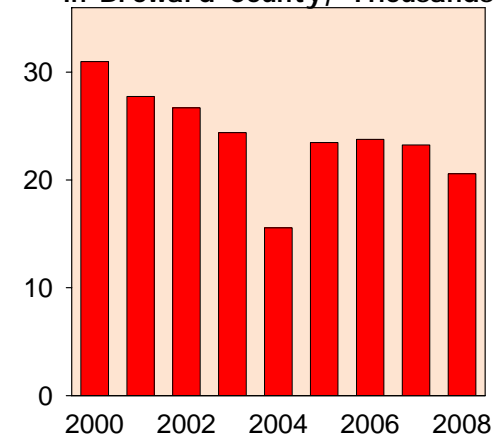


Endnotes for the Reef Resource benchmarks are on pages 109-110.

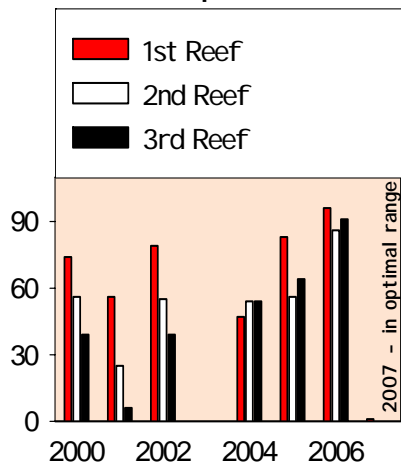
PRESSURES ON REEF RESOURCES



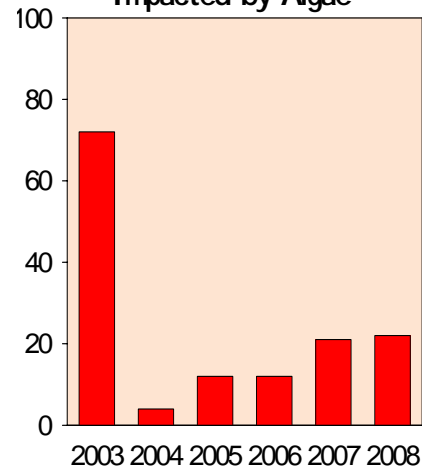
(A) Saltwater Fishing Licenses Issued in Broward County, Thousands



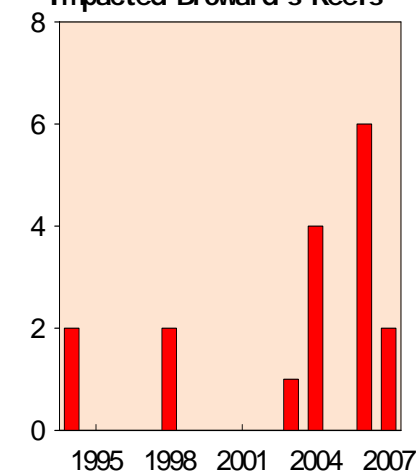
(B) Number of Days Water Temperature Was Not Optimal for Corals



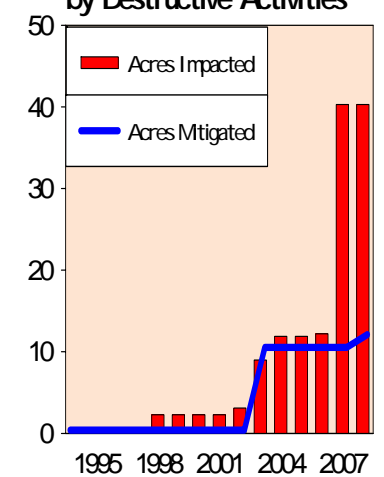
(C) Percent Reef Monitoring Sites Impacted by Algae



(D) Number of Times Ship Damage Impacted Broward's Reefs

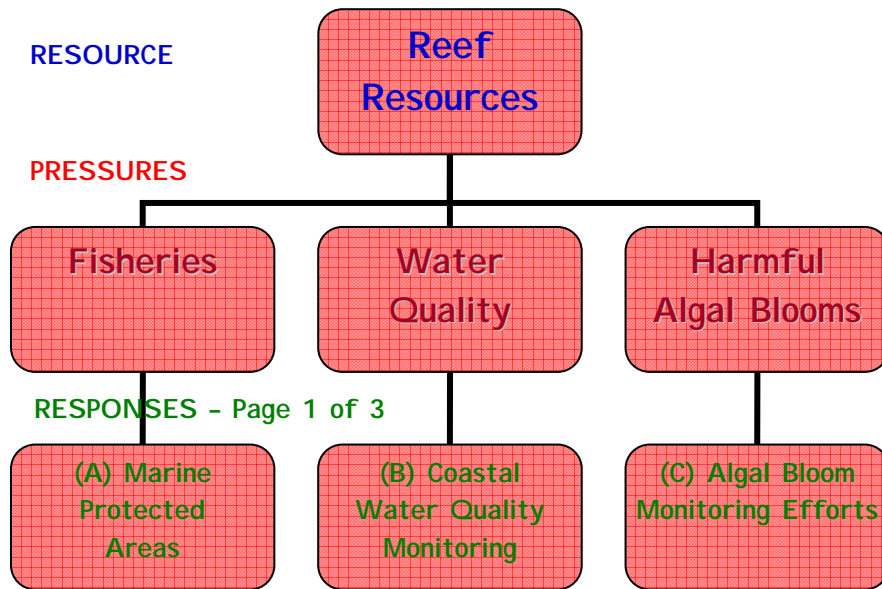


(E) Cumulative Acres of Reef Impacted by Destructive Activities



Endnotes for the Reef Resource Pressure benchmarks are on pages 110-114.

RESPONSES TO PRESSURES ON REEF RESOURCES



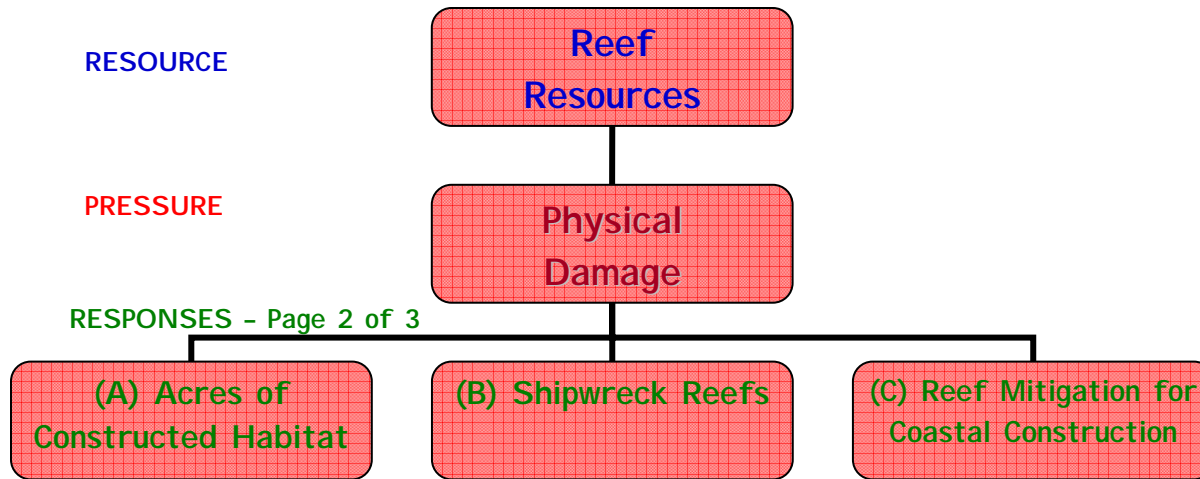
(A) Marine Protected Areas - MPAs have been used effectively to conserve biodiversity, manage natural resources, protect endangered species, reduce user conflicts, provide educational and research opportunities, and enhance commercial and recreational activities in other areas. MPAs are a tool that could be used to preserve Broward's reefs. Florida Department of Environmental Protection's Southeast Florida Coral Reef Initiative has developed local strategies for managing coral reef resources in SE Florida including evaluating the potential of a scientifically-based marine zoning plan. To do this, they will identify criteria useful for zoning reef resources as special, sensitive and representative areas needing enhanced management through local input in order to develop zoning alternatives by county. To learn more, read the endnotes on page 114.

(B) Coastal Water Quality Monitoring - Broward County has initiated a Coastal Water Quality Monitoring Program to generate baseline data to better understand how stormwater flows from inlets and other discharges influence the water quality reaching our reefs. Currently four sites are monitored including one at the mouth of Port Everglades. To learn more, read the endnotes on page 115.

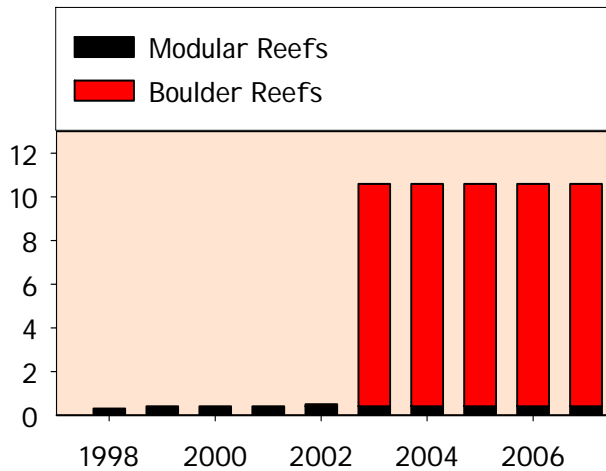


(C) Algal Bloom Monitoring Efforts - Twenty five sites off Broward County are monitored annually for the presence of algal blooms. To learn more, read the endnotes on page 115.

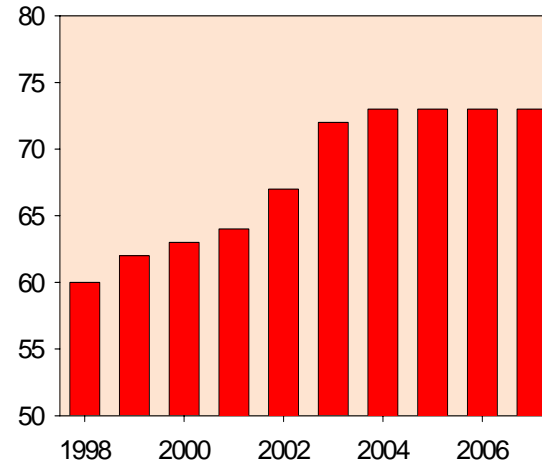
RESPONSES TO PRESSURES ON REEF RESOURCES



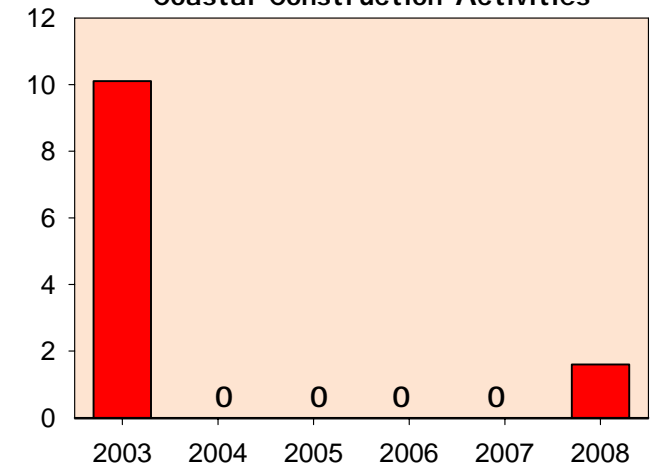
(A) Acres of Constructed Habitat



(B) Number of Shipwreck Reefs

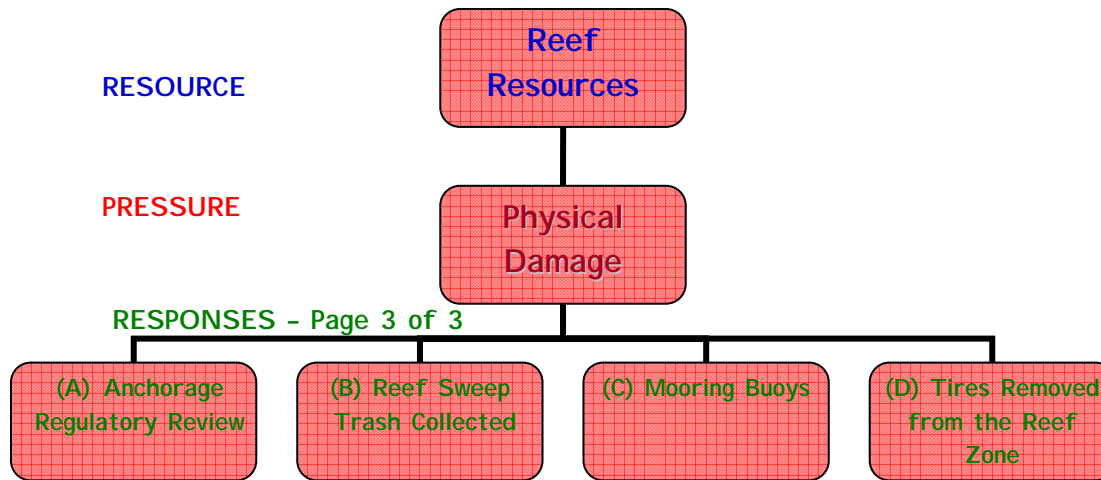


(C) Acres of Reef Mitigation for Coastal Construction Activities



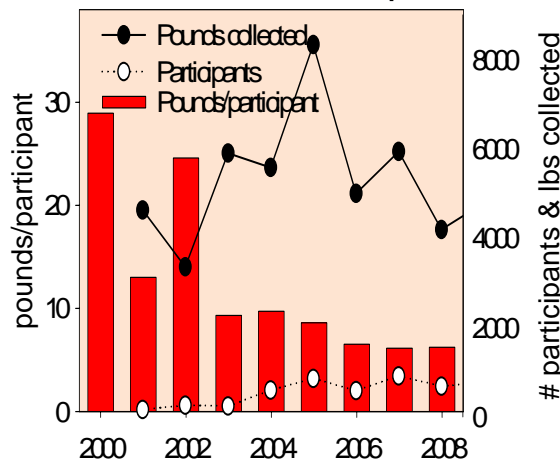
Endnotes for the Reef Resource Response benchmarks are on pages 115-116.

RESPONSES TO PRESSURES ON REEF RESOURCES

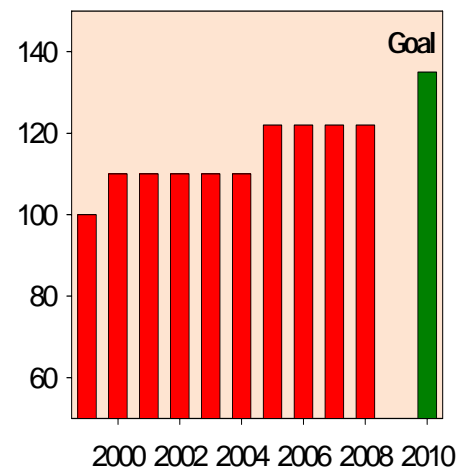


(A) Anchorage Regulatory Review -
Following numerous ship groundings on the reefs, Broward County staff requested that the Coast Guard review the current location and extent of the ship anchorage outside of Port Everglades. A change in the boundaries has been made which provides greater protection of Broward's reef resources. To learn more, read the endnote on page 116.

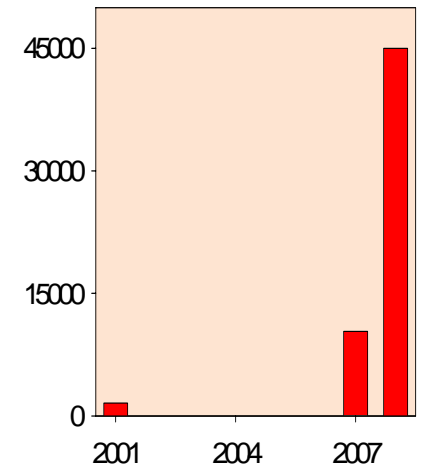
(B) Marine Debris Clean-up Campaigns, Pounds of Litter Collected/Participant/Event



(C) Number of Mooring Buoys

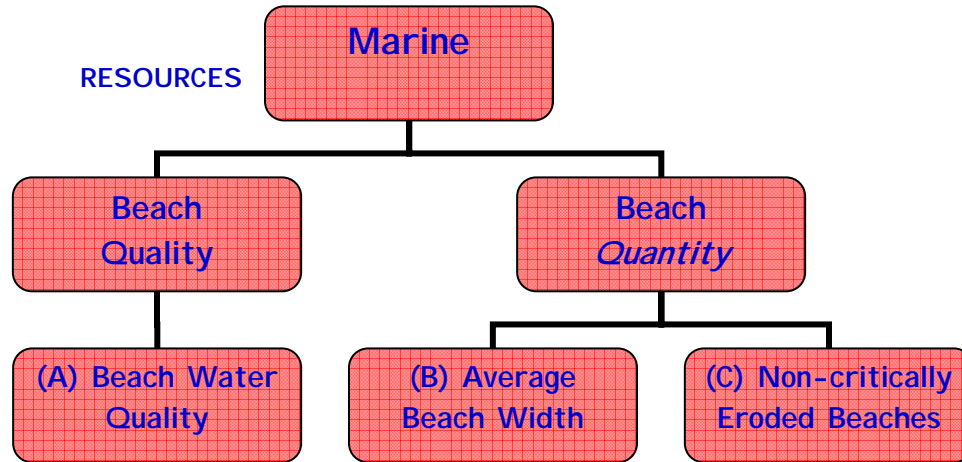


(D) Number of Tires Removed From the Reef Zone

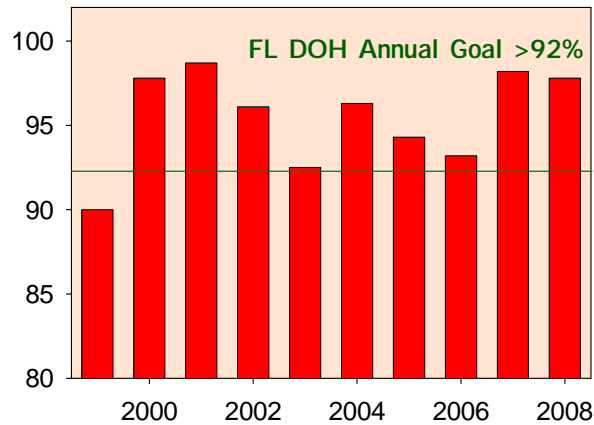


Endnotes for the Reef Resource Response benchmarks are on pages 116-118.

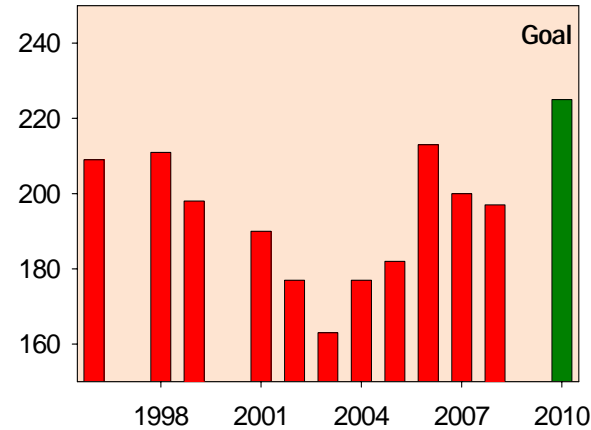
MARINE RESOURCES- Beach Quality and Quantity



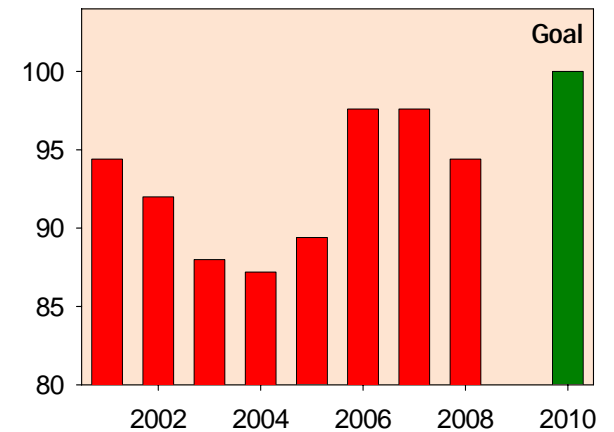
(A) Percent of Beach Water Quality Results Rated "Good"



(B) Average Beach Width at High Tide, Feet

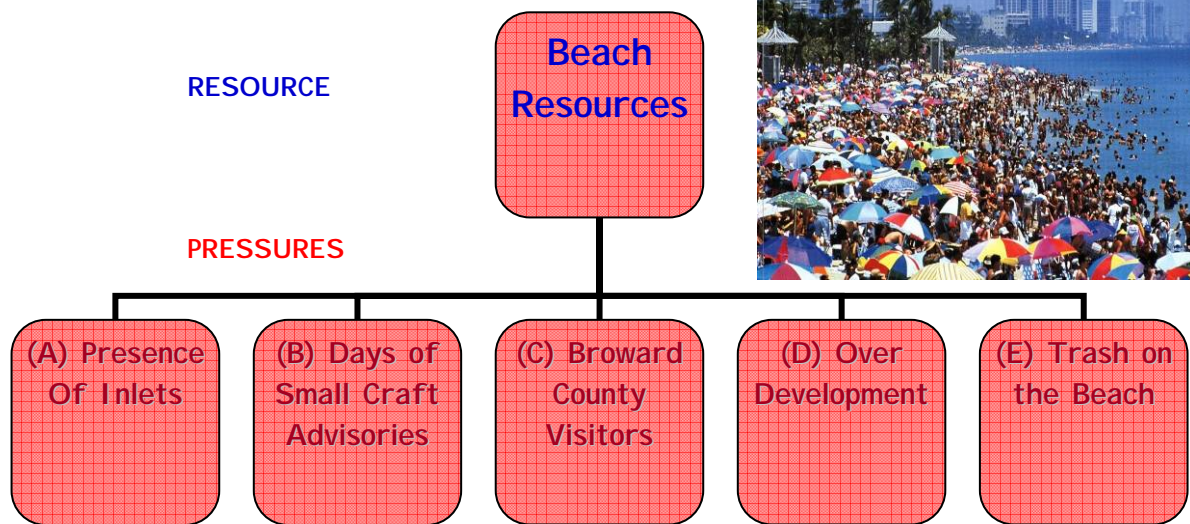


(C) Percent of Non-critically Eroded Beaches



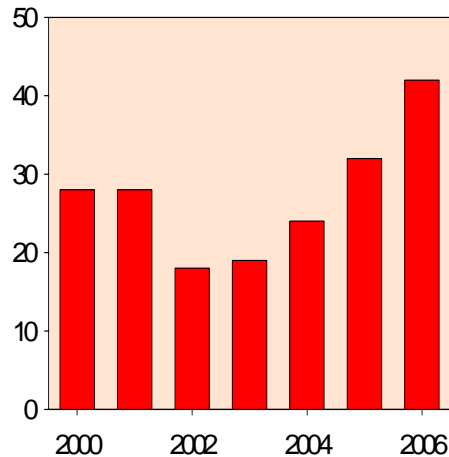
Endnotes for the Beach Resource benchmarks are on pages 118-119.

PRESSURES ON BEACH RESOURCES

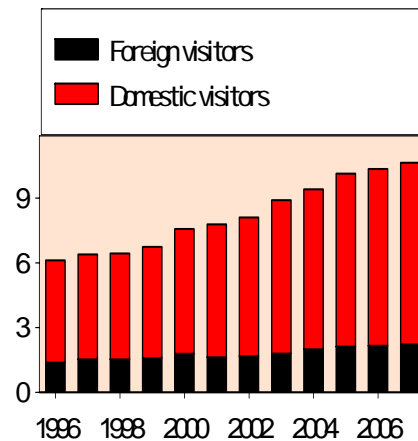


(A) Presence of Inlets - Inlets, composed of jetties and dredged channels, interrupt the movement of sand, causing buildup to the north and erosion to the south of the channel. To learn more, read the endnote on page 120.

(B) Days of Small Craft Advisories



(C) Number of Visitors to Broward County, Millions

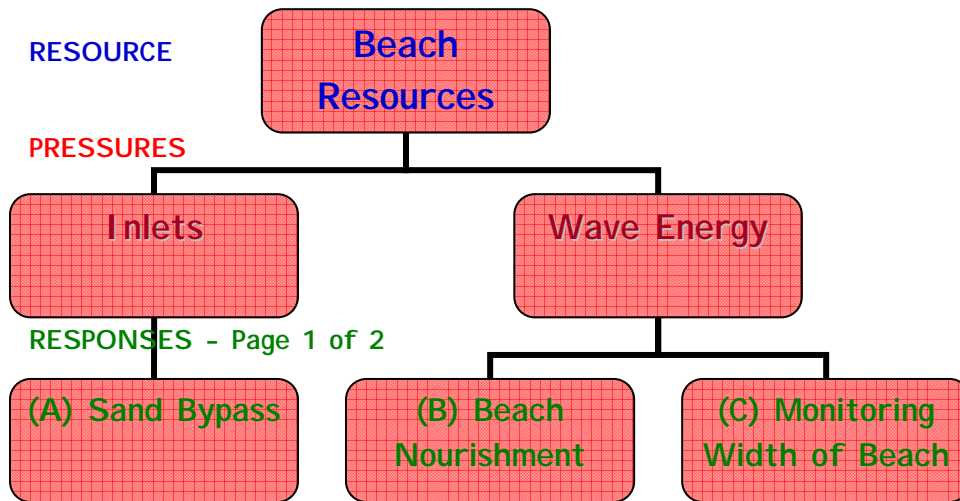


(D) Over Development - Coastal development, in areas prone to tropical storms, can place lives and property at risk and stress natural resources. Properly controlling beachfront development leads to more sustainable economies and environmental resources. To learn more, read the endnote on page 121.

(E) Trash on the Beach - The coastline receives trash from careless people, up land sources like wind blown trash and from the ocean side where vessels may throw or lose debris overboard. To learn more, read the endnote on page 121.

Endnotes for the Beach Resource Pressure benchmarks are on pages 120-121.

RESPONSES TO PRESSURES ON BEACH RESOURCES

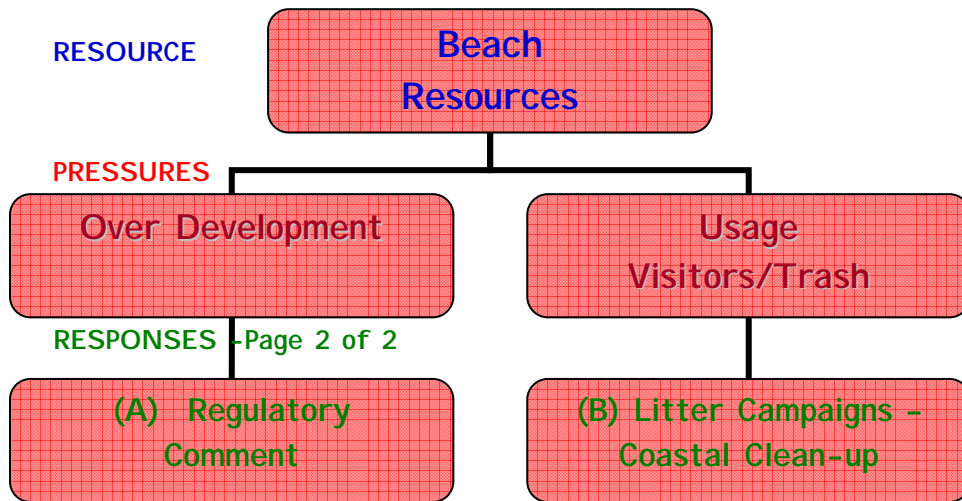


(A) Sand Bypass - Sand bypassing is conducted to reduce erosion of beaches which are impacted by stabilized inlets like Port Everglades. Sand bypassing captures sand which accumulates on the updrift side of a stabilized inlet or that might be lost into the channel and mechanically move the sand to the downdrift side. To learn more, read the endnotes on page 122.

(B) Beach Nourishment - By acquiring sand of a similar grain size, composition, and color, Broward County has been able to restore its eroding beaches to their historical width and slope. Beach nourishment is performed to increase storm damage prevention to coastal properties, to provide increased recreational opportunities and to restore sea turtle nesting habitat. To learn more about future plans, read the endnotes on page 123.

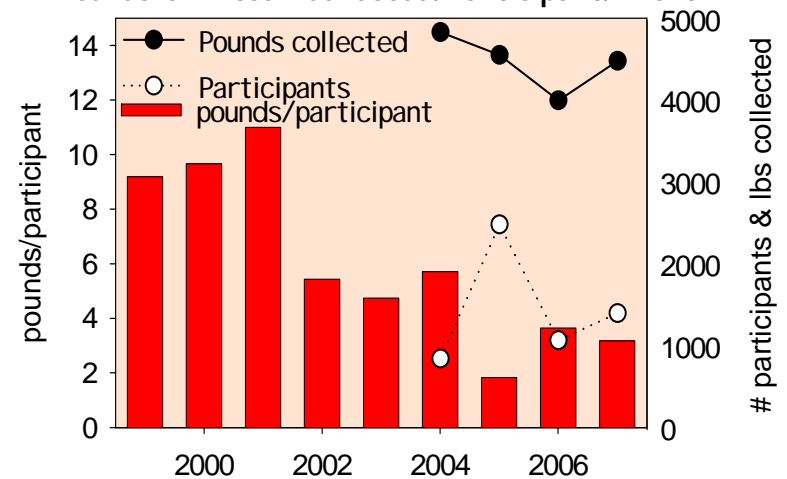
(C) Monitoring the Condition of the Beach - Monitoring the condition of the beach is essential to understanding how the beach behaves. Monitoring includes regular surveys of the extent and elevation of the sand. Aerial photos are often used for this purpose. To learn more, read the endnotes on page 123.

RESPONSES TO PRESSURES ON BEACH RESOURCES



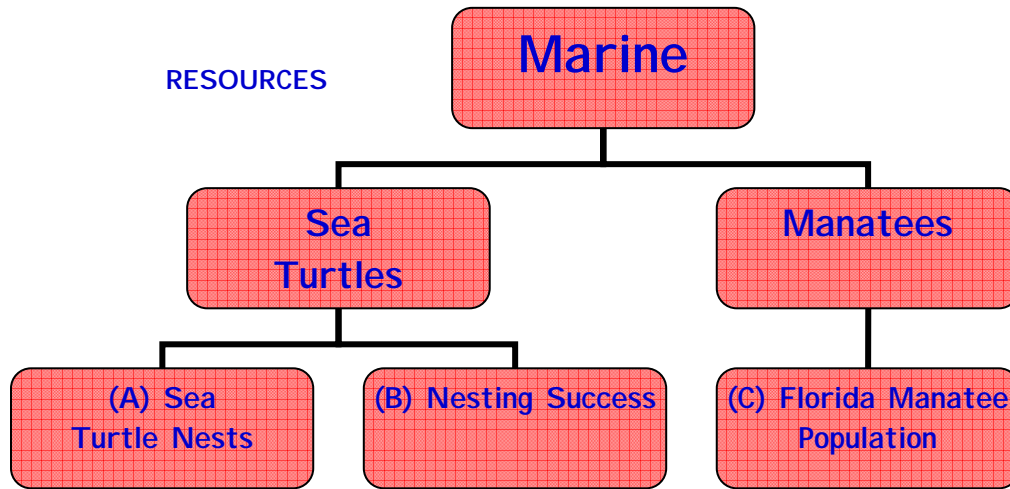
(A) Regulatory Comment on Beach Resources - Florida's Department of Environmental Protection (FDEP) administers the statewide Coastal Construction Control Line Program (CCCL). This program provides protection for beaches, dunes and their associated wildlife, while assuring reasonable use of private property. Broward County staff refers prospective permittees to the proper contact points at FDEP and provides information to potential developers of beachfront property regarding the state's CCCL permitting requirements. To learn more, read the endnotes on page 124.

(B) Beach Clean-up Campaigns, Pounds of Litter Collected/Participant/Event

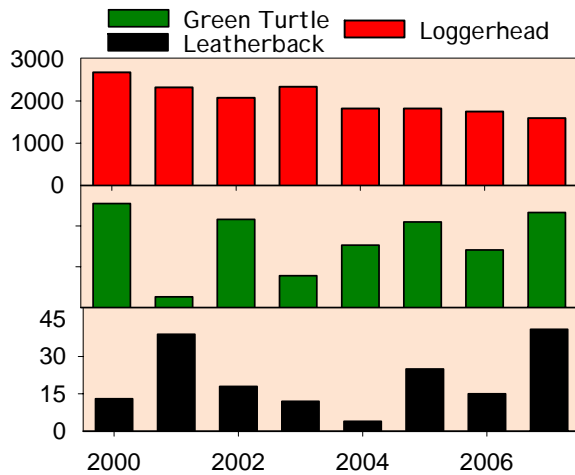


Endnotes for the Beach Resource Response benchmarks are on page 124.

MARINE RESOURCES- Marine Wildlife



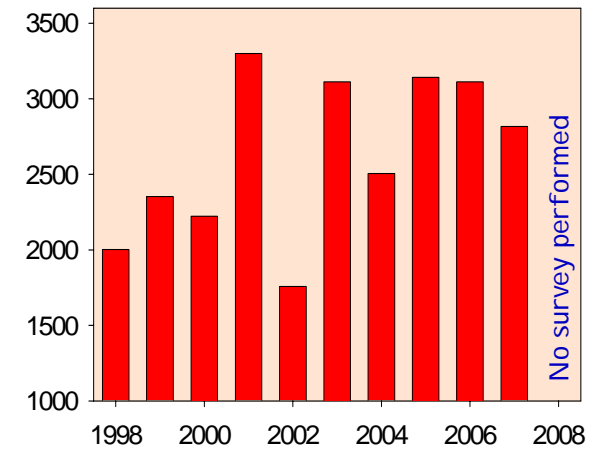
(A) Number of Sea Turtle Nests



(B) Percent of Sea Turtle Nesting Success

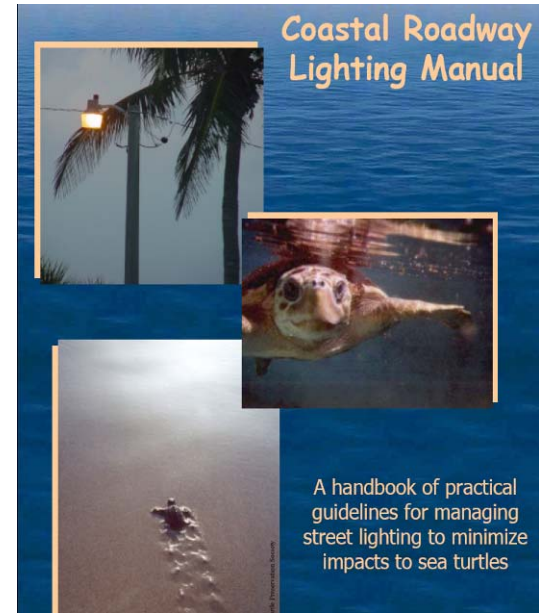
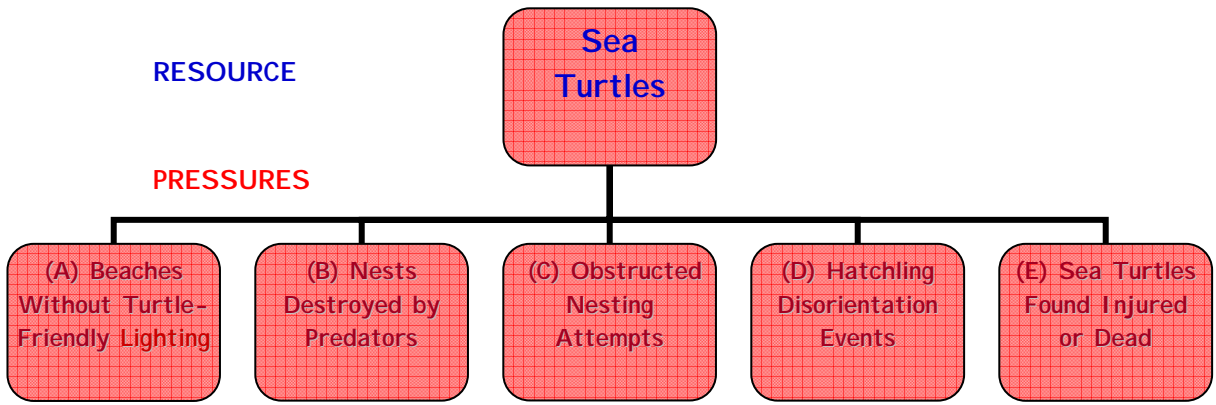


(C) Florida West Indian Manatee Population



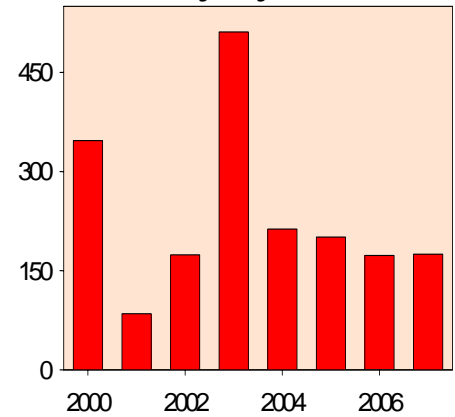
Endnotes for the Marine Wildlife Resource benchmarks for Sea Turtles are on pages 125-126 and for Manatees on page 129.

PRESSURES ON MARINE WILDLIFE - Sea Turtles



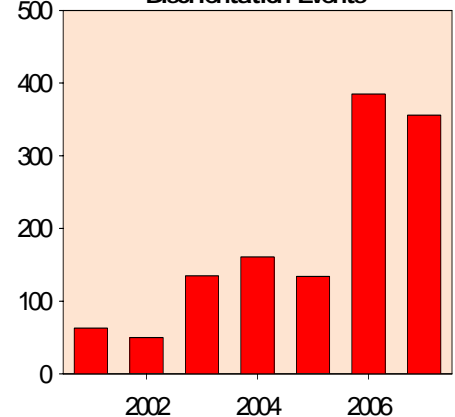
(A) Beaches Without Turtle-Friendly Lighting - Even active enforcement of lighting ordinance enacted in 5 of the 8 coastal municipalities in Broward County has not resulted in enough light reduction to have areas of the beach considered "turtle friendly". To learn more, read the endnote on page 126.

(B) Number of Sea Turtle Nests Destroyed by Predators

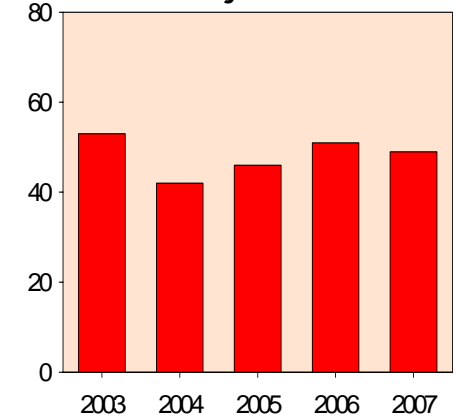


(C) Obstructed Nesting Attempts - Crawl marks left by the nesting female sea turtle can show whether she encountered any potential obstruction while attempting to nest. This information will begin to be collected this nesting season. To learn more, read the endnote on page 127.

(D) Number of Sea Turtle Hatchling Disorientation Events

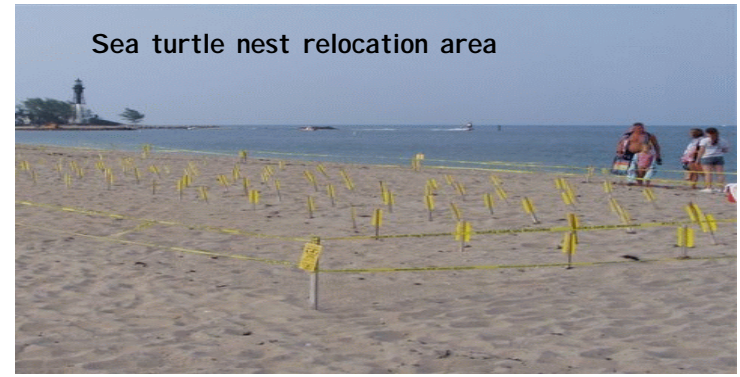
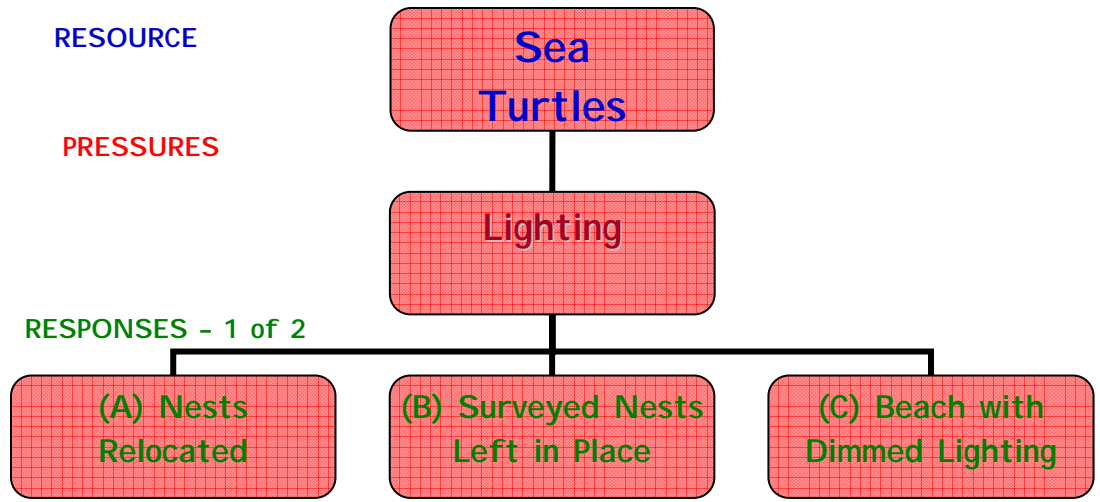


(E) Juvenile or Adult Sea Turtles Found Injured or Dead

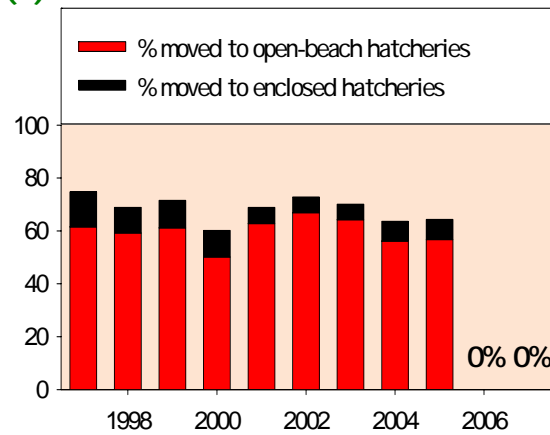


Endnotes for the Marine Wildlife Pressure benchmarks are on pages 126-128.

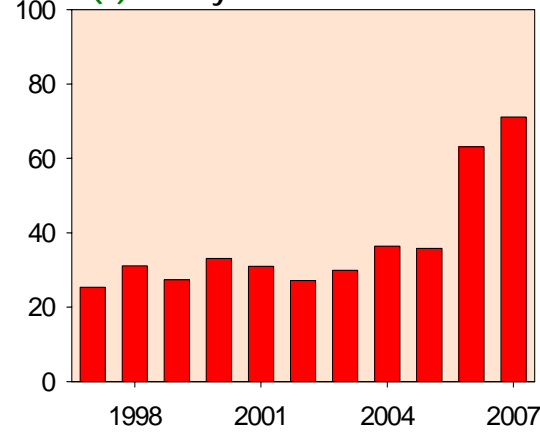
RESPONSES TO PRESSURES ON MARINE WILDLIFE - Sea Turtles



(A) Percent of Sea Turtle Nests Relocated



(B) Surveyed Nests Left in Place

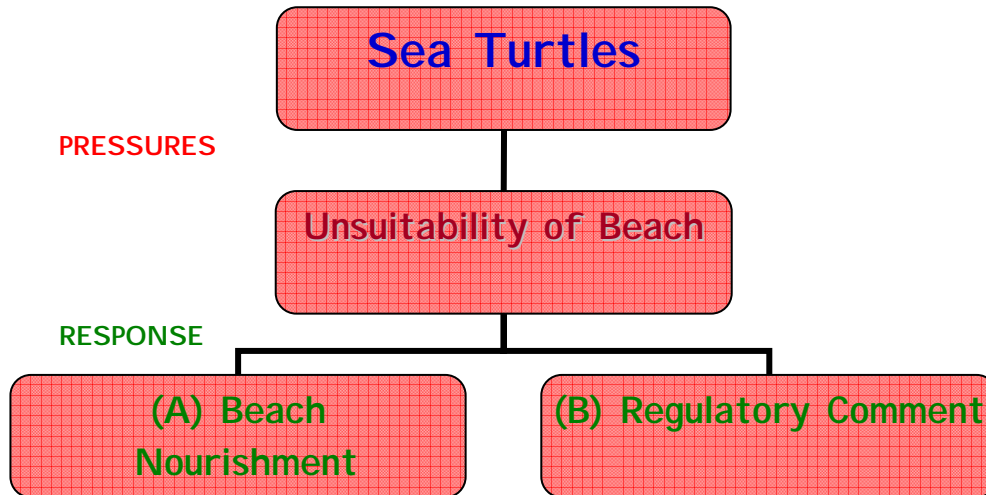


(C) Linear Feet of Beach with Dimmed Lighting



Endnotes for the Marine Wildlife Response benchmarks are on pages 128-129.

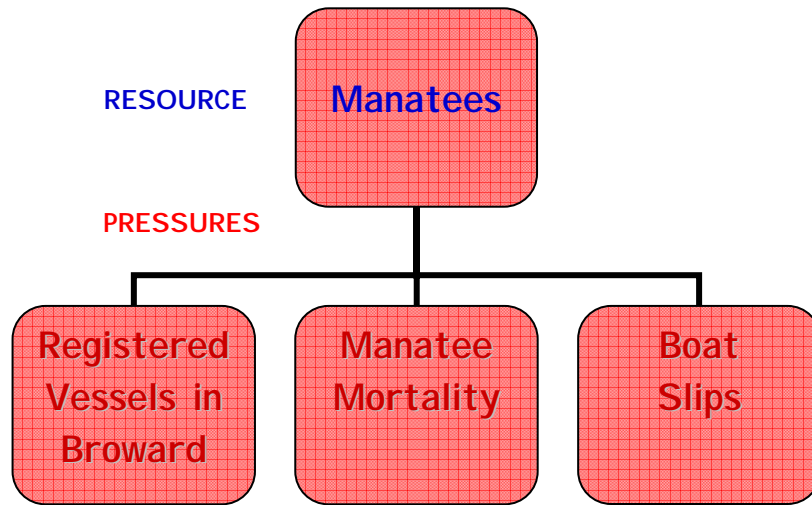
RESPONSES TO PRESSURES ON MARINE WILDLIFE - Sea Turtles



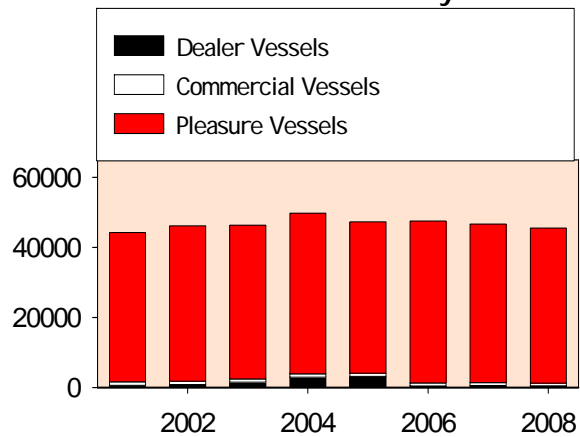
(A) Beach Nourishment - Adding sand to restore the historical width and slope of the beaches also serves to preserve critical nesting habitat for sea turtles. Grain size and composition of the replacement sand is important. To learn more, read the endnotes on page 123.

(B) Regulatory Comment on Beach Resources - The statewide Coastal Construction Control Line Program includes review of the application by the Florida Fish and Wildlife Conservation Commission for impacts to sea turtles and certain shorebirds. County staff may serve as liaison between the state and the applicant to protect sea turtles and their habitat. To learn more, read the endnotes on page 124.

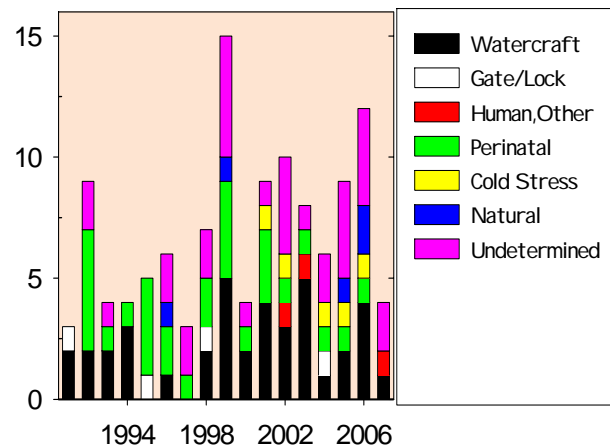
PRESSURES ON MARINE WILDLIFE - Manatees



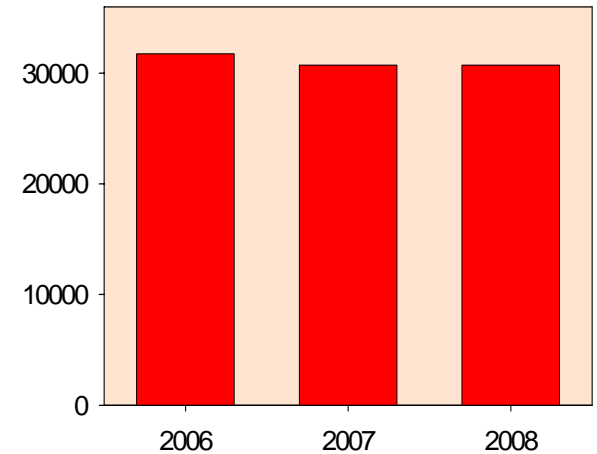
(A) Numbers of Vessels Registered in Broward County



(B) Manatee Mortality in Broward County



(C) Number of Boat Slips in Broward County



Endnotes for the Marine Wildlife Pressure benchmarks are on pages 130-131.

RESPONSES TO PRESSURES ON MARINE WILDLIFE - Manatees

RESOURCE

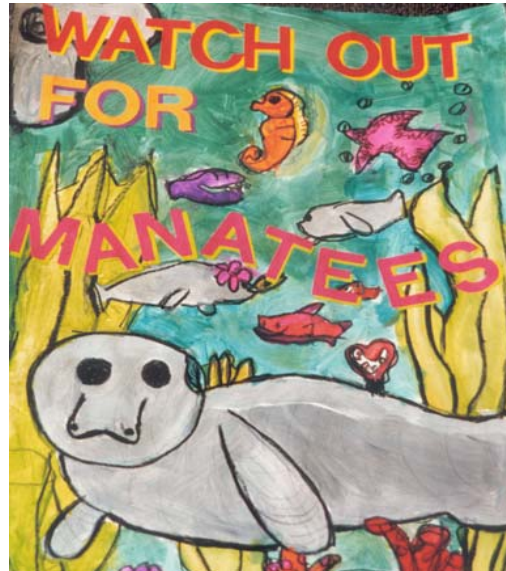
Manatees

PRESSURE

Human Encounters

RESPONSES

Broward County's Manatee Protection Plan



Manatee Poster Contest
Winner 2003.
First Place in the
Beginner's Category, Jenin
Mohammed from Sunshine
Elementary.

Manatee Protection - Broward County has completed the Broward County's Boat Facility Siting Plan (BFSP) and incorporated it with the previously-approved Boating Safety and Manatee Education elements of the Manatee Protection Plan (MPP). In December 2007, the MPP received approval from the Florida Fish and Wildlife Conservation Commission (FWC) and the US Fish and Wildlife Service (FWS). Broward County maintains numerous education and awareness efforts alone and in conjunction with other government and non-profit environmental agencies. The efforts include regular distribution of educational materials, public forums, informational kiosks, educator toolboxes, and a manatee webpage on the Broward County website. For more information, see the endnotes on page 132.

ENDNOTES

CLIMATE

DEVIATION OF THE ANNUAL AVERAGE TEMPERATURE IN FORT LAUDERDALE FROM THE 1950-1970 BASELINE

Measurement: This is the change in annual average temperature as measured against the baseline of average annual temperature for the period of 1950-1970 at the Fort Lauderdale weather station number 083163 located at lat 26 06 N and between long 80 09W and 80 12 W since 1948. The data is from the National Climatic Data Center historical listing for National Weather Service Cooperative Network (<http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?fl3163>).

Explanation: Local weather changes from year to year. As cities develop, the physical infrastructure impacts the local weather. In addition, global events such as El Niño or volcanic explosions influence local weather. The change in temperature from a twenty-year period beginning five decades ago demonstrates the influence of local and global changes on local climate.

Trends: Since 1971, only five of the 17 years have shown an average annual temperature below the 1950-1970 baseline. In 2007, the average annual temperature was 1.82 °F above the baseline.

Data source: Calendar year data. Raw data from the Southeast Regional Climate Center and North Carolina State University, sercc@climate.ncsu.edu. Calculations made by Broward County Environmental Protection and Growth Management Department, Environmental Monitoring and Enforcement Division, Nancy J. Gassman, PhD (954) 519 - 1241

CHANGE OF ANNUAL AVERAGE SEA LEVEL (INCHES) IN KEY WEST FROM THE 1920 BASELINE

Measurement: This is the change in annual average sea level at station 940/071, Lat 24 33 N Long 81 48 W, located in Key West using the average annual sea level from 1920 as a baseline.

Explanation: One impact of global climate change is the melting of the polar ice caps. This increases the volume of water in the world's oceans resulting in a change in sea level. As an oceanic peninsula with relatively flat topography, Florida's coastline is particularly vulnerable to significant deviations in mean sea level.

Trends: The trend since 1920 has been a variable increase in sea level. In 2006, the average sea level was 8.26 inches greater than the 1920 baseline.

Data source: Calendar year data. Raw data is from the Permanent Service for Mean Sea Level (PSMSL) based in Liverpool at the Proudman Oceanographic Laboratory (POL) which is a component of the UK Natural Environment Research Council (NERC) (http://www.pol.ac.uk/psmsl/psmsl_individual_stations.html). Calculations made by Broward County Environmental Protection and Growth Management Department, Environmental Monitoring and Enforcement Division, Nancy J. Gassman, PhD (954) 519 - 1241

PRESSURES ON CLIMATE

GREENHOUSE GAS EMISSIONS GENERATED IN BROWARD COUNTY

Measurement: This is a measurement in the total amount of greenhouse gas emissions generated in Broward County. Greenhouse Gas (GHG)

emissions generated by human activities in Broward County come from a variety of sources including vehicles, energy consumption, waste generation, etc. Currently a GHG emissions inventory for Broward County is not available.

Explanation: One of the main factors contributing to global climate change is carbon dioxide (CO₂) emissions. Due to human activities such as the combustion of fossil fuels, the concentration of atmospheric carbon dioxide has increased by about 35% since the beginning of the age of industrialization.

Trends: Not available.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Fields (954) 519 - 1220

RESPONSES TO CLIMATE

BROWARD COUNTY GOVERNMENT OPERATIONS GHG EMISSIONS REDUCTION

Measurement: This is a measurement of the total amount of greenhouse gas (GHG) emission reductions from Broward County government operations by source category implemented from 1997-2007. The Clean Air and Climate Protection (CACP) Software was used as the methodology for the development of the GHG emission reduction inventory. The CACP software was developed by the National Association of Clean Air, the International Council for Local Environmental Initiatives (ICLEI), and Torrie Smith Associates. The CACP Software calculates the GHG emission reductions achieved by energy efficiency measures, fuel savings, and waste reduction initiatives at government level. The CACP Software calculates carbon dioxide (CO₂) emission reduction directly from the amount of fuel or energy saved and from the amount of waste recycled or incinerated. The total amount of GHGs (CO₂, nitrous oxide [N₂O] and methane [CH₄]) reduced by a source are aggregated by the software and reported in units of carbon dioxide equivalents (eCO₂), a commonly used unit that combines greenhouse gases of differing impact on the earth's climate into one weighted unit.

Explanation: In response to well substantiated and compelling scientific evidence supporting the validity and urgency of climate change and the public's desire for action, a political environment has been created for local, state, and federal lawmakers to press for real changes in public policy related to energy consumption/climate change. On June 12, 2007, the Broward County Board of County Commissioners adopted Resolution 2007-391 to reduce greenhouse gas (GHG) emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. Broward County developed a Broward County government operations report, including a GHG emissions inventory for baseline year 1997 and recommendations on GHG reduction strategies (Broward County Government Operations Climate Change Report available at http://www.broward.org/air/broward_county_climate_change_report.htm).

Trends: Since 1997, Broward County implemented measures that resulted in 62,491 tonnes GHG emissions reductions from County government operations. The most significant reductions were achieved in vehicle fleet operation, energy use and waste. The goal moving forward is to eliminate an additional 51,359 tonnes GHG by 2015.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Fields (954) 519 - 1220

CLIMATE CHANGE TASK FORCE

Narrative: On June 24, 2008, the Broward County Board of County Commissioners adopted Resolution 2008-442 to create a Broward County Climate Change Task Force.

Explanation: Global climate change has emerged as a phenomenon of critical concern worldwide. According to the Intergovernmental Panel on

Climate Change: warming of the climate system is unequivocal; global concentrations of greenhouse gas (GHG) have increased markedly as a result of human activities; global air and ocean temperatures are increasing; and average sea level is rising globally. The Broward County Board of County Commissioners approved the creation of a Climate Change Task Force to develop recommendations for a coordinated countywide strategy in mitigating the causes, and addressing the local implications, of global climate change.

The Climate Change Task Force will be appointed by the Board and supported by County staff. The goals of the climate change program include:

- * development and implementation of projects and incentives for residents, businesses, and organizations to conserve energy and reduce greenhouse gases (GHG);
- * development and implementation of adaptation strategies to alleviate the likely adverse consequences of climate change;
- * provision of education and outreach to encourage Broward County residents, businesses and organizations to participate in the program; and
- * pursuit of federal and state grants, energy cost savings, and other financial resources to offset program costs.

Trends: At the time of publication of this report, the Task Force appointments were being made.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Jennifer Jurado, PhD, (954) 519 - 1464

AIR RESOURCES

PERCENTAGE OF DAYS WHEN OUTDOOR AIR QUALITY WAS GOOD

Measurement: This performance measure shows the percentage of monitored days when the air quality is rated good based on the highest pollutant concentration measured that day. The Air Quality Program monitors air quality throughout Broward County (site map at www.broward.org/air/monitoring.htm) for a variety of different pollutants used to determine daily air quality.

Explanation: Poor air quality can affect public health, especially the health of children, the elderly, and people with pre-existing respiratory problems, such as asthma. The United States Environmental Protection Agency (U.S. EPA) has established National Ambient Air Quality Standards (NAAQS) for the criteria pollutants [ozone (O₃), particulate matter (PM), oxides of nitrogen (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), and lead (Pb)] to ensure adequate public health and environmental protection. The U.S. EPA developed the national Air Quality Index (AQI) to reflect air quality on any given day. An AQI is calculated for each of the criteria pollutants monitored based upon the methods established by the U.S. EPA and the highest AQI value of these for any given day is designated as that day's AQI. Daily AQI information for Broward County is available to the public by dialing (954) 519-1280 or on the web at www.broward.org/air/.

Trends: NAAQS and AQI are dynamic systems designed to accomplish two objectives: 1) to establish acceptable air quality standards; and 2) to inform the public about the level of air pollution in their community and the associated health risks. The NAAQS and the AQI are routinely scrutinized by the U.S. EPA's Clean Air Scientific Advisory Committee to ensure that the latest medical and health related research are considered when the NAAQS are set. Therefore, the concentration ranges associated with the different levels of the AQI may change from year to year. Further complicating trend analysis and comparative studies of air quality are the local and regional variations in meteorological conditions which play a large part in dispersing or retaining air pollutants in our urban area. In Broward, yearly ambient air quality is a measure of the percentage of days in a calendar year that are ranked in the "good" category based upon the current AQI. Recent trends show a period of improvement in yearly ambient air quality (2001-2003) followed by a slight decrease (2004). The improvement was due to control technology implemented to prevent high ozone days. The decrease was due to the addition of PM_{2.5} real-time data to the AQI determination. This better reflected the impact of smoky conditions on the AQI. The ability to monitor PM_{2.5} concentrations in real-time was due to new instrumentation previously not available or approved for real time PM_{2.5} monitoring. Therefore, ambient air quality was not necessarily worsening; rather the new

standards made it more challenging for any given day to achieve a rating of "good" on the AQI. Additionally, changes by the U.S. EPA to the NAAQS for ozone may affect future trends. In previous editions of the Environmental Benchmark Report, an "AQI goal" for the year 2010 was included in the graph of this resource. However, it has been removed from this year's report because changes made to the NAAQS have changed the way the U.S. EPA calculates the AQI. These changes have made it difficult to determine an appropriate goal for this resource. The AQI was in the good range for 302 days, in the moderate range for 55 days, in the unhealthy for sensitive groups range for six days, and in the unhealthy range for two days in 2007. There were fewer "good" days in 2007 due to the impact of the North Florida and Georgia fires to the Southeast Florida airshed.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Monica Pognon (954) 519 - 1476

AVERAGE ANNUAL OZONE CONCENTRATIONS, ppm

Measurement: Ozone (O₃) is not usually emitted directly into ambient air; rather it is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of high temperatures and sunlight at ground level. It is measured in units of parts per million by volume (expressed as ppm). The unit ppm is used to describe very dilute concentrations. In quantifying the concentration of O₃, the unit basically states that per one million liters of air there are the stated numbers of liters of O₃. Eight-hour average ozone concentrations are used to determine the AQI. Annual average O₃ concentrations are shown in this report.

Explanation: Motor vehicle exhaust, some industrial emissions, gasoline vapors, and emissions of chemical solvents, as well as some natural sources, contribute NO_x and VOCs to the atmosphere. These compounds along with the required ambient conditions (heat and sunlight) cause ozone formation. Ozone can irritate lung airways and cause inflammation much like sunburn. Repeated exposure to ozone pollution for several months may cause permanent lung damage. Ozone also damages the leaves of trees and other plants, reduces crop and forest yields, and increases plant vulnerability to disease.

Trends: Over the past ten years, the average annual concentrations have remained relatively uniform. Average annual ozone concentrations for the 2007 calendar year were 0.026 ppm. The major source of pollution in Broward County (including VOC and O₃) is motor vehicles. While vehicle miles traveled has increased from the previous year, emissions from motor vehicles are expected to decrease due to cleaner-emitting new vehicles and turnover of the vehicle fleet. Ozone formation is also dependent on sunlight and high temperatures, thus it is very dependent not only on NO_x and VOC emissions but on weather and climate. In 2007, the National Ambient Air Quality Standards (NAAQS) for ozone was 0.08 ppm. Broward County has been in attainment with the ozone standard since 1997. Attainment is reached when the 3 year average of the annual fourth highest daily maximum 8 hour average, which is the ozone compliance value, does not exceed the standard. Broward County's ozone compliance value for 2004-2006 is 0.066 ppm and for 2005-2007 is 0.067 ppm. Broward County is part of the Southeast Florida Airshed, along with Miami-Dade and Palm Beach Counties. Compliance with the ozone standard is determined for the entire airshed, based on ozone concentrations monitored in Broward County as well as in Miami-Dade and Palm Beach Counties. Our neighboring counties have significantly influenced on our ozone levels because we shared the same air shed.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Monica Pognon (954) 519 - 1476

AVERAGE ANNUAL PARTICULATE CONCENTRATION, µg/m³

Measurement: Fine particulate Matter (PM_{2.5}) is a complex mixture of small particles and liquid droplets (aerosols). PM_{2.5} refers to particles of aerodynamic diameter 2.5 µm or smaller. Concentrations of these particles or aerosols are reported in micrograms per cubic meter of air (µg/m³). Continuous 24-hour average concentrations are used to determine the Air Quality Index. Annual average concentrations are shown in this report.

Explanation: Any component of ambient air that is not a gas is considered a particle. Particle pollution includes acid aerosols (such as nitrates

and sulfates), organic compounds, metals, and soil or dust particles. The smaller the particles, the easier those particles pass through the nose, throat, trachea, and primary bronchi, and enter the lungs. Once inhaled, these particles can affect the lungs and heart and may cause serious health effects. These particles can be directly emitted from sources or form in the atmosphere through photochemical reactions.

Trends: Average annual concentrations have fluctuated over the past 5 years with the highest ($12.1 \mu\text{g}/\text{m}^3$) occurring in 2001. The last few years have reflected a relatively consistent annual average between $8.3 - 8.7 \mu\text{g}/\text{m}^3$. The annual average concentration for the 2007 calendar year was $8.6 \mu\text{g}/\text{m}^3$. The National Ambient Air Quality Standards (NAAQS) for $\text{PM}_{2.5}$ is $15 \mu\text{g}/\text{m}^3$ for the annual average.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Monica Pognon (954) 519 - 1476

AIR RESOURCES - PRESSURES FROM MOBILE SOURCES

MOBILE SOURCE EMISSIONS, THOUSANDS OF TONS/YEAR

Measurement: This performance measure tracks the amount of volatile organic compounds (VOC), oxides of nitrogen (NO_x), and carbon monoxide (CO) emissions from mobile sources (automobiles and trucks). The Air Quality Program staff used the U.S. EPA MOBILE 6.2 model to obtain emission factors that were used to calculate the mobile source emissions. These emissions were calculated using the Vehicle Miles Traveled (VMT) data from the 2007 Florida Department of Transportation Public Roads Mileage and Miles Traveled Report.

Explanation: Emissions from mobile sources remain a major air quality concern in Broward County. VOC and NO_x emissions from mobile sources are precursors for ozone, the pollutant of concern in Broward County. Exceedances of the air quality standard for ozone not only result in poor air quality but can also trigger additional costly regulatory controls and loss of federal funding for construction/transportation development. Furthermore, benzene emissions from motor vehicles are the primary factor contributing to respiratory cancer risk to drivers in the U.S., including Broward County, according to the 1999 National Air Toxics Assessment (NATA, <http://www.epa.gov/ttn/atw/nata1999/> and <http://www.broward.org/air/nata1999.pdf>). Through more stringent fleet performance and fuel quality standards, transportation conformity, and voluntary initiatives, the U.S. EPA is implementing additional programs to offset the increase of mobile source emissions due to population growth and vehicle miles traveled. In addition, due to updates in federal vehicle emission standards, older vehicles built to less stringent emission standards are replaced in the fleet by newer vehicles built in compliance with more stringent standards.

Trends: The total level of pollution from mobile source emissions in Broward County, measured in tons per year (TPY), has decreased between the years 2000 - 2006. However, in 2007 the total level of pollution from mobile sources increased by 2.4%. The level of CO emissions in Broward County increased for the first time since 2000 by 4.5% (from 2006 to 2007). This is likely a result of the introduction of ultra-low sulfur diesel (ULSD) fuel in late 2006. ULSD is being mixed with higher bio-diesel fuel blends in on-road and off-road vehicles, which produces higher CO emissions. However, the levels of both NO_x and VOC decreased by 5.3% from 2006 to 2007. This was influenced by a combination of the mandatory phase-in of cleaner fuels, computerized onboard emissions diagnostic systems, and cleaner burning engines.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Fields (954) 519 - 1220

PERCENTAGE OF OVER-CAPACITY ROADWAY SEGMENTS

Measurement: This performance measure tracks the relative proportion of roadway segments operating below the designated level of service

standard in the specified calendar year.

Explanation: The established roadway level of service standard used in the Broward County Comprehensive Plan (<http://www.broward.org/planningservices/upi00112.htm>) defines "overcapacity" segments as those operating at levels of service worse than Level of Service "D." This performance measure supplements the information provided by the two "Vehicle miles traveled" performance measures. It provides a more comprehensive picture of how vehicular traffic and the adequacy of the roadway system can affect the environmental quality of life in a county experiencing continuing urbanization. More information is available at <http://www.broward.org/mpo/plansprograms.htm>.

Trends: The 2007 figure is 4.03% lower than the 2006 levels, which is directly attributed to the lower annual growth in population, employment, school enrollment and other socioeconomic variables leading to lower travel demand.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Metropolitan Planning Organization Division, Lina Kulikowski (954) 357-6610

THOUSANDS OF VEHICLE MILES TRAVELED/DAY/1000 PEOPLE

Measurement: This benchmark is a measurement of vehicular traffic and represents the total vehicle miles traveled per day in a given area for the indicated calendar year by 1,000 people, based upon population estimate figures provided by the Bureau of Census.

Explanation: See explanation for "Vehicle miles traveled" above. Note: This benchmark is different from the "Vehicle miles traveled" benchmark; it is unbiased to population increase and reflects emissions decrease resulting from improvements in the transportation sector, land use planning and technological improvements. The evolution of this benchmark will provide information regarding transportation planning, land use planning and technological improvements.

Trends: The 2007 figure increased by 0.38% over the 2006 figure. The increase in travel per capita is likely the result of increase in people living in other counties that commute to work in Broward County. Figures from 2003-2006 were adjusted to reflect current population estimates from the Census.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Metropolitan Planning Organization Division, Lina Kulikowski (954) 357-6610

VEHICLE MILES TRAVELED/DAY, MILLIONS

Measurement: This is a measure of vehicular traffic representing the total miles traveled (VMT) in a given area for the indicated calendar year.

Explanation: Poor air quality affects public health, especially of children and the elderly. In Broward County, vehicular traffic is a major source of air pollution and a major source of precursors for the pollutant ozone. The level of vehicular traffic directly impacts air quality and Broward County's ability to meet the National Ambient Air Quality Standard for ozone. Ozone exceedances result not only in poor air quality but can also trigger additional costly regulatory controls and loss of federal funding for construction/transportation development. Through more stringent fleet performance standards and transportation conformity, the 1990 Clean Air Act implemented additional programs to offset the increasing VMT, due to population increase.

Trends: The 2007 figure is 0.52% lower than the 2006 levels, which is directly attributed to the lower annual growth in population, employment, school enrolment and other socioeconomic variables leading to lower travel demand.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Metropolitan Planning Organization Division, Lina Kulikowski (954) 357-6610

AIR RESOURCES - RESPONSES TO PRESSURES FROM MOBILE SOURCES

NUMBER OF AIR QUALITY OUTREACH EVENTS

Measurement: The Air Quality Program is responsible for the development and implementation of numerous educational outreach programs and events throughout the fiscal year indicated ending September 30th. This benchmark is a measurement of the number of educational programs coordinated.

Explanation: Providing educational opportunities about Broward County air quality issues and regulations to government officials, regulated community, business leaders, students and citizens will increase awareness about local issues and help educate residents about the importance of conserving our natural resources.

Trends: In 2007, the number of educational outreach programs and events decreased by 27.6% compared to 2006, due to vacancies in the Air Quality Program. In 2006, Air Quality developed a Five-Year Outreach Plan to provide a clear strategy for conducting outreach in conformance with federal, state and local goals and objectives. The plan includes a description of activities to be conducted in a five-year period and incorporates measures of success to evaluate performance. A few of this year's outreach programs included two major tri-county educational campaigns: Clean Air Month and Car Care Month; educational programs in support of the School Board Partnership Agreement such as the Character Education Newsletters, environmental art contests; educational presentations for residents and civic groups; radio shows and more.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel F. Fields, (954) 519-1220

NUMBER OF MASS TRANSIT PASSENGER TRIPS, MILLIONS OF TRIPS/ YEAR

Measurement: The number of trips made by the citizens of Broward County utilizing mass transit (i.e., buses, shuttles, Tri-Rail) in the fiscal year indicated ending September 30th.

Explanation: Alternative means of transportation such as buses, shuttles, and trains, reduce traffic activities and improve air quality. In Broward County, vehicular traffic is a major source of air pollution, posing threats to both public health and the environment. It is also a major source of precursors for ozone, the pollutant of major concern in the area. Poor air quality affects public health, especially children and the elderly. The use of public transportation services will help to meet stringent air quality standards and therefore reduce air pollution, reduce single occupancy vehicle trips, and improve transit efficiency.

Trends: For the fiscal year of 2007, to enhance the Mass Transit System, major service changes were directed toward improving connections to West Regional Terminal and Sawgrass Mills Mall, by improving service frequency from 20 minutes to 15 minutes for routes #22, and #36. For route #31 having a high student ridership/crowding during peak hour, frequency times were improved to meet that demand north of Broward Community College. Peak hour service, from Broward Central Terminal was extended from 6:00pm to 7:00pm. Other routes that had headway improvement that were not related to student crowding are: route #72 and route #18. Also, realignment improvements were made to routes #1 and #42. The impact of the above changes for fiscal year 2007 was a 5.3% increase in ridership for the year as compared to 2006.

Data source: County fiscal year data. Broward County Office of Transportation, Robert Fossa (954) 357-8336

COMMUNITY SHUTTLE RIDERSHIP, THOUSANDS OF TRIPS/YEAR

Measurement: The fleet size is the number of vehicles (mid-size buses) operated by municipal and local governments, Transportation Management Associations (TMAs), public/private partnerships, and other neighborhood/civic associations. Ridership is the number of trips made by the users of the Community Bus Services in the fiscal year indicated ending September 30th.

Explanation: The Broward County Mass Transit Division (BCT) in cooperation with the Community Transportation Initiative (CTI), the Florida Department of Transportation, and the Environmental Protection and Growth Management Department are promoting the efficient mobility of persons and goods through the Community Bus Service program. The CTI encourages the use of alternative fuel vehicles for neighborhood buses, addressing issues of air quality and traffic congestion, while providing user-friendly transit services.

Trends: As the community shuttles/bus program has grown over the years from seven (7) to twenty (22) cities, steps were taken in BCT scheduling, marketing and outreach programs to assist and improve cities abilities in operating the community bus program. BCT staff continues its support with collection and analysis of ridership data, which is used in designing and refining the route alignments to serve and meet local needs, diverting and connecting to the Broward County Fixed Route Transit System. The increase in ridership for 2007 is also the result of continually providing passengers with access to schedules for BCT and the Community Shuttles/Buses. Schedules are being posted in many public locations including neighborhood shops, parks, churches and libraries. This year the Community Bus Service fleet total was 87 and a 10% improvement in ridership was made compared to year 2006. To access the website, go to www.broward.org/bct/welcome.htm.

Data source: County fiscal year data. Broward County Office of Transportation, Service Development Team, Robert Fossa (954) 357-8336

AIR RESOURCES - PRESSURES FROM REGULATED STATIONARY SOURCES

NUMBER OF REGULATED STATIONARY SOURCES

Measurement: The number of regulated stationary air pollution sources is used to monitor annual trends in the total number of air pollution sources that are operating in Broward County. This allows the Air Quality Program to quantify the air quality pressures that are posed as a result of emissions from the various sources.

Explanation: The types of regulated air pollution sources include, but are not limited to, electric power plants, waste incinerators, various product manufacturing operations, crematories, dry cleaners, printers, wastewater-treatment plants, concrete batch plants, petroleum product transfer and storage, as well as painting and repair shops. This category includes both major industries and small operations. Major industries are generally large facilities that emit or have the potential to emit any pollutant regulated under the Clean Air Act at a significant emission rate. Major industries are issued State of Florida air permits. Small operations are small, stationary sources that usually do not emit large amounts of criteria pollutants or toxics at individual sites. However, small operations are more numerous than major industries and therefore they can also contribute a significant amount of emissions when taken collectively. Small operations located in Broward County are issued either State of Florida air permits or County Licenses depending on the type of work done and the amount of air emissions generated.

Trends: The Air Quality Program began reporting the number of regulated stationary sources in 2006. In 2007, there was an overall increase in the total number of facilities, compared to 2006. We observed a 14.7% increase in State of Florida air permits issued to small operations and a 7.6% increase in the number of county licenses issued to small operations as compared to 2006.

Data: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Clifton Bittle (954) 519-1208

EMISSIONS FROM POWER PLANTS, TONS/YEAR

Measurement: The amount of criteria pollutants (carbon monoxide-CO, sulfur dioxide-SO₂, nitrogen oxides-NO_x, particulate matter-PM and volatile organic compounds-VOC) emitted by power plants in Broward County in a calendar year. The data is reported by Florida Power & Light Company, annually.

Explanation: Emissions from power plants contribute to air pollution in Broward County. Sulfur dioxide and nitrogen oxides are precursors for acid rain that in turn contribute to poor air and water quality. VOC and NO_x are important emission categories because they are the primary contributors to the formation of ground-level ozone. Some VOCs fall into the category of Air Toxics. Some Air Toxics can (with prolonged exposure) lead to cancer and non-cancer respiratory health effects or neurological effects.

Trends: Total power plant emissions have fluctuated over the past few years. Emissions from power plants are influenced by the amount of electricity generated and, to a great extent, by the type of fuel that is burned. Natural gas is a cleaner burning fuel than oil so that emissions are generally lower during those periods when natural gas is fired. However, FPL's decision to burn oil or gas is principally an economic one depending on fuel prices and fuel availability. Therefore, year-to-year fluctuations can be generally explained by the variability in the type of fuel used. Other factors such as equipment outages and facility outages can also be significant. In the case of the Port Everglades Power Plant, FPL began a phased modification of the facility in 2005 to install low-NO_x burners to control NO_x emissions and electrostatic precipitators to control emissions of particulate matter (PM). The project was concluded in 2007. During the phased construction period, at least one of the four boiler units was offline at any one time. By 2008, emissions of NO_x and PM are likely to be lower than levels prior to the modification. Following is a summary of changes in reported emissions. In 2007, CO emissions decreased by 14.4%, NO_x emissions continued to drop by 26.3%, and PM dropped by 16.3% as compared to 2006. However, in 2007, there was an increase in both SO₂ emissions by 8.3% and VOC emissions by 1.4% compared to 2006 levels. Overall, emissions for CO, NO_x, and PM from the FPL Port Everglades and the Fort Lauderdale Power Plant decreased by 57% in 2007. In 2007, SO₂ and VOC emissions increased by 9.7% as compared to 2006.

Data source: FPL Annual Operating Report data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Clifton Bittle (954) 519-1208

TOTAL AND PER CAPITA ELECTRICAL POWER CONSUMPTION, KILOWATT-HOURS [KWH]/YEAR

Measurement: This is a measure of the total annual electric power consumed in Broward County. Total electrical consumption includes residential and nonresidential. Per capita includes only residential consumption.

Explanation: The production and consumption of electric energy are significant sources of air pollution. Generating electricity by burning oil and natural gas generates emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂) and carbon dioxide (CO₂). VOCs and NO_x are precursors for ozone, whereas CO₂ is a greenhouse gas that contributes to climate change. NO_x and SO₂ are also precursors for acid rain that in turn contribute to poor air and water quality. Poor air quality affects public health, especially of children and the elderly.

Trends: Total Electrical Consumption has, for the most part, been increasing over the last ten years (only calendar year 2004 saw a decrease of 1.46% due in part to outages caused by tropical storms). Calendar year 2007 was no exception as the Total Electrical Consumption increased by 0.82%. This increase correlates with the increase in the 2006 figure. This increase, however, remained lower than the 1.47% to 13.91% increases that have been seen in the past ten years prior to 2006. Unlike the trend for Total Electrical Consumption which has been increasing steadily over the past ten years, Per Capita Electrical Consumption has fluctuated over time. Per Capita Electrical Consumption began to decrease in 2007 by 0.68%. This is opposite of what was observed in 2005 and 2006 which was a slightly increasing trend. Current levels still remain almost 500 KWH/Yr more than levels observed 10 years ago.

Data source: Calendar year data. Florida Power & Light Co., Maria Betancur, (954) 321-2074

AIR RESOURCES - RESPONSES TO PRESSURES FROM REGULATED STATIONARY SOURCES

NUMBER OF COMPLIANCE INSPECTIONS OF REGULATED STATIONARY SOURCES

Measurement: The compliance inspections are included as a benchmark in order to track one of the regulatory tools used by the Air Quality Program to ensure that operations at major industries and small operations comply with local, state, and federal regulations.

Explanation: Natural Resource Specialists periodically conduct inspections of regulated facilities in Broward County to ensure that the operations are conducted within the regulatory parameters. This measure includes inspections of both major industries and small facilities operating in the County.

Trends: The Air Quality Program implemented a Quality Assurance Program for tracking air compliance inspections starting with the 2006 calendar year. In 2007, the total number of inspections decreased compared to 2006. While the number of compliance inspections for point sources with State of Florida permits increased by 40% compared to 2006, the frequency of inspections for area sources (predominantly dry cleaners) decreased from annually to once every 5 years, resulting in a downward trend between 2006 and 2007.

Data source: Calendar year data, Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Clifton Bittle (954) 519-1208

CHANGES IN STATIONARY SOURCE REGULATIONS

Narrative: In 2006, the Board of County Commissioners approved revisions to Broward County's air quality code (Article IV, Broward County Code of Ordinances Chapter 27, Pollution Control) that require the owners and operators of human and animal crematories to periodically conduct air pollutant emissions tests. These tests are intended to help protect the public by assuring compliance with the State of Florida's air pollution emission limitations for crematories. These requirements were amended in 2008 in order to consider revisions that were made to Florida Administrative Code.

Explanation: On a regular basis, the Pollution, Prevention, Remediation and Air Quality Division evaluates the need to update Broward County's air quality code in order to address new developments and needs.

Trends: The Broward County's air quality code was revised in 2000, 2006 and 2008.

Data source: Calendar year data, Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Clifton Bittle (954) 519-1208

FLORIDA POWER AND LIGHT'S ALTERNATIVE FUEL PROGRAM

Narrative: This benchmark is used to illustrate the impact Broward County Florida Power and Light (FPL) customers that were enrolled in the utility company's Sunshine Energy® Program (http://www.fpl.com/residential/electric/sunshine_energy.shtml) had in 2007 and to track associated enrollment trends.

Explanation: In 2007, FPL offered its customers an option to pay an additional fee each month to support "green power" which refers to "electricity supplied in whole or in part from renewable energy sources, such as wind, solar power, and bioenergy". According to FPL, by signing up for the Sunshine Energy® program, each customer in Broward can reduce over 10,800 pounds of greenhouse gas emissions – as much as a car would produce in almost 12,000 miles of driving. By enrolling in FPL's Sunshine Energy® program, customers are also helping to spur the development of new green energy facilities. For every 10,000 customers who sign up for Sunshine Energy, an additional 150kw of solar arrays

will be built in Florida. Sunshine Energy ensures that the environmental credits associated with 1,000 kWh of electricity are produced by cleaner generators serving Florida and other states nationwide.

Trends: FPL reports that there are 6,391 participants currently enrolled in the program in Broward County. Since the program's inception in 2004, the more than 38,000 FPL customers choosing the Sunshine Energy program have helped avoid more than 756 million pounds of Carbon dioxide (CO₂) emissions from being released into the environment. On September 27, 2007, FPL Group announced it planned a \$2.4 billion investment to increase the use of solar thermal energy by building 300 megawatts of solar generating capacity in Florida.

Data source: Calendar year data. Florida Power & Light Co., Maria Betancur, (954) 321-2074

AIR RESOURCES - PRESSURES FROM OTHER SOURCES

DAYS AIR QUALITY WAS IMPACTED BY AN UNUSUAL EVENT

Measurement: This measure represents the number of calendar days that the Air Quality Index was impacted by atypical meteorological events.

Explanation: Large quantities of dust, originating in the African Sahara, are periodically blown across the Atlantic Ocean and can, on certain days, impact air quality. Other factors such as fireworks, wildfires and open burning can also have an effect on the air quality in Broward County.

Trends: The Broward County Air Quality Program recorded seven days during 2007 where the air quality was affected by wildfires. This was lower than the 13 days that were recorded in 2006. The Air Quality Program did not record any days in 2007 where the Air Quality was affected by Sahara Dust, compared with the 10 days that were recorded during 2006.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Monica Pognon (954) 519 - 1476

AIR RESOURCES - RESPONSES TO PRESSURES FROM OTHER SOURCES

OPEN BURNING REGULATIONS

Narrative: In Broward County, open burning is regulated under Broward County Code Chapter 27, Article I X.

Explanation: To reduce the impact of smoke from open burning operations in Broward County, open burning is subject to required operational practices including minimum set-back distances and prohibitions on certain materials. Broward County also coordinates with local officials and agencies to ensure comprehensive compliance with all open burning regulations. In the unusual event of a nearby large-scale fire (e.g., wildfires, forest fires, burning of sugar cane fields) that affects air quality in Broward County, the Broward County Air Quality Program issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases.

Trends: In 2007 the Board of County Commissioners approved revisions to Broward County's open burning code. These changes were deemed necessary to provide for consistency with State of Florida requirements, and to establish comprehensive requirements to reduce the impact from burning of vegetative debris generated by natural disasters.

Data source: Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Clifton Bittle (954) 519-1208

WATER RESOURCES – SURFACE WATER QUALITY

EVERGLADES WATER QUALITY – PHOSPHORUS AT THE S-9 PUMP STATION, ppb

Measurement: This measure tracks the quality of urban stormwater discharges from the C-11 West Basin (Griffin Road Canal) in Broward County to the Everglades for the indicated water year (WY) ending April 30th.

Explanation: Phosphorus has been identified as one of the primary pollutants impacting water quality and ecological function in the Everglades. The freshwater Everglades is a highly oligotrophic system (characterized by extremely low nutrient concentrations) that is considered phosphorus-limited. Historically, such low phosphorus concentrations have favored the growth of plants with low nutrient requirements (like saw grass) and have inhibited the growth of plants with higher nutrient requirements (like cattails). However, urban and agricultural discharges rich in phosphorus have created a nutrient imbalance and an environment that now favors the growth of invasive cattails over slower-growing saw grass. As cattails sprout and thicken, they push out native saw grass, wading birds and fish, fill in open water areas, and lower dissolved oxygen levels. To support restoration of the Everglades, the State of Florida has proposed a phosphorus criterion for discharges to the Everglades of 10 parts per billion (ppb). Since the S-9 pump station located in the C-11 West Basin of Broward County is a major source of urban phosphorus pollution to the Everglades, our goal is to reduce average phosphorus concentrations in stormwater and landscape runoff to consistently achieve this goal at this site. Water quality improvements are being sought through broad implementation of best management practices such as source controls on pollution, changes in water management operations, and improvements in surface water quality treatment.

Trends: Water quality has remained relatively constant during the last 5 years with an average phosphorus concentration of 13.8 ppb. Water quality during the last 2 years has been better than average with phosphorus concentrations of 11.8 ppb measured in WY '07 and 13.4 ppb in WY '08.

Data source: Water Year - May 1 to April 30. South Florida Water Management District, DB Hydro Database. Data summary, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

URBAN FRESHWATER QUALITY IN THE C-13 CANAL, PERCENT IMPROVEMENT OVER THE 1995 BASELINE

Measurement: This performance measure is calculated based on four quarterly sampling events per calendar year obtained from Environmental Protection and Growth Management Department's surface water quality monitoring network along the fresh water portion of the C-13 (Middle River) canal (University Drive to Interstate 95) as measured at Environmental Protection and Growth Management Department station numbers 12, 13 and 14. Station 13 was dropped from the monitoring network in 2006. Percent improvement is measured by comparing the overall annual average water quality index of these three stations against their 1995 (baseline) overall annual average water quality index. The index is calculated using the Florida Department of Environmental Protection's Florida Stream Water Quality Index (WQI) to rate the quality of fresh water systems. The WQI is based on the measurement of six water quality categories: water clarity, dissolved oxygen, oxygen-demanding substances, bacteria (total and fecal coliform), nutrients and biological diversity with each category potentially having more than one parameter. Total coliform was dropped as a parameter in 2006. We converted annual average raw data for the six categories to index values from 0-99 and

assigned a percentile value based on Florida stream water quality data. The Environmental Protection and Growth Management Department WQI is based on the five water chemistry parameters as biological diversity measurements are not available for Broward County surface waters.

Explanation: County and federal governments have developed and improved regulations and programs intended to impact surface water quality positively since 1995. These regulations and programs encompass three areas: 1) redevelopment of areas constructed before the implementation of surface water management regulations, 2) the 5-year renewal of surface water management licenses issued before 1989, and 3) the Broward County National Pollution Discharge Elimination System Municipal Separate Storm Sewer System Permit. The C-13 Canal basin was selected because most of the basin is outside independent drainage districts and is subject to Environmental Protection and Growth Management Department's surface water management regulations.

Trends: Both natural and human events impact this measure causing variability. Rainfall and stormwater runoff are particularly strong influences on water quality. Readers interested in this benchmark should look at long term trends not annual variability. In 2006, total nitrogen concentrations were 44% lower than the previous year resulting in the improved water quality index. In 2007, total nitrogen concentrations were higher but improvements in the concentrations of dissolved oxygen, total phosphorus and fecal coliform resulted in overall improved water quality.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Environmental Monitoring and Enforcement Division, Nancy Gassman, PhD, (954) 519-1241

ESTUARINE WATER QUALITY IN THE C-13/C-14 CANALS, PERCENT IMPROVEMENT OVER THE 1995 BASELINE

Measurement: This performance measure is calculated based on four quarterly sampling events per calendar year obtained from Environmental Protection and Growth Management Department's surface water quality monitoring network within the tidal portion of the eastern C-13 (Middle River and Coastal Basin) and eastern C-14 Canals (Cypress Creek and Pompano Canals, east of I-95) as measured at Environmental Protection and Growth Management Department station numbers 5 and 10. Percent improvement is measured by comparing the overall annual average Tropic State Index (TSI) of these two stations against their 1995 (baseline) overall annual average TSI. The index is calculated using the Florida Department of Environmental Protection's Trophic State Index, to rate the quality of estuarine systems. The annual TSI is based on raw annual average measurements of chlorophyll and nutrients. Calculating an overall TSI value requires both nitrogen and phosphorus measurements.

Explanation: County and federal agencies have developed and improved regulations and programs to affect surface water quality positively since 1995. These regulations and programs encompass three areas: 1) redevelopment of areas constructed before the implementation of surface water management regulations, 2) the 5-year renewal of surface water management licenses issued before 1989, and 3) the Broward County NPDES Municipal Separate Storm Sewer System Permit. The C-13 and C-14 Canal basins were selected because most of the basins are outside independent drainage districts and are subject to Environmental Protection and Growth Management Department surface water management regulations.

Trends: Both natural and human events impact this measure causing variability. Rainfall and stormwater runoff are particularly strong influences on water quality. Readers interested in this benchmark should look at long term trends not annual variability. In 2006, the index was impacted by chlorophyll readings 2.8 times higher than the previous years. Total nitrogen values were actually 28% lower. In 2007, the average chlorophyll value was approximately four times less than 2006 and total nitrogen values fell resulting in an improvement in water quality over the 1995 baseline.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Environmental Monitoring and Enforcement Division, Nancy Gassman, PhD, (954) 519-1241

PRESSURES ON SURFACE WATER QUALITY

URBAN STORMWATER RUNOFF

Narrative: Urban stormwater runoff has been identified as the major source of pollution to our surface waters. This runoff is often referred to as non-point source pollution because its origins are diverse and difficult to trace and it is generally representative of pollution captured over a broad area.

Explanation: Nutrients are one of the major pollutants of concern since their input to waterways can stimulate high levels of algal growth, reductions in oxygen concentrations, and stresses on aquatic life. Where nutrients are present in discharges to the Everglades and coastal areas, the impacts can be especially deleterious, resulting in significant shifts in the composition of aquatic plant communities. Fertilizers and pet waste are known to be significant sources of nitrogen and phosphorus (the most critical nutrients), but sediments can also pose a problem. Sediments can be introduced to surface waters when rainfall washes across roadways and during construction projects. Rainfall can pick up more than sediments. Other pollutants of concern are heavy metals, hydrocarbons, and certain trace elements. Many of the County's efforts to reduce urban stormwater runoff have included source controls. Development projects are now required to provide more on-site retention and pretreatment systems that help remove pollutants from runoff. The County encourages the integration of creative stormwater designs into permitted site plans through its green building goals and priorities. "Green" infrastructural approaches to stormwater management infiltrate, evapotranspirate or reuse stormwater rather than treating it as a nuisance. A number of training programs have also been implemented, with courses in construction and landscape best management practices. Other efforts include street sweeping programs, storm drain cleaning and community outreach.

Trends: As older properties undergo development and redevelopment, these sites are required to comply with current surface water management regulations. This means that fewer and fewer sites contain drainage systems that predate today's modern standards. Redevelopment accounts for the majority of construction projects underway and is expected to continue to be prominent during the next several decades. While the development process itself creates an opportunity for sediment erosion and loading, strict sediment controls and dewatering practices help to minimize the disturbance and potential impacts, and the new stormwater management system is generally a substantial improvement to the site. Local governments and communities throughout the State have been growing increasingly concerned with nutrients due to improper landscape practices.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

BUILDING PERMITS -NEW STRUCTURE/NON-RESIDENTIAL ADDITION APPROVALS ISSUED

Measurement: Before the issuance of construction permits for all new buildings and additions to non-residential buildings within Broward County, developers must obtain environmental review approval from the Broward County Development and Environmental Regulation Division (DERD). The approval process includes an evaluation of potential environmental impacts of the proposed construction. To find the number of approvals issued, we query the DERD Permit Monitoring System for the number of approvals issued during the calendar year.

Explanation: A measure of pressures on our natural resources is the number of building permits issued by municipalities and Broward County for all new buildings and additions to non-residential buildings. All building permits require review and approval by DERD. Readers should interpret the data with the understanding that developers must obtain building permits for both new construction on vacant land and renovations of existing buildings. Furthermore, a developer may not actually start the construction of an approved project even though they have the permits in hand.

Trends: The availability of vacant land to build new construction projects continues to diminish as the County approaches build out. This will result in a decrease in the number of new buildings and additions to non residential buildings until all vacant land is used up at which time existing structures will be demolished to make way for new development.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Monthly Reports and Permit Monitoring System data base - Environmental Review Section, Martin Weigand, (954) 519-1251

PERCENTAGE OF DEVELOPED LAND NOT SUBJECT TO SURFACE WATER MANAGEMENT REGULATION

Measurement: The percentage of developed land not subject to surface water management regulation is estimated utilizing the South Florida Water Management District GIS surface water management coverage (including the conceptual permits for the independent drainage districts) and the average number and size of developments licensed by Environmental Protection and Growth Management Department and its predecessor agencies.

Explanation: Developed property can contribute a significant amount of non-point source pollution to receiving water bodies. Before the 1970s, runoff from developed property and the associated non-point source pollution was directed away from the property as quickly as practical. Development regulations in effect since the 1970s that instituted surface water management practices have mitigated the water quality and quantity impacts of construction activities. Regulation of the redevelopment of the areas developed before the 1970s will result in improved water quality and quantity in receiving water bodies. Most of the areas not currently under surface water management licenses are in the eastern portion of the developed county.

Trends: The percentage of developed land not subject to surface water management regulation continues to decrease as the County continues its licensing/permitting activities for new projects and redevelopment projects. The average size of each project has decreased in recent years as the available undeveloped land is exhausted and significantly smaller redevelopment projects now constitute a substantial portion of the projects permitted. Therefore, the percentage decrease has begun to taper off and will likely continue to do so.

Data source: Calendar year data. The South Broward Drainage District, Leo Schwartzberg (954) 680-3337 and the South Florida Water Management District, Tony Waterhouse (561) 686-8800. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Leonard Vialpando, (954) 519-1473

RESPONSES TO PRESSURES ON SURFACE WATER QUALITY

MILES OF STREETS SWEEPED

Measurement: This measure tracks the amount of street sweeping performed as a best management practice (reported in linear miles) in municipal and unincorporated areas included under the National Pollutant Discharge Elimination System (NPDES) permit managed by Broward County.

Explanation: Streets, roads, highways and parking lots accumulate significant amounts of pollutants that contribute to stormwater pollutant runoff to surface waters. Pollutants, including sediment, debris, trash, and trace metals can be minimized by street sweeping. Street sweeping can also improve the aesthetics of municipal roadways, control dust and decrease the accumulation of pollutants in catch basins. An effective municipal street sweeping program can meet regulatory requirements, assess street sweeping effectiveness, and minimize pollutants in roadways. Weekly to bimonthly sweeping programs can achieve reductions of up to 80 percent in annual total suspended solids and associated pollutants.

Regular sweeping of impervious roadways and parking areas is a best management practice (BMP) recommended by the United States Environmental Protection Agency as part of the NPDES program. Broward County, 26 local municipalities, and the Florida Department of Transportation are co-

permittees under a shared NPDES permit requiring local implementation of pollution reduction activities to reduce pollutant loads to local water bodies. Street sweeping is just one of the BMPs implemented by co-permittees in the NPDES permit, but can provide an indication of the level of resources and effort being invested by local partners to achieve compliance with the NPDES permit, with the total number of miles swept serving as a proxy for the overall effectiveness of the NPDES program activities in achieving environmental/water quality improvements.

Trends: The overall trend shows an increase in the number of miles swept each year.

Data source: Calendar year data. Annual NPDES report as summarized by the Florida Department of Environmental Protection. Data summary, Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Ashok Raichoudhury, (954) 519-1490

TOTAL NUMBER OF CERTIFIED NATURSCAPE SITES

Measurement: This measure tracks the total number of properties that have been certified as NatureScapes based on the creation and maintenance of landscapes in a manner consistent with the NatureScape Broward program principles (<http://www.broward.org/naturescape/>).

Explanation: Landscape design and maintenance have the ability to exert tremendous influence on the quantity and quality of Broward's water resources. Landscape irrigation is estimated to account for as much as 50% household water consumption and landscape runoff is identified as a major source of water pollution. In 2002, NatureScape Broward program was created as an environmental initiative with the goals to conserve water quantity, protect water quality, and create wildlife habitat through environmentally-friendly landscape practices that include the use of native and other drought tolerant plants and the prudent use of our water resources. NatureScape properties adhere to the principles of Right Plant, Right Place, Get the Water Right, and other landscape best management practices (including integrated pest management and the use of low and no phosphorus fertilizers). In 2005, Broward County achieved recognition by the National Wildlife Federation (NWF) as a Certified Wildlife Habitat based in large part on the number of certified NatureScapes registered by the County and the environmental standards by which landscapes are evaluated. The County's certification program serves to recognize those properties that exemplify the NatureScape principles and includes those properties certified under similar programs administered by the NWF and Florida Yards and Neighborhoods Program. NatureScapes include residential, commercial, public, and educational properties, and can range in size from several tens of feet to many acres in total area. In 2006, Broward County and the School Board of Broward County entered into an historical partnership agreement to NatureScape certify all school properties as an environmental goal. Planning for certification of five schools began in 2007.

Trends: The total number of NatureScape certified sites reached 2026 in 2007. The number of certified NatureScapes in Broward County has steadily increased since program inception, with annual increases of 38% in 2003, 85% in 2004, 50% in 2005, 24% in 2006, and 36% in 2007.

Data source: Calendar year data. Data maintained by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

NUMBER OF EDUCATIONAL PROGRAMS DELIVERED

Measurement: This measure tracks the total number of education programs provided through the NatureScape Broward program beginning in County fiscal year 2005. The data reported is for the fiscal year indicated ending September 30th.

Explanation: The NatureScape Broward, Know the Flow and Water Matters Day components of the County's Integrated Water Resources Plan are part of an outreach campaign designed to produce long-term water demand reductions and water quality improvements through public education. The concepts imparted through these programs play a key role in reducing urban runoff and in supporting water quality protection initiatives throughout the County. NatureScape Broward is a public education program that promotes the concept of "Florida-friendly" landscaping through the NatureScape Broward website and through classes, workshops, and presentations conducted by County staff.

Companion materials are provided that teach participants about the benefits of using native plants in landscapes and the use of landscaping best management practices to reduce water use, irrigation runoff, and to protect water quality through prudent use of lawn chemicals. Under a partnership agreement with the School Board of Broward County, NatureScape Broward principles are being integrated into native landscapes at middle schools throughout the County. Through landscape make-overs, students, teachers and school maintenance staff learn the value of water conservation, native landscaping, and landscape best management practices that reduce water use and pollution. The Know the Flow program is a water management course delivered monthly to residents and businesses by County staff in coordination with the South Florida Water Management District. This course is geared toward licensed property managers, municipal employees, homeowner associations, landscape service providers, and community groups, and it offers opportunities for participants to earn continuing education credits. Know the Flow provides a comprehensive overview of water management systems and operations in Broward County and encourages participants to adopt environmentally sound landscaping and stormwater best management practices to help protect water resources while maintaining essential flood control. The County's premier education event of the year is Water Matters Day. This is an annual community outreach event that educates homeowners about the role they play in managing water resources in their homes, yards and communities. Water Matters Day features water related educational booths, giveaways (trees, native plants, rain gauges, etc.), workshops and family entertainment to help residents understand the importance of protecting our water resources and to learn how to maintain beautiful yet environmentally-friendly landscapes.

Trends: Since 2005, the number of water resource related educational programs delivered by the County has doubled. The 2007 goal was delivery of 90 programs, which was exceeded by 24% with delivery of 112 programs. Through the NatureScape Broward and School Board partnership alone, 110 District teachers and 50 custodial/maintenance staff were trained in Board approved NatureScape Broward training sessions. Program information was provided to an additional 500 teachers, administrators, custodial staff and other school board employees through personal contact. Over 1,100 Broward County students have directly participated in educational lessons that raised their consciousness on the importance of environmental stewardship. Through 2007, 40 Know the Flow seminars were held with a total of over 600 participants. The Sixth Annual Water Matter Day event held in March, 2007 was attended by 4,000 participants, and by December, 2007, the NatureScape Broward website had 11,774 visits. In addition, the County is actively working to develop further educational opportunities for elected officials and policymakers to be delivered in 2008 to inform their decisions regarding management of population growth in the face of diminishing water supply.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

C-11 WEST CANAL BASIN/ BROWARD EVERGLADES WORKING GROUP ACTIVITIES

Narrative: The State's Long-term Plan for Achieving Water Quality Improvements in the Everglades Water Conservation Areas (2003) was drafted to bring greater focus to pollution reduction efforts relating to Everglades Stormwater Program (ESP) Basins and non-Everglades Construction Projects. The ultimate goal of the Long-term Plan was to detail the methods by which pollution reductions would be achieved, consistent with the State's proposed water quality criterion of 10 parts per billion (ppb) phosphorus for discharges into the Everglades. In response to recommendations outlined in the State's Long-term Plan, and through the efforts of the Broward County Natural Resources Planning and Management Division and the South Florida Water Management District, the Broward Everglades Working Group (BEWG) was convened in 2004 to develop and implement strategies to achieve water quality improvements in Broward County in support of Everglades restoration. There are three ESP Basins in Broward County (North Springs Improvement District, North New River Canal Basin, and C-11 West Basin).

Explanation: The C-11 West Basin of Broward County is a major source of stormwater discharge and urban pollution to the Everglades, so

controlling polluted stormwater discharges to the Everglades from the C-11 West Basin is the primary goal of the BEWG. Stakeholder groups in the C-11 West Basin, including municipalities, drainage and water control districts, the agricultural industry and others, were invited to identify and implement specific strategies for reducing phosphorus pollution in urban landscape which contributes to the degradation of the Everglades. The result was the creation of the C-11 West Basin Pollution Reduction Action Plan. The idea was to initially focus on the C-11 West Basin, where discharges and pump operations have been a subject of litigation, but to then expand the approach to other Everglades Stormwater Program (ESP) basins and eventually to all of Broward County. Representatives from state agencies, affected municipalities, drainage districts, the nursery industry, and others are currently working to implement the C-11 West Basin Pollution Reduction Action Plan. The BEWG meets quarterly to review progress relative to commitments and water quality goals and to identify strategies for enhancing efforts.

Trends: Since the first meeting was convened in May 2004, a total of nine BEWG meetings have been held, with broad and enthusiastic participation from elected officials, agency staff, environmental groups, the Miccosukee Tribe of Indians, and others. The collaborative, inclusive, and voluntary process by which the BEWG has operated is now serving as a model for similar local pollution reduction efforts. Participants representing drainage districts and municipalities approved the final draft of the C-11 West Basin Pollution Reduction Action Plan, which was subsequently adopted as part of the State's Long-term Plan. In 2007, the BEWG met three times, and will continue to meet quarterly to report activities, assess progress, and modify pollution reduction approaches as needed to meet water quality goals. An agreement between the County and the South Florida Water Management District has been drafted to increase efforts to improve and protect water quality within the C-11 West Basin. This three-year agreement will provide educational opportunities to residents, property managers, business owners and the regulated community in Non-Everglades Construction Project basins about the relationship between the Everglades, urban water resources, our coastal environment, and best management practices that protect water quality and improve water resource management.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

CLEAN WATER ACT - TOTAL MAXIMUM DAILY LOAD PROGRAM

Narrative: A Total Maximum Daily Load, or TMDL, is the maximum amount of a pollutant a surface water body can assimilate and still meet State water quality standards. TMDLs are established by the State for all waters that have been deemed impaired for one or more pollutants, such as nitrogen, phosphorus, bacteria and heavy metals. The goal of the TMDL program is to reduce pollutant loads to impaired waters to levels that allow them recover and meet their designated uses.

Explanation: Section 303(d) of the Federal Clean Water Act requires the development of TMDLs for all surface waters nationwide which the States have identified as impaired, or not meeting State water quality standards. The U.S. Environmental Protection Agency is ultimately responsible for TMDL development, but in the State of Florida this task has been largely delegated to the Florida Department of Environmental Protection (FDEP). In response, the FDEP developed a science-based methodology for assessing waters statewide and adopted it by rule (Impaired Waters Rule, or IWR, Rule 62.303, FAC). The FDEP develops TMDLs for waters that have been verified impaired through application of the assessment methodology in the IWR. The TMDL development process requires significant interagency coordination among the FDEP, Counties, Water Management Districts and other stakeholders to ensure the most comprehensive assessment of surface waters possible. This requires a significant amount of water quality data and interagency collaboration on appropriate methods of assessment. Broward County has provided the State with water quality data for the assessment of County surface waters for many years, and has been a key contributor to the development of TMDLs and implementation strategies.

Trends: Six water bodies in Broward County are currently on the State's verified list of impaired waters. The County's first TMDL was completed in June, 2008 for the Pompano Canal and the process to develop a plan to meet the TMDL has already begun. All of the County's surface waters will be reassessed under the IWR in 2009.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

ACTIVE CONSTRUCTION SITES WITHIN BROWARD COUNTY JURISDICTION WITH SURFACE WATER MANAGEMENT LICENSES

Measurement: This measure tracks the number of surface water management system construction authorizations issued outside of the independent drainage districts.

Explanation: Construction activities represent a significant potential for pollution runoff to surface waters as a result of the exposure of bare soils to precipitation and dewatering of soils for foundation and underground utility installation. Improper management of sediment and erosion or inadequate dewatering controls may result in turbidity-related pollution events in adjacent water bodies. Excess sediment in a water body (turbidity) makes it difficult for aquatic plants to receive the sunlight necessary for growth, smothers aquatic habitat, clogs fish gills, and over time impedes navigation by reducing the water depth. The turbidity associated with construction activities may pose significant risk for aquatic communities as the violations often involve high levels that can be sustained over several weeks if not quickly controlled. In addition, sediments that remain suspended are generally negatively charged and will therefore attract positively charged molecules such as phosphorus, heavy metals and pesticides that are then released slowly into the water column. The Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual contains BMPs for construction activities during and after construction to reduce erosion and sedimentation and to properly manage runoff for both stormwater quantity and quality.

Trends: The total number of open construction authorizations continues to increase as a result of the construction boom that started in 1999. The increase in open authorizations may also indicate that a growing number of projects are delayed or not completed due to recent changes in the real estate market and population growth.

Data source: Calendar year data. Surface Water Management licensing databases, FOXPRO and POSSE. Data summary, Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Leonard Vialpando, (954) 519-1473

TOTAL SURFACE WATER MANAGEMENT CONSTRUCTION LICENSES ISSUED SINCE 1989

Measurement: This measure tracks the total number of surface water management licenses issued since 1989 each calendar year.

Explanation: The Surface Water Management Program is responsible for licensing all construction of surface water management systems as required under Broward County Code of Ordinances, Chapter 27, Article V, renewal of operation licenses, and certain environmental resource, wetland resource and surface water management permitting, compliance and enforcement responsibilities under part IV, Ch 373, F.S. and the rules promulgated thereto as set forth in the Delegation Agreement Among the Florida Department of Environmental Protection, the South Florida Water Management District and the Broward County Board of County Commissioners. Please reference the ERP Delegation Boundary Map depicting the areas for which Broward County has delegated authority for the Environmental Resource Permit (ERP) program (<http://www.broward.org/waterresources/wti00115.pdf>). Properly designed, constructed, operated, and maintained drainage systems remove pollutants from storm runoff prior to discharging into Broward County's surface waters and provide the required levels of flood protection in accordance with established criteria for proposed developments. There are currently 35,700 acres of existing pre-regulation developed land

without a required surface water management license in the ERP delegated areas.

Trends: The total number of surface water management licenses issued is dependent upon the real estate market and population growth and includes major redevelopment or expansion of existing developed areas.

Data source: Calendar year data. Surface Water Management licensing databases, FOXPRO and POSSE. Data summary, Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Leonard Vialpando, (954) 519-1473

WATER RESOURCES - GROUNDWATER QUALITY

PERCENT OF POTABLE WATER WELLS MEETING DRINKING WATER STANDARDS

Measurement: This measure tracks the percent of public water supply wells that do not contain regulated substances exceeding the drinking water standards. Supply wells from 39 public wellfields are sampled quarterly for regulated substances stored, handled, used and produced by businesses located in the source water assessment area of each supply well. Regulated substances are hazardous chemicals listed in Article XIII, Appendix A of the Broward County Code of Ordinance - Pollution Control (Chapter 27).

Explanation: The purpose of wellfield protection is to prevent contaminants from reaching and polluting the public water supply. We designed compliance inspections and water monitoring plans to ensure the proper storage, handling, use and production of hazardous materials, some of which contain regulated substances, at businesses located in the public wellfields. Monitoring wells are constructed and sampled by businesses in the public wellfields to monitor releases from the businesses. Raw water is sampled from public supply wells to verify that regulated substances are not contaminating the public water supply. In 2001, we began to upgrade the Wellfield Protection Program through a Source Water Assessment and Protection Program grant from the Florida Department of Environmental Protection. The ultimate goal of this program is to identify all potential sources of contaminants within the public wellfields, maintain an inventory of all active public supply wells, reduce the quantity of chemicals containing regulated substances in the public wellfields, and monitor businesses using these chemicals for compliance with Chapter 27.

Trends: The percent of public supply wells that do not contain regulated substances exceeding the drinking water standards continues to remain at 100%. More than 3.5 million gallons of liquid hazardous materials and more than 1.5 million pounds of solid hazardous materials are stored, handled, used and produced within the public wellfields. We continue to provide protection for the water supply from these chemicals through inspections, public education, water monitoring plans and enforcement.

Data source: Calendar year data. Quarterly raw water sampling data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Harvey I. Schneider, PhD, (954) 519-1439

PRESSURES ON GROUND WATER QUALITY

PERCENT SALTWATER MONITORING WELLS WITH CHANGING CHLORIDE CONCENTRATION, 2000 BASELINE

Measurement: This performance measure reflects the potential for saltwater intrusion to impact potable water supplies. It is based upon data from monitoring of the Regional Saltwater Intrusion Monitoring Network in Broward County. The changes are classified as the percentage of all monitored wells in the Regional Network whose chloride concentration increased or decreased, expressed as a logarithm, by 0.5 or remained

unchanged from the baseline year (2000). Individual well chloride concentrations are annual averages recorded for the well in the calendar year indicated with the exception of the current year which is as of June 30th.

The following wells, using their USGS identification numbers, are monitored for this performance measure:

G-2149	G-2445	G-2693	G-2697	G-2752	G-2785
G-2893	G-2894	G-2896	G-2897	G-2898	G-2899
G-2900	G-2901	G-2902	G-2903	G-2904	G-2906

Explanation: The presence of elevated levels of chloride in potable water supplies can cause treatment problems because it cannot be removed by certain types of treatment plants and the treated water is subject to the secondary water quality standard for chloride. We think that changes in chloride concentrations, expressed as the common logarithm, of 0.5 tend to correlate with the degree of coastal saltwater intrusion, and low values indicate a lack of saltwater contamination at the monitoring point. As of 2002, Well G-2901 has been deleted from the network due to a leaky casing giving false readings. A data correction for well G-2693 (previously G-2694) resulted in a change in 2001 which previously caused a false indication of declining chlorides in that well. As of 2003, G-2894 was destroyed reducing the network to 16 wells. Find additional technical information at http://www.sflorida.er.usgs.gov/edl_data/text/brw_qw.html.

Trends: Complete data for 2007 and partial data for 2008 shows three wells where the increase in chloride concentrations exceeds a 0.5 logarithm change (G-2893, G-2898, G-2899). This result suggests the saltwater intrusion front may be advancing in the areas monitored by these wells. Other wells show a lesser increase in chloride concentration compared to the 2000 baseline except wells G-2445 and G-2785, which are showing small decreases. However, the change in chloride concentration in these wells does not exceed a 0.5 logarithm change

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Darrel Dunn, PhD, (954) 519-1450

PERCENT BROWARD COUNTY WHERE CENTRAL DOMESTIC SEWER SERVICE IS NOT AVAILABLE

Measurement: The percentage of the developed portion of the County without central sewage service is estimated utilizing the Environmental Protection and Growth Management Department GIS coverage and the average number and size of developments licensed by the Environmental Protection and Growth Management Department. We assume on-site sewage treatment facilities, such as septic systems serve areas without central, domestic sewer service.

Explanation: Broward County's drinking water comes primarily from the Biscayne Aquifer, a shallow ground water aquifer. Its proximity to the surface leaves it vulnerable to various types of contamination including septic systems. In older areas of the County, aging tanks and drain fields may cause the septic system to fail to treat incoming sewage and household waste effectively. A reduction of these systems especially in industrial areas will lower the contamination threat to the aquifer.

Trends: The percentage of area where central domestic sewer service is not available continues to decrease. In previous years, the percentage decreased as new subdivisions were developed. More recently, redevelopment activities have increased while new subdivisions have decreased. The City of Fort Lauderdale and unincorporated Broward County continue to provide central sewage system connections where properties had been served by on-site treatment and disposal facilities.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Leonard Vialpando, (954) 519-1473

TOTAL SOLID WASTE PRODUCED, MILLION TONS/YEAR SOLID WASTE PRODUCED, TONS/YEAR/PERSON

Measurement: This performance measure tracks the quantity of solid waste produced in Broward County. Broward County Waste and Recycling Services (WRS) provides data on waste production by Broward County to the Florida Department of Environmental Protection (FDEP). The FDEP, Bureau of Solid and Hazardous Waste, Division of Waste Management, publishes the data in the Solid Waste Management in Florida

Annual Report (http://www.dep.state.fl.us/waste/quick_topics/publications/default.htm). The total waste tonnage includes construction and demolition debris. Per capita amounts are based upon Census 2000 figures.

Explanation: Tracking of the handling, management and disposal of solid waste helps to prevent illegal dumping and allows the maintenance of sufficient disposal options for future generations.

Trends: For the first time since 1997, the total waste produced in Broward County has decreased (0.4% between 2006 and 2007), perhaps associated with the downturn in the economy.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Sermin Unsal, (954) 519-1460

NUMBER OF CONTAMINATED SITES

Measurement: This is the total count of sites with petroleum contamination that are being cleaned up or are awaiting cleanup.

Explanation: One of the greatest threats to our drinking water supply is contamination from leaking underground petroleum storage tanks. The Biscayne Aquifer, Broward County's sole source of drinking water supplies, lies very close to the surface, making it extremely vulnerable to contamination from surface and near-surface pollution sources. Underground petroleum storage tanks are the most common of these sources.

Trends: Overall, the historical data shows continued variability in the number of contaminated sites, with a 2.4% increase in the number of contaminated sites since 2005. Under State rules, many underground fuel tanks need to be replaced by the end of 2009; as tanks are replaced, new contamination is discovered and, therefore, this number is anticipated to increase through 2009.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Lorenzo Fernandez, (954) 519-1249

NUMBER OF HAZARDOUS MATERIAL AND STORAGE TANK LICENSES

Measurement: This is the number of hazardous materials and storage tank licenses issued by Environmental Protection and Growth Management Department. It includes facilities with current facility management licenses for hazardous materials, storage tank, or wellfield hazardous materials activities. It also includes the number of facilities with current consolidated facility management licenses for hazardous materials/storage tank activities and wellfield hazardous materials/storage tank activities. A current license is one that the Environmental Protection and Growth Management Department issues before the end of the quarter and that expires on or after the end of the quarter. The number does not include un-issued new licenses in process or facilities facing enforcement action for non-renewal or operating without a license through September 30th of the year given.

Explanation: Businesses that handle and store hazardous materials represent a potential threat to ground and surface water quality. The Environmental Protection and Growth Management Department licenses and inspects facilities operated by these businesses to minimize the threat. Licensing information is available to the public on the web at <http://dpep.broward.org/ENVIROS/>.

Trends: The number of hazardous material licenses has leveled as implemented efficiencies have been realized in maintaining facility licenses. Though new licenses continue to be issued, there has been an increase in licenses lost to closures of small businesses. In addition, staff has handled an increase in tank modification applications due to mandated tank upgrades.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Connie Boden, (954) 519-1260

AMOUNT OF HAZARDOUS MATERIALS HAULED, MILLION GALLONS

Measurement: This measure tracks the amount of discarded hazardous material, sludge, and biomedical waste transported to, from and within

Broward County. Environmental Protection and Growth Management Department licensed waste transporters submit a report to Environmental Protection and Growth Management Department of the total amount of waste they transport on a monthly basis.

Explanation: In Broward County, certain discarded hazardous material, sludge, and biomedical waste hauling are regulated to eliminate deleterious effects upon the quality of air, waters, soils, and human health from improper disposal. Tracking of these wastes helps to prevent illegal dumping.

Trends: The total amount of discarded hazardous material, sludge, and biomedical waste hauled decreased approximately 16% during year 2006 due. Currently, EPD cannot attribute this decrease to any particular issue.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Sermin Unsal, (954) 519-1460

NUMBER OF NEW REPORTED DISCHARGES

Measurement: This measure tracks the total number of discharges reported (mostly from petroleum storage tank facilities) during the County fiscal year which ends on September 30 of the year shown.

Explanation: Discharge Reporting Forms (DRF) are required to be completed and submitted to the Pollution Prevention, Remediation and Air Quality Division for processing within 24 hours of determination that a discharge has occurred. These reports include receipt of analytical results or visual observations of a spill of regulated substances that might impact soil, ground water or surface waters of the County. Upon receipt of DRFs, field staff complete discharge investigation inspections, verify that a discharge has actually occurred and enter same into FDEP's database to initiate cleanup tracking activities.

Trends: As storage tank technology improves, the state requires all facilities to upgrade to tanks meeting the next level of safety by a specific year. The number of reported discharges has historically correlated to storage tank systems upgrade years. This occurs because discharges are observed and identified in the process of removing/upgrading the old tanks. Facility owners/operators steadily reported discharges to a peak around an upgrade year, a drop thereafter and a steady increase till the next upgrade event. The next upgrade requirement deadline is Dec. 31st, 2009. The 41.3% jump in reported discharges in 2007 is mostly due to discharges discovered when facilities upgraded their storage tank systems in anticipation of that deadline.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Ali Younes, (954) 519-1486

RESPONSES TO PRESSURES ON GROUND WATER QUALITY

LOCAL SURFACE WATER MANAGEMENT

Narrative: Surface water management improvement projects designed to increase the storage of stormwater and landscape runoff within the secondary canal system serve to increase aquifer recharge and can raise ground water levels. Aquifer recharge is an important means of combating saltwater intrusion.

Explanation: Broward County consists of a diverse water management community with dozens of discrete water management entities, including municipalities, drainage/water control districts, water suppliers, and water managers. Water is a regional resource however, with management implications that extend well beyond the jurisdictional boundaries of individual entities. The need for a coordinated approach among water managers to effectively meet the County's future water supply needs and water resource goals resulted in the establishment of the County-wide Integrated Water Resources Plan (IWRP). The IWRP is implemented by the Broward County Natural Resources Planning and Management

Division, in partnership with local governments, water providers and water managers, to further efficient and effective water resource planning and management activities with a focus on coordination and cooperation. Elements of the IWRP include water resource assessments; development of technical tools to aid in planning and management decisions; development and implementation of diverse traditional and nontraditional water management strategies; a comprehensive water conservation outreach and education program; and projects that are multi-jurisdictional in nature and that have multiple water resource benefits. A principle water management strategy of the IWRP has been to better utilize its existing canal infrastructure to move water to areas where it can be used for a number of beneficial uses, including recharge of our existing groundwater supplies, rehydrating urban wetlands, and preventing saltwater from intruding into our coastal wellfield areas.

Trends: Since 2006, and through the IWRP, the County has provided interlocal partners with cost share funding for numerous projects to improve surface water management, enhance wellfield recharge and stormwater reuse, and to investigate ways to abate saltwater intrusion into coastal wellfields. Broward County has partnered with the United States Geological Survey to develop a saltwater intrusion model for northern Broward County. The saltwater intrusion model is in the third year of development and is nearly complete. When finalized it will provide water managers with a better understanding of the degree to which climatologic factors and water management operations influence saltwater intrusion, and will guide future efforts in effective management of saltwater intrusion. Plans are underway for expansion of this modeling effort in FY 09 into central Broward County. The development of an advanced hydrologic model has been completed to assist local water managers in identifying and quantifying the benefits of various secondary canal improvement projects and it is being applied in the development of a County-wide Water Management Master Plan for surface water and groundwater resources. The construction of a secondary canal interconnect between the Old Plantation Water Control District and the C-12 Canal was completed and is expected to enhance wellfield recharge with both water quality and water quantity benefits.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

NET GAIN/LOSS IN SEPTIC SYSTEM WASTEWATER FLOW, THOUSANDS OF GALLONS/DAY

Measurement: This is the net gain or loss in wastewater flow handled by septic tank facilities (also known as on-site treatment) associated with certain building permit approvals granted for the subject period. The flow figures used are those identified for new septic tank installations minus those identified for septic to sewer conversions by calendar year.

Explanation: This performance measure compliments the information provided by the "Percentage of the county where central domestic sewer service is not available" performance measure. This measure of progress is designed to deal with both sides of the equation. It provides a comparative analysis of development approvals that either involve flows associated with new on-site treatment and disposal system (septic) installations or add to the total flows handled by sanitary sewer facilities.

Trends: Several of the County's Neighborhood Improvement Projects and City of Fort Lauderdale's "Water Works 2011" projects have been completed and released for use resulting in a large influx of septic to sewer conversions. These Neighborhood Improvement Projects are ongoing and we anticipate this trend of high septic to sewer conversions for the next two to three years.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Monthly Reports – Environmental Review Section, Martin Weigand, (954) 519-1251

PERCENT OF SOLID WASTE RECYCLED

Measurement: This performance measure tracks the percent of recyclable materials separated from the total waste stream.

Explanation: Tracking of the handling, management and disposal of solid waste helps to prevent illegal dumping and allows the maintaining of sufficient disposal options for future generations.

Trends: The percentage of solid waste recycled decreased 17% between 2005 and 2006, reflecting a general downward trend in this benchmark.
Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Sermin Unsal, (954) 519-1460

PERCENTAGE OF CONTAMINATED SITES CLEANED UP TO STATE STANDARDS

Measurement: This is the cumulative percentage of contaminated sites cleaned up to state standards in the indicated calendar year.

Explanation: One of the greatest threats to our drinking water supply is contamination from leaking underground petroleum storage tanks especially where these sources are within drinking water wellfield zones. The Biscayne Aquifer, Broward County's sole source of drinking water supplies, lies very close to the surface, making it extremely vulnerable to contamination from surface and near-surface pollution sources. Underground petroleum storage tanks are the most common of these sources.

Trends: The historical data shows a continued increase in the percentage of sites cleaned up. However, new discharges make the cleanup of all sites a moving target. For example, under State rules, many underground fuel tanks need to be replaced by the end of 2009; as tanks are replaced, new contamination is discovered which will need to be cleaned up.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Lorenzo Fernandez, (954) 519-1249

NUMBER OF LICENSED HAZMAT SITES INSPECTED

PERCENT OF LICENSED HAZMAT SITES INSPECTED AND FOUND TO BE IN COMPLIANCE

Measurement: This is a measure of the activities of the Pollution Prevention, Remediation and Air Quality Division to inspect the holders of hazardous material licenses in Broward County during the fiscal year indicated. The total number of inspections is determined by using the Pollution Prevention, Remediation and Air Quality Division's POSSE Licensing and Inspection database. The query provides the number of sites inspected in a given month. The output is then corrected for sites that have received a Licensing Non-Compliance Notice or Warning Notice. This leaves all sites visited and found to have no compliance problems, for a given month. We compile annual figures from the monthly reports for the fiscal year indicated ending September 30th.

Explanation: Compliance with hazardous material and storage tank regulations will result in decreased incidences of pollution. Furthermore, site visits by Pollution Prevention inspectors, general knowledge within the regulated community of an ongoing inspection program, and the potential of enforcement action for non-compliance will result in increased compliance. Pollution Prevention, Remediation and Air Quality Division designed these measurements to track both the activity and outcome associated with the number of satisfactory hazardous material facility inspections.

Trends: The number of hazardous material sites inspected has increased 2.0% between 2006 and 2007, and continues an upward trend begun in 2004. This reflects an increased number of inspections within the Broward County wellfields, an increase in the production of inspectors, and an increase in the installation and/or closure inspections at licensed facilities due to emergency preparedness needs and the Dec. 31st, 2009 upgrade schedule requirements. The number of sites found to be in compliance continues to vary, decreasing from 79% in 2005 to 76% in 2006, to 71.5% in 2007. The downward trend for this metric is due to a specific focus on Wellfield and Drycleaner facilities, and the inability of single wall storage tank facility owners/operators to acquire/maintain pollution insurance in anticipation of the upgrade schedule deadline. Finally, note the spike in the 2003 data. Between 2002 and 2004, PPRAO's inspection system was changed to an e-inspection protocol, reducing the number of sites inspected. Specifically, beginning in 2004, inspectors were required to complete new inspection requirements at each site (electronic site diagrams, electronic photographs, electronic hazardous material inventory, etc.), resulting in a decrease in the number of sites inspected between 2003 and 2004.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Ali Younes, (954) 519-1486

WATER RESOURCES – GROUND WATER QUANTITY

PERCENTAGE OF GROUND WATER MONITORING WELLS WITH CHANGING GROUND WATER LEVELS

Measurement: This measure tracks the change in ground water levels with respect to a long-term (16 year) average at seven (7) ground water monitoring wells representing northern, central, and southern parts of Broward County and extending from west to east. The response is presented as the percent of total wells with changes in ground water levels that are considered “substantial.” A change is termed “substantial” if the difference between the current annual average compared to the historic mean is greater than one standard deviation as measured over the baseline period of record (1983 to 1999).

Explanation: Surface water management operations in Broward County support a finely-calibrated system. The County’s elaborate canal network generally moves water from western portions of the County to the east, providing necessary drainage and flood control while at the same time enhancing aquifer recharge. One of the County’s main water management objectives is to maintain the urban hydrology to meet urban water supply needs, whether through wetland and wellfield recharge or efforts to abate saltwater intrusion. During recent years, saltwater intrusion has begun to threaten some of the County’s more coastal wellfields, resulting in imposed constraints on wellfield operations and in some cases leading to the development of additional wellfields to the west. The threat of saltwater intrusion is exacerbated when ground water levels decline. By measuring ground water levels at various points throughout the County, the goal is to attempt to identify general trends in Broward’s urban hydrology and respond with changes in surface water management and/or wellfield operations accordingly.

Trends: No substantial changes in ground water levels have been measured at sites monitored during the last seven years. Ground water levels in the northern saltwater intruded area of the county are about one foot above the historical long-term average, a trend that has been maintained since 2001. Ground water levels in the southern saltwater intruded area have averaged 0.25 feet above the long-term average during this same timeframe. Ground water levels in other parts of the County show little change.

Data source: Calendar year data. Data sets maintained by the United States Geological Survey and the South Florida Water Management District. Data summary, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

PRESSURES ON GROUND WATER QUANTITY

INCHES OF ANNUAL RAINFALL

Measurement: This measure tracks the average annual rainfall measured across Broward County, in inches. This is provisional data based on numerous rain gauges located throughout the County and monitored as part of a network by the South Florida Water Management District.

Explanation: Local rainfall significantly influences surface and ground water hydrology in Broward County. Annual rainfall in Broward County averages 57.65 inches per year (1976-2005 30-year average http://www.sfwmd.gov/sfwmd/common/images/weather/30yr_rain.html), approximately 50% of which serves to recharge the Biscayne Aquifer, the County’s current source of drinking water. The remaining 50% is lost to the atmosphere through evapotranspiration. Water management efforts in Broward County are heavily focused on the management of this annual rainfall. The vast majority of annual precipitation falls between the months of May and November. Unfortunately, the County is unable to

take full advantage of this rainfall since there is little topography and hence long-term surface water storage is a challenge. As a result, despite the apparent abundance of rainfall, during drier months, reduced rates of rainfall and aquifer recharge can stress local water supplies and wetland systems by causing reductions in ground water levels. This is particularly true during the winter and spring months when irrigation demands increase and the region's population expands with winter residents. Such strains are greatest during prolonged periods of drought when surface water recharge of potable water wellfields can leave eastern wellfields vulnerable to saltwater intrusion. With such close connection between local rainfall, ground water levels, wellfield management, and surface water management operations, it is of great value to monitor changes in each of these areas, assess potential short- and long-term implications for Broward's urban hydrology, and ideally respond with appropriate water management operations that can help to protect the County's local water resources.

Trends: Annual rainfall in Broward County as measured over a 30-year period of record averages 57 inches. Annual Broward County rainfall has exceeded this long-term average in six of the last eleven years, suggesting a pattern of wetter than normal weather conditions during the last decade. However, rainfall was particularly low in both 2004 and 2006, with a total of 45 inches of annual local rainfall, much less than the historical average. In 2007, the annual average rainfall was 53 inches.

Data source: Calendar year data. Data provided by the SFWMD and are considered provisional, summarized by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

POTABLE WELLFIELD WITHDRAWALS FROM THE BISCAYNE AQUIFER, MILLION GALLONS/DAY

Measurement: This measurement tracks the total amount of water withdrawn from the Biscayne Aquifer by public and private water utilities, in millions of gallons per day (MGD), for the purpose of meeting urban water supply demands in Broward County.

Explanation: The Biscayne Aquifer is the primary water source used by Broward County, Miami-Dade County, and the southeast portion of Palm Beach County to meet urban water supply needs. The Biscayne Aquifer is also one of the most productive aquifers in the world, as it is relatively shallow (only 6 feet below ground in some areas) and consists of highly permeable and porous limestone, which allows for high rates of recharge and transmissivity. Recharge of the Biscayne Aquifer is provided by local rainfall (which averages 57 inches per year in Broward County) and ground water seepage and surface water deliveries from the Everglades. In recent years, concern has grown about reliance upon the Everglades as a water source for aquifer recharge, and in the carrying capacity of the Biscayne Aquifer for potable water demands. Establishment of the regional water availability rule by the South Florida Water Management District now restricts water management operations that create additional demands on the regional system in excess of those measured prior to April 2006. With Broward County's urban population expected to reach 2.4 million by 2025, discussion is increasing about the need to develop alternative water supplies in order to ensure an adequate and reliable water supply is available, regardless of climatologic conditions, while working to ensure regional water is reserved for restoration of the Everglades, consistent with the intent of the federal Comprehensive Everglades Restoration Plan. Wellfield withdrawals by public and private water suppliers provide a measure of the degree to which utilities are maintaining or reducing wellfield withdrawals through conservation programs and the development of alternative water supplies.

Trends: Wellfield pumpage was relatively constant from 2000 through 2006, with an increase over this period of only 2.6%, or 6.76 million gallons per day (MGD). Wellfield pumpage was highest in 2004 (270.4 MGD) when annual rainfall measured 45 inches, or 12 inches less than the 30-year long-term average of 57 inches for Broward County. Wellfield pumpage was lowest in 2001 (233.7 MGD) when annual rainfall was 60 inches, three inches above the long-term average. In 2007, wellfield pumpage was 244 MGD and rainfall averaged 53 inches. During 2007, as in 2001, pumpage primarily declined due to watering restrictions put into place by the SFWMD in response to regional drought conditions.

Data source: Calendar year data. Data provided by the SFWMD and summarized by Broward County Environmental Protection and Growth

BROWARD COUNTY WATER AND WASTEWATER SERVICES WATER CONSUMPTION, GALLONS/DAY/PERSON

Measurement: This performance measure reflects trends in the consumption of water resources by the residents of Broward County. The data are based upon total finished and purchased water consumed annually in each Broward County Water and Wastewater Services (WWS) district divided by our best estimate of population derived from the 2000 census and projected forward for each district. The methodology for determining per capita rates is outlined in the 2004 Broward County 10 Year Water Supply Plan.

Explanation: Per capita water consumption reflects resident's attitudes regarding water use and conservation as indicated by a sub-set of users within the WWS franchise area. It can be influenced by inverted block rates charged by the provider during droughts declared by the South Florida Water Management District. Lower values in 2007 reflect water restrictions that were required by the SFWMD.

Trends: The reduction in the overall per capita consumption is the result of several factors.

1. The WWS Neighborhood Improvement Projects have replaced 25% of our underground infrastructure thereby reducing leaks and per capita consumption.
2. All new construction is required by Broward County Ordinance to use more efficient low-flow plumbing fixtures.
3. 2006 was considered a dry year, with increased demands for irrigation resulting in water restrictions beginning in March, 2007.
4. We believe our ongoing Water Conservation Program has also helped reduce per capita consumption.
5. 2007 was the second consecutive year with drought conditions and mandatory Stage II or Stage III water restrictions imposed by the SFWMD for the entire year (see note 3 above).

Data source: Calendar year data. Broward County Public Works, Water and Wastewater Services, Chuck Flynn, (954) 831-0886

REGIONAL SURFACE WATER MANAGEMENT

Narrative: Implementation of the Comprehensive Everglades Restoration Plan and associated changes in regional water policy results in modified surface water management operations with implications for urban water supply.

Explanation: Surface water deliveries from the regional, or the Everglades system, are an important component of Broward's hydrologic system. While local rainfall provides the vast majority of water needed to meet Broward's urban water supply needs, rainfall is seasonal and unpredictable. During the dry season and periods of drought, Broward County's reliance upon surface water deliveries from the Everglades system increases as this water is used to maintain canal and aquifer levels. The maintenance of these water levels is critical in maintaining hydration of urban wetlands, preventing saltwater intrusion into potable wellfields, and in protecting water management infrastructure from erosion. When Water Conservation Areas located in western Broward County lack the water necessary to provide for urban water deliveries, recharge of the County's canal network can be temporarily suspended (as occurred during spring 2007). Furthermore, the regional water availability rule developed by the South Florida Water Management District restricts water management operations that create additional demands on the regional system in excess of those measured prior to April 2006. Regional policies and climatologic variability necessitates efficiencies in surface water management and the development of alternative source waters for canal and aquifer recharge.

Trends: The relationship between urban water management and the Everglades system is in transition. As part of the Comprehensive Everglades Restoration Plan, regional water management practices and policies are being modified to retain a greater volume of water within the Everglades system for Everglades restoration and to reduce overall urban reliance upon the Everglades as a source of water supply. Local governments will need to identify and develop alternative water supplies to meet future water demands, and to offset some portion of current water demands.

Broward County is pursuing regional alternative water supply solutions in partnership with local water providers, neighboring counties, and the South Florida Water Management District. Hydrologic modeling efforts are underway to identify local alternative water supply projects, points of distribution, and secondary canal routing needed to provide for the County's long-term water demands and in compliance with regional policies and management constraints. The Broward Water Resources Task Force will be convened in 2008 to provide a forum in which to discuss effective alternative water supply strategies to meet current and future regional water demand.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

RESPONSES TO PRESSURES ON GROUND WATER QUANTITY

MAINTENANCE OF URBAN GROUND WATER LEVELS

Narrative: The County is supporting a sub-regional water planning effort to develop long-term strategies for meeting the County's future water supply needs and water resource goals. These strategies include alternative water supply development and coordinated surface water management operations that serve to reduce urban demands on ground water supplies while enhancing canal/aquifer recharge with deliveries from alternative water sources.

Measurement: This measure tracks improvements and progress in water management operations, projects, and partnerships that are undertaken as part of a County-wide effort to maintain urban ground water levels.

Explanation: A direct connection exists among urban ground water levels, the integrity of the Biscayne Aquifer, the health and function of urban wetlands, the operation of drainage infrastructure, and Everglades restoration. As ground water levels decline, wetland systems can dehydrate, urban wellfields can become impacted by saltwater intrusion, the operation of drainage infrastructure can become compromised due to erosion, and induced rates of ground water seepage from the Everglades can increase. The County has committed many resources to the development of technical tools to better manage surface water resources for the purposes of aquifer, wetland, and wellfield recharge. The County is also participating in efforts to identify sub-regional alternative water supply projects that will help reduce urban demands on the Biscayne Aquifer and the Everglades. All of these undertakings are designed to protect the water resources needed for the County's urban and natural areas, including the Everglades.

Trends: The County's activities in recent years have focused in large part on the construction of secondary canal projects to make more efficient use of existing water resources. Efforts are underway to identify and pursue sub-regional alternative water supply projects to replace and augment existing water resources. The County's secondary canal system will likely continue to constitute a fundamental part of our local water management system and efforts to integrate the canal network have positioned the County to make efficient use of all surface waters.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

ALTERNATIVE WATER SUPPLY DEVELOPMENT

Narrative: This benchmark measures progress toward development of alternative water supplies to meet future County water demand.

Explanation: Broward County is estimated to need an additional 100 million gallons of water each day (mgd) to meet water demands projected for 2025. Due to uncertainties about the carrying capacity of the Biscayne Aquifer (the County's current source of potable water) and the pressing

need to reduce urban reliance on the Everglades system as a source of water in support of Everglades restoration, future water needs will not likely be met through traditional water supplies. As such, local water utilities are being urged to develop alternative water supplies, independent of the Biscayne Aquifer and water deliveries from the Everglades system. Potential alternative water supplies are the Floridan Aquifer, aquifer storage and recovery wells, wastewater reuse, stormwater reuse, and desalination. Chapter 373, Florida Statutes, requires that local governments provide for the planning, design, construction, operation, and maintenance of alternative water supply development projects; the formulation and implementation of alternative water supply development strategies and programs; and encourages cooperation between counties, municipalities, regional water supply authorities, multi-jurisdictional water supply entities, special districts, and the publicly and privately owned water utilities in the development of countywide and multi-countywide alternative water supply projects. The Broward County Water Resources Policy and Planning Program has developed technical tools and is currently coordinating the development of a County-wide Water Management Master Plan, with 31 municipalities, 28 water utilities and 23 drainage/water control districts, to help guide these efforts and to effectively meet the County's water supply needs and water resource goals for the benefit of all water users. On June 11, 2007, the Water Management Master Plan contract was executed by the County and the Danish Hydrologic Institute for consultant services in the application of the County's hydrologic model, with the objective to identify alternative water supply projects and water management strategies capable of meeting the County's water supply needs and water resource goals through 2025. The Regional Water Availability Rule (Feb 2007) requires that all new water demands (post April 2006) be met through conservation activities or the development of alternative water supplies. The Water Resources Policy and Planning Program has implemented the County-wide Integrated Water Resources Plan which provides for water resources technical assessments, water management strategies, and water conservation activities that will help the County and all of its water providers to comply with this mandate in a coordinated and cost-effective approach.

Trends: A number of efforts are underway in the County to identify alternative water supply options. Broward County is partnering with the United States Geological Survey to conduct a geotechnical study of the Upper Floridan Aquifer to benefit the development of alternative water supplies including Aquifer Storage and Recovery. Modeling is being conducted in support of developing the C-51 Reservoir as an alternative water supply. In 2007, as part of the County's Integrated Water Resources Plan, cost share grants were offered to municipalities to conduct feasibility and design studies for the development of alternative water supply options. A total of eight grant applications were received and five projects were approved for funding. Some of these projects include investigating the directing of reclaimed water to area lakes for aquifer recharge, expansion of withdrawals from the Upper Florida Aquifer and treating membrane filtration concentrate with low pressure reverse osmosis to increase overall water recovery from filtered groundwater withdrawals. Connecting secondary canals in the County is a viable option for storing water for recharge and conveying water to where it is needed.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards, (954) 519-0356

PERCENT PARTICIPATION OF LOCAL WATER MANAGERS IN COUNTY-WIDE PLANNING EFFORTS

Measurement: This measure tracks municipal and drainage/water control district participation in sub-regional water management activities and planning efforts through support of water resource planning initiatives implemented as part of the Broward County-wide Integrated Water Resources Plan (IWRP).

Explanation: The overall goal of the Broward County-wide Integrated Water Resources Plan (IWRP) is to provide the tools and information to develop high quality, reliable water for all of Broward County. In 1997, Broward County began development of the IWRP as a strategy for meeting its long-term water supply needs and water resource goals. The South Florida Water Management District (SFWMD) was invited to

participate in the effort and has been an important partner in both development and implementation of the plan. The Plan has four main goals: (1) To make the most of our local water resources through a comprehensive water conservation program so that Broward's long-term water supply needs are met; (2) To coordinate a diverse water management community ensuring the efficient and effective management of our water resources; (3) To match up local water sources and users to ensure that water supplies are available when and where they are needed; and (4) To diversify water supplies so that the needs of urban and natural systems are met under wet and dry conditions.

With an urban population expected to reach 2.4 million by 2025, water demands are expected to increase about 34% during the next 20 years. At the same time, constraints are increasing on our ability to use current water resources to meet future water demands. These constraints are closely linked to the health of the Everglades and the integrity of the Biscayne Aquifer. One way we are working to ensure the sustainability of the Broward's urban and natural systems is through coordinated water management efforts, community outreach and educational initiatives, and the pursuit and promotion of sub-regional projects that meet multiple water resource needs. The success of these efforts can be measured, in part, by the level of participation and support of other governmental entities, including municipalities and drainage/water control districts in these efforts and planning committees. Our goal is to achieve 95% participation by our local partners in one or more of these IWRP initiatives, whether that includes staff attendance in the monthly Know the Flow course, participation in the Broward Everglades Working Group, membership in the Water Advisory Board or its Technical Advisory Committee, or one of the many other programs included under the IWRP.

Trends: Participation by the municipalities and major water control/drainage districts in IWRP projects increased from 83% in 2004 (when tracking began) to 87% in 2007. Sixteen IWRP-related activities and programs were provided support in 2007.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

NATURESCAPE IRRIGATION SERVICE, MILLION GALLONS SAVED/YEAR

Measurement: This measure tracks the total number of gallons of water saved in a year as a result of irrigation system repairs and modified irrigation system operations following site assessment and recommended improvements provided by Broward County's NatureScape Irrigation Service.

Explanation: The NatureScape Irrigation Service (NIS) is a water conservation service offered by the County in cooperation with 22 municipal and water utility partners and the County's Water and Wastewater Services. Goals of the NIS are to reduce urban water consumption and improve the quality of surface waters through more efficient irrigation operations and environmentally-friendly landscape practices. The NIS partners are dedicated to protecting water as a valuable resource and are focusing their efforts on large properties, such as parks, schools, and residential complexes, where water conservation efforts can produce the greatest water savings. The NIS provides water users with irrigation system evaluations and recommendations for improving irrigation system efficiency and operation, through basic site assessment, inspection of existing irrigation systems and operational schedules, measurement of current water usage, and a general landscape analysis. Property managers are provided with a summary of recommended improvements, which can include such things as reducing the frequency and duration of turf grass irrigation, removal of water-thirsty plants, replacement of sprinkler heads to improve uniformity in water application, and the repair of leaky pipes and faulty pumps. Quite often, significant water savings can be achieved with minor repairs and a basic irrigation system tune-up. Water savings are documented based on these initial recommendations and follow-up evaluations. Property managers are also provided with information on the NatureScape Broward program and are encouraged to pursue NatureScape certification of their landscapes, if appropriate. Since the NIS is focused on delivering only the amount of water that can be effectively used by plants in the landscape plus typical losses to evaporation, many of the problems associated with inefficient and excessive irrigation are reduced, including the growth of dollar weed, presence of fungus,

and proliferation of pests. Improvements implemented based on NIS recommendations result in water, energy, time and money savings, and the improved health of turf grass and landscape plants. Such improvements translate into a reduced demand for fertilizers and other lawn care products, producing additional environmental benefits and cost savings.

Trends: Since beginning operations in 2005, the County's NIS has saved over 425 million gallons of water. In 2007, 250 evaluations were completed and a total water savings of 102 million gallons was achieved. This year's values were lower due to water restrictions in place at the time of assessment.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

WATER MATTERS DAY ATTENDANCE

Measurement: This measure tracks the total number of South Florida residents who attend the annual Broward Water Matters Day event held annually in March.

Explanation: Water Matters Day is a key component of Broward County's effort to educate residents about the importance of water conservation (<http://www.broward.org/watermatters/>). This fun, activity-filled event focuses upon teaching County residents about the need to conserve and protect our water resources. It is geared toward making a connection between our daily activities and the impact of those activities upon local water resources and adjacent natural systems. The Water Matters Day water conservation message is largely focused upon outdoor water uses, such as irrigation, because they account for about half of all household water usage. Equally important is protection of water quality, and to that end, the event provides educational opportunities to residents on proper fertilizer and lawn chemical application methods that reduce runoff to adjacent surface waters. Participants learn about local water management, Everglades restoration, and how our canals interconnect the County's urban and natural systems. Residents also learn about indoor conservation, and how water-wise practices save money as well as water. Personal responsibility is emphasized as attendees gather information about how to maintain their swales, reduce stormwater runoff, and ensure the proper function of stormwater systems. Water Matters Day is about education, but it is also about fun. It is packed with workshops, giveaways, children's activities, and entertainment. While parents learn about choosing the right plants for their yards, children can learn about the creation of backyard wildlife habitats as they participate in a birdhouse-building workshop. Giveaways include rain gauges, automatic shut-off devices for irrigation systems, native trees and plants, and garden mulch. Not only are these giveaways popular, but they help attendees apply what they've learned when they get home. Perhaps the most significant benefit of Water Matters Day is imparting the message that water conservation and environmental stewardship should be a conscience part of our daily activities, from selection of plants for our landscaping to the methods we use to irrigate and maintain landscapes.

Trends: The first Water Matters Day event in 2003 was attended by 1,300 individuals. Attendance increased by 46% in 2004 with an estimated 1,900 attendees. The event continued to grow in 2005 with 2,250 participants, an increase of 18% compared to 2004. In 2006 and 2007, 4000 people attended the event which was supported by more than 100 volunteers. In 2008 Water Matters Day drew 3,000 attendees, a reduction from the previous two years, which is partly attributed to the occurrence of another major environmental and native plant event that same day.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Toni Edwards (954) 519-0356

OUR LAND RESOURCES - NATURAL LAND QUANTITY

ACRES OF PROTECTED LAND AND UNPROTECTED LAND

- Conservation and passive recreational land
- Active recreational land
- Water Preserve Area

ACRES OF UNPROTECTED (DEVELOPABLE) LAND

- Potential Conservation Land and Green Space acquisitions
- Potential Open Space acquisitions

Measurement: The Land Preservation Section maintains an inventory of Conservation Lands, Green Spaces and Open Spaces targeted for preservation through the Land Preservation Bond program (2000 Safe Parks and Land Preservation Bond Referendum). The protected lands inventory includes lands successfully acquired through the Bond program in addition to those lands already managed as natural areas and passive parks. The unprotected lands are those for which Broward County is pursuing preservation through acquisition. The data is calculated through the end of August of the calendar year given.

Protected Land

Conservation and passive recreational land: This category consists of environmentally sensitive lands and passive recreational parks.

Active recreational land: This category includes active recreational facilities and parks. These are no longer being tracked by this Department.

Other protected land: This category contains mitigation sites and other public or private land managed for conservation but are no longer being tracked by this Department.

Water Preserve Area: These sites have been acquired by the South Florida Water Management District.

Unprotected Land

Potential Conservation Land, Green Space and Open Space acquisition: These parcels have been approved for preservation by the Broward County Board of County Commissioners through acquisition.

Conservation Land: Land which contains one or more native vegetative communities, rare, endangered, threatened or endemic flora and fauna, or outstanding physiographic or archaeological features, or land which functions as an integral and sustaining component of an existing ecosystem.

Green Space: Land where only some aspects of the native vegetative community still remain; or greenway component; or land with a potential as buffer to environmental lands and conservation lands, or connector to existing protected natural lands and parks.

Open Space: Undeveloped land within the urban area of Broward County where the native vegetative community has been cleared or replaced; or agricultural land such as row crops, nurseries, groves, or pasture, or, solely for the purpose of Resolution 2000-1230, developed land selected for acquisition to be reclaimed to open space in perpetuity.

Explanation: Natural resource lands are important to the community as examples of Broward's ecological history and provide important habitat for local and migratory wildlife and indigenous plants. We wish to protect these lands from development, the effects of invasive plants, over-drainage and other deleterious effects to maintain or regain their function and values.

Trends: To date, over 250 acres of Conservation Land and Green Space sites have been acquired through the 2000 Safe Parks and Land Preservation Bond program. Additionally, over 580 acres of Open Space sites are protected.

Data source: Calendar year as of August. Broward County Environmental Protection and Growth Management Department, Natural Resources

EVERGLADES WATER CONSERVATION AREAS

Narrative: Approximately two-thirds of Broward County lands exist as Water Conservation Areas (WCA's) in the Everglades. Four WCA's serve as a buffer between developed regions and the Everglades while providing wetland habitat.

Measurement: WCA 2A has an area of approximately 164.7 square miles, a portion of which is located in north-central Broward County (99.2 square miles). The remainder is located in south-central Palm Beach County (65.5 square miles). WCA 2B, centrally located in Broward County, has an area of 43.8 square miles. WCA 3A has an area of 767.3 square miles and is located mostly in western Broward County (568.4 square miles) with a significant amount in northwestern Miami-Dade County (198.9 square miles). The WCA 3B basin has an area of 153.6 square miles with a portion located in south-central Broward County (30.5 square miles) and the majority located in north-central Miami-Dade County (123.1 square miles).

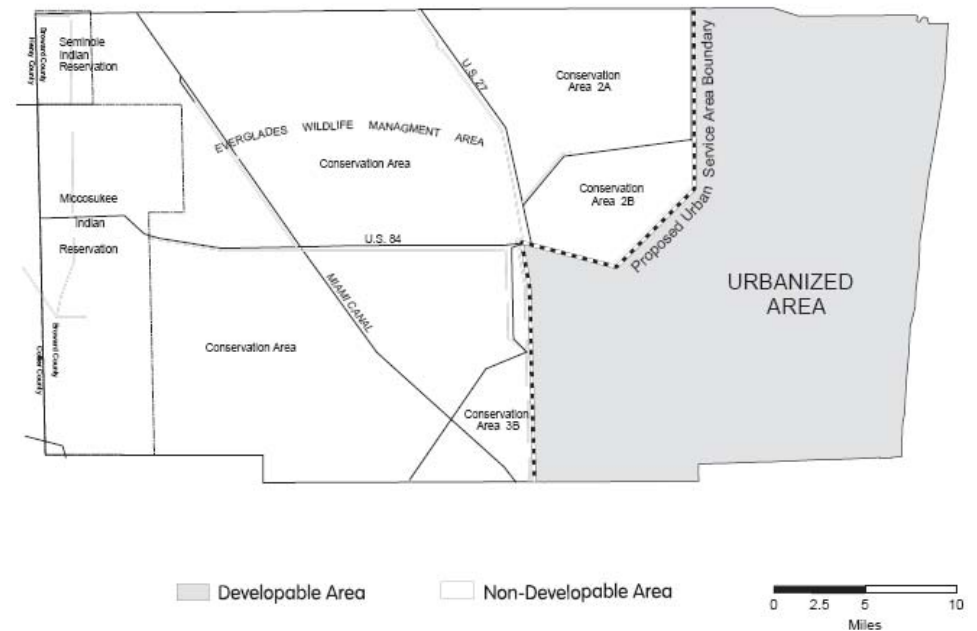
Explanation: One of the foremost functions WCA 2A serves is to receive, detain and store flood water. These flood waters are primarily from Palm Beach County, to the north, and are in the form of stormwater runoff from the Everglades Agricultural Area, and regulatory releases from Lake Okeechobee and WCA 1 for water supply during the dry season. Other functions include the prevention of urban flooding, the conveyance of Lake Okeechobee water to the Atlantic Ocean, and the supply of water to WCA 2B.

WCA 2B is an area of significant recharge to the Biscayne Aquifer. Water supplied to the aquifer by way of WCA 2B is important to maintaining ground water levels in coastal areas, which, in turn, sustains municipal water supplies.

WCA 3A regularly receives untreated urban and agricultural stormwater runoff from the Western C-11 Canal basin. One of the primary functions of WCA 3A is to protect the urban and agricultural lands in Broward and Miami-Dade Counties from flooding and to supply water to Everglades National Park. Other functions include the storage of regulatory releases from Lake Okeechobee and WCA 2A, the conveyance of excess water to Biscayne Bay and the storage of water for water supply use during the dry season.

WCA 3B is an area of significant recharge to the Biscayne Aquifer. Water supplied to the aquifer by way of WCA 3B is important to maintaining ground water levels in coastal areas. Other functions include the conveyance of water supply releases from Lake Okeechobee and WCA 3A to eastern Miami-Dade County and Everglades National Park, discharge of excess flood water to the tide, and to provide flood control for urban and agricultural land in Miami-Dade County.

Trends: While two-thirds represents a large quantity of Broward County lands established as conservation areas, the issue of quality must be



considered. The function and water quality of WCA's are being addressed through projects undertaken as a part of the Comprehensive Everglades Restoration Plan. The South Florida Water Management District indicates project activities will include efforts to:

- Reduce seepage of water from the natural areas of WCA 3A and WCA 3B into urban areas;
- Improve Everglades water quality by capturing and diverting stormwater runoff previously discharged to WCA 3; and
- Provide supplemental water supply and aquifer recharge to urban areas, thus reducing demands on the natural system in the WCA's.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

PRESSURES ON NATURAL LAND QUANTITY

BROWARD COUNTY POPULATION, MILLIONS

Measurement: Annual Broward County population estimates are based upon the 1990 and 2000 Census. The Bureau of Economic and Business Research at the University of Florida (<http://www.bebr.ufl.edu/>) provides the annual estimates.

Explanation: Population increases are a direct impact on our land resources. The temperate weather of South Florida is a powerful lure to the area and will result in continued land resource impacts. More information on population statistics may be found at Broward-by-the-Numbers at <http://www.broward.org/planningservices/upi00136.htm>. In addition, current and historic county populations going back to 1972 can be found at <http://www.floridalcir.gov/UserContent/docs/File/data/FLcopops.xls>.

Trends: We are seeing a lull in the population growth. Although the most recent Bureau of the Census estimate reported more people moving out of Broward than into Broward; this is expected to be a short-term trend related to recent escalation of housing costs. As soon as the relationship of housing cost to income is at a more acceptable level; the County will begin experiencing growth resulting from more people moving in than moving out. According to U.S. Census estimates of population, most of Broward's in-migrant growth is international indicating that Broward's demographic is changing as well as growing.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Planning and Redevelopment Division, Bill Leonard, (954) 357-6033

BUILDING PERMITS - NEW STRUCTURE/NON-RESIDENTIAL ADDITION APPROVALS ISSUED

Measurement: Before the issuance of construction permits for all new buildings and additions to non-residential buildings within Broward County, developers must obtain environmental review approval from the Broward County Development and Environmental Regulation Division (DERD). The approval process includes an evaluation of potential environmental impacts of the proposed construction. To find the number of approvals issued, we query the DERD Permit Monitoring System for the number of approvals issued during the calendar year.

Explanation: A measure of pressures on our natural resources is the number of building permits issued by municipalities and Broward County for all new buildings and additions to non-residential buildings. All building permits require review and approval by DERD. Readers should interpret the data with the understanding that developers must obtain building permits for both new construction on vacant land and renovations of existing buildings. Furthermore, a developer may not actually start the construction of an approved project even though they have the permits in hand.

Trends: The availability of vacant land to build new construction projects continues to diminish as the County approaches build out. This will result in a decrease in the number of new buildings and additions to non residential buildings until all vacant land is used up at which time existing structures will be demolished to make way for new development.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Monthly Reports and Permit Monitoring System data base - Environmental Review Section, Martin Weigand, (954) 519-1251

WETLANDS IMPACTED BY DEVELOPMENT, ACRES

Measurement: We obtain a value for this performance measure during the processing of the Environmental Resource License. We compute the data by adding the total acreage of impacted wetlands licensed during the 12-month period ending June 30th of the reported year and add that to the previous total.

Explanation: Wetlands serve as habitat for a variety of plant and animal life and can serve water storage and purification functions essential to the maintenance of the county's water supplies. We track impacts on wetlands resulting from development activities through the Environmental Resource Licensing process. This process includes provisions for mitigation of any unavoidable impacts on wetlands.

Trends: The observed trend of diminishing wetland acres being licensed (historic east Everglades) correlates with the decreasing land availability in the County. The wetland acres available for development are diminishing and the total is somewhat skewed this year by the licensing of a single large project (77.23 acres). The majority of projects licensed averaged less than 3 acres of wetland impacts.

Data source: State fiscal year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Linda Sunderland, (954) 519-1454

MITIGATION LEAVING BROWARD COUNTY, ACRES

Narrative: After avoidance, minimization, on-site and other in-county mitigation options are exhausted, a licensee is allowed to provide out-of-county wetland mitigation.

Explanation: Impacts to wetlands are reviewed during the processing of Environmental Resource License applications. Staff works with the applicant to avoid impacts to wetlands. If avoidance is not possible, impacts are minimized as much as possible. County regulations require impacts to wetlands to be mitigated (compensated) for by providing off-setting wetlands elsewhere. With the rising value of land, developers wish to construct the largest project possible. This impacts more wetlands and provides less area for on-site mitigation.

Trends: With the rising value of land, fewer natural areas within the County for mitigation options and cost of constructing on-site mitigation, applicants are requesting to use out-of-county wetland mitigation banks more frequently.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Linda Sunderland, (954) 519-1454

RESPONSES TO PRESSURES ON NATURAL LAND QUANTITY

PUBLIC DOLLARS SPENT TO PRESERVE NATURAL LANDS, MILLIONS

Measurement: The 2000 Safe Parks and Land Preservation Bond Referendum authorized \$200 million to acquire Conservation Land, Green Space, and Open Space, to provide for additional passive recreation opportunities.

Explanation: To date, 24 Conservation Lands, comprising more than 145 acres, have been acquired through the Bond Program as well as 18 Green Spaces totaling more than 112 acres. Due to the difficulty in acquiring additional natural lands, funds originally intended for their acquisition were reallocated to Open Space sites. Forty-eight (48) Open Spaces comprising more than 580 acres have been acquired to be managed by the municipalities in compliance with interlocal agreements and an approved management plan. A component of Open Space program is the Purchase

of Development Rights (PDR); five sites with 66 acres consisting of horse farms, pasture lands and plant nurseries have been preserved through the PDR program to ensure a component of our rural past will remain in perpetuity.

Trends: As funded projects continue to be unsuccessful, funds originally intended to acquisition of natural lands are reallocated to Open Space projects.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

ENVIRONMENTAL REVIEW

Narrative: All projects which are proposed on undeveloped parcels are reviewed by the Environmental Protection and Growth Management Department's Development and Environmental Regulation Division to evaluate any impacts to wetlands. Wetland permitting ensures that mitigation for impacts fully compensates for the functional loss caused by those impacts.

Explanation: Wetland impacts and mitigation requirements are regulated through Chapter 27 of the Broward County Natural Resource Protection Code.

Trends: Few undeveloped wetlands remain in urban Broward County so that aspect of licensing will slow down in the future. Interestingly enough, a current development trend is to try to develop existing mitigation areas for other uses. Another more qualitative trend is that with the increased cost and reduced amount of raw land, many developers are looking to take mitigation directly to a wetlands mitigation bank without doing any mitigation near the impact. Trying to locate mitigation close to the impact pursuant to Broward County Comprehensive Plan Policy 09.05.16 is becoming increasingly more difficult and time-consuming. Another aspect of the program which increases over time is the need for compliance monitoring. Some level of monitoring is necessary to ensure that mitigation areas are maintained in perpetuity as required pursuant to the conservation easement. The cumulative number of sites increases over time as more mitigation areas are being licensed.

Data source: Applications received year round. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Linda Sunderland, (954) 519-1454

ACRES OF MITIGATION LICENSED

Measurement: The Wetlands Resources Section maintains an inventory of wetland mitigation projects which itemizes the acres of wetland impacts and acres of mitigation.

Explanation: Wetland impacts are evaluated using the Florida Unified Wetland Mitigation Assessment Method (UMAM). Step one of this methodology looks at the wetland function provided by the area based on hydrology, vegetation and community structure. Numeric values are assigned and the "function loss value" of wetlands for impacts to that wetland area is determined. Step two evaluates the proposed mitigation area, as it currently exists and how it is expected to function after the mitigation is complete, using the same criteria. Step three then determines the "functional gain value" the mitigation area will provide. The "functional loss" should be equal to the "functional gain". *This is not an acre for acre replacement calculation.*

Trends: Land available for large-scale developments has continued to decrease over the past year as several large projects have been completed. Applications are trending toward redevelopment (i.e., several single family home sites merged for townhouse development) or single family home tracts that are now being constructed.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Linda Sunderland, (954) 519-1454

MITIGATION ON PUBLIC LANDS

Narrative: During development, impacts to wetlands areas are required to be mitigated. When mitigation is unavailable on or near the construction site, natural lands or wetlands are investigated in other areas. Public lands are now being considered as areas for potential mitigation.

Explanation: Wetlands provide values that no other ecosystem can such as improving water quality, providing flood protection, controlling shoreline erosion and providing opportunities for recreation and nature appreciation. Wetlands also serve as natural water filtration systems and water storage areas that provide flood protection. Because of these values, Broward County desires to retain the site of compensatory mitigation for impacts to wetlands as close to the impact as possible and, most specifically, within the County. Because of rising land costs, the licensee often desires to fully develop their property and mitigate off site. In order to achieve both of these goals, the County is attempting to utilize public lands as sites for wetland mitigation projects. The created wetlands serve as stormwater retention areas for the park and provide additional passive recreational opportunities to park visitors such as nature appreciation and wildlife observation. This partnership helps to allow development while retaining wetland values in Broward County.

Trends: The County will continue to create partnership with municipalities to help to allow development while retaining wetland values in Broward County.

Data source: Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Linda Sunderland, (954) 519-1454

OUR LAND RESOURCES - NATURAL LAND QUALITY

NATURAL LANDS QUALITY

Narrative: Broward County Parks and Recreation Division manages over 3,200 acres of natural lands within the Broward County park system. These habitats are varied and include communities such as sand pine, pine flatwood, live oak hammock, cypress strand and mangrove swamp. Additionally, several municipalities are responsible for the management of over 100 acres of natural areas within their cities. In compliance with environmental resource licenses which authorize impacts to wetlands, 94 wetland mitigation areas comprising over 6,000 acres have been created or preserved.

Measurement: Currently, no comprehensive assessment of the "ecological health" of these natural areas has been performed. Invasive exotic plant species, altered hydrology, fire suppression and human disturbance have placed strain on these natural lands and many of these sites are in a state of decline.

Trends: The management of protected natural lands is handled through the various managing entities as time and funds are available. The wetland mitigation areas are to be maintained by the property owner which generally is a homeowners association with limited or no knowledge of natural area management. A regional approach to land management is not in place. Developing a comprehensive, County and regional approach to protecting, enhancing and restoring the remaining natural resources within Broward County remains a priority.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

PRESSURES ON NATURAL LAND QUALITY

INVASIVE EXOTIC VEGETATION

Narrative: While non-native species may constitute a significant portion of the Broward County tree canopy, they provide less benefit to our native ecosystem.

Explanation: Non-native, invasive tree species have a high potential to crowd out indigenous vegetation that native Florida wildlife relies on for food and shelter. Public education is critical on both the value of native trees and the importance of contributing to a healthy urban landscape by choosing appropriate trees when planting. Further, the public needs to understand the harmful effects of invasive exotic species so they can make informed decisions when planting or removing trees. Efforts are being made to reduce coverage by invasive plant species. The Natural Resources Planning and Management Division, through the Land Stewardship Program, is initiating the "Partners in Preservation" Grant Program. This program will provide funding (\$500,000 a year for five years) for the removal of invasive non-native vegetation and replanting with appropriate native plants on public properties in Broward County, which contain one or more defined native vegetative communities. Reduction of invasive plant species also includes efforts by the South Florida Water Management District within the Water Conservation Areas, Broward County's largest area of natural land, as well as the efforts by County and city governments within the eastern, urban portion of Broward County.

Trends: To date, the Broward County Parks and Recreation Division has inventoried more than 722 acres of exotic species coverage on park lands. Of those 722 acres, over 100 acres of Australian pine-dominated lands has been documented. The County is focusing management efforts on these locations to minimize the effects of the invasive species and restore native canopy in these areas. Ecological restoration dollars are available for conservation land sites acquired through the 2000 Safe Parks and Land Preservation Bond program and are being utilized to stabilize these sites through removal of exotic vegetation in compliance with the approved management plans.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

NATURAL LAND UNDER HYDROLOGIC STRESS

Narrative: Many natural wetland areas in Broward County have been altered by historical development practices, roadway construction, and other drainage alterations. Those predominantly forested wetlands have historically been drained by the construction and operation of drainage canals.

Explanation: The alteration of Southeast Florida's hydrology by the elaborate canal systems designed to protect residents from flooding has impacted wetlands by decreasing the hydrology necessary for maintaining wetland plant species. Pollutants from storm runoff on streets and highways combined with the use of fertilizers and pesticides have increased the nutrients introduced into surface waters and degraded the water quality that supports wetland plant species.

Wetlands provide values that no other ecosystem can. These values include improving water quality, flood protection, shoreline erosion control and opportunities for recreation and nature appreciation. Wetlands serve as natural water filtration systems and water storage areas that provide flood protection. They serve as important aquifer recharge areas or areas where ground water is replenished. In addition, wetlands have recreational, historical, scientific and cultural values.

Trends: The Broward County Environmental Protection and Growth Management Department has undertaken efforts to restore some of the damaged wetlands, and contracted with Hartman & Associates, Inc. in 2002 to conduct studies in preparation for restoration efforts. Broward County will continue to seek opportunities to hydrologically restore damaged wetlands.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management

Division, Donald Burgess, (954) 519-0305

FIRE SUPPRESSION ON NATURAL LANDS

Narrative: Pineland communities generally benefit from prescribed burning, an important long-term management tool in maintaining the natural quality of the land. However, prescribed burning in urban areas is very difficult to accomplish. As Broward County acquires and maintains additional natural lands, prescribed burning or alternative means will continue to be pursued to ensure the integrity of the resources are retained.

Explanation: The natural fire regime of pineland communities has been disrupted by development and the encroachment of non-native plant species. A natural fire regime re-established to fire-dependent communities will help maintain the ecological integrity and increase the native herbaceous component found in open flatwoods communities. Prescribed burning in urban areas is very difficult to accomplish. The frequency and timing of burns is restricted by both the conditions required by the resource (weather, wind direction, humidity etc.) and proximity to smoke-sensitive sites such as schools and hospitals. Areas that have been without fire for long periods of time may accumulate a high fuel load, which further increases the challenges involved in re-establishing a burn schedule.

Trends: Broward County will continue to seek opportunities to conduct prescribed burns on acquired natural lands to ensure the integrity of the resources is retained.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

RESPONSES TO PRESSURES ON NATURAL LAND QUALITY

PERCENT OF MUNICIPAL NATURAL LAND SITES WITH MANAGEMENT PLANS

Measurement: Percent of lands purchased under the 2000 Safe Parks and Land Preservation Bond program under municipal control who have an approved resource management plan in place.

Explanation: For all acquired natural lands, Resource Management Plans are created to direct present and future staff as to how the resources should be managed to ensure that they remain viable natural communities, in perpetuity. These plans include, at a minimum, securing the site, removing trash and debris, removing invasive exotic species, replanting native vegetation, and providing for public access. Depending upon the habitat present, the resource management plans may include ecological restoration, re-watering of impacted wetland, or plans for burning fire-dependent communities.

Resource Management Plans will include regular site monitoring to ensure that maintenance is ongoing and that management plans are complied with and amended as needed. A wide variety of monitoring techniques such as aerial photography analysis and seasonal plant diversity surveys, are used to assess changes in natural community composition and rare species population status. Monitoring can determine the status of natural processes essential to natural resource health and whether or not management actions have been effective. Monitoring will also document effects of human visitation and public use patterns on natural resources and other natural features protected within natural areas.

Trends: Final Resource Management Plans are due within one year of the execution of the interlocal agreement for transfer of property to the municipality or reimbursement of the city for site acquisition. Broward County will continue to pursue management plans for all acquired sites.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

LAND STEWARDSHIP

Narrative: The Natural Resources Planning and Management Division of the Environmental Protection and Growth Management Department is initiating the Land Stewardship Program, a five-year capital improvements program which will oversee two new grant funding opportunities.

Explanation: One will fund the "Parks for People" program, for sites acquired through the 2000 Safe Parks and Land Preservation Bond Program, providing competitive matching funds of up to \$75,000 a year per project, for a period of five years. This grant will help to promote "green concepts" of water and energy conservation, native plantings, recycled materials and other efforts which meet the comprehensive grant criteria. The second grant program, "Partners in Preservation" will fund the ecological restoration of natural public lands within Broward County. This program for the removal of invasive non-native vegetation has a maximum of \$ 50,000 per project and will also follow a five-year cycle.

Trends: These programs will assist Broward County cities to implement conservation measures and facilitate the opening of park and open space sites to the public.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

COMPREHENSIVE EVERGLADES RESTORATION PLAN

Narrative: The Water Conservations Areas (WCAs) are a large area of Broward County. Their protection and restoration will occur through the Comprehensive Everglades Restoration Plan.

Explanation: While two-thirds represents a large quantity of Broward County lands established as conservation areas, the issue of quality must be considered. The function and water quality of WCA's are being addressed through projects undertaken as a part of the Comprehensive Everglades Restoration Plan.

Trends: The South Florida Water Management District indicates project activities will include efforts to:

- Reduce seepage of water from the natural areas of WCA 3A and WCA 3B into urban areas,
- Improve Everglades water quality by capturing and diverting stormwater runoff previously discharged to WCA 3,
- Provide supplemental water supply and aquifer recharge to urban areas, thus reducing demands on the natural system in the WCA's.

Data source: Official website for the Comprehensive Everglades Restoration Plan, <http://www.evergladesplan.org>, Fact Sheet for Broward County Water Preserve Area, http://www.evergladesplan.org/docs/fs_bcwpa_sept_2007.pdf, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

RESTORING HYDROLOGIC FUNCTION TO NATURAL LANDS

Narrative: The alteration of Southeast Florida's hydrology by the elaborate canal systems designed to protect residents from flooding has impacted wetlands by decreasing the hydrology necessary for maintaining wetland plant species.

Explanation: In developing an Integrated Water Resources Plan, a County contractor documented volumes, sources, and facilities needed to supply water to rehydrate and improve eight hydrologically deficient wetlands. The work performed for each site included a topographic survey, monitoring well installation, slug testing, soil testing, and profiling. The data collected from these tests and the analytical results were used to simulate wetland hydroperiods, and to estimate the quantity of water needed to remediate hydroperiod alteration. Potential sources of supply were identified for each site, and quantities were documented to allow the County to apply for water reservation rights from the South Florida Water Management District. Estimated volumes of water needed for rehydration based on average rainfall conditions and on 10-year drought conditions, the potential sources of water, the distribution of the water sources, the timing, and the potential water conveyance facilities were determined for each site.

Trends: Presently, these restoration sites are in various stages of completion. According to Broward County Parks and Recreation staff, some

sites such as Forman ESL and Tradewinds ESL North have been funded for construction according to the design specified in the original report. The Tradewinds Park North will propose a windmill as a pump and will be funded in the future by a park wetland mitigation project. The Coconut Creek Maple Swamp plans have changed due to the tendency for the site to flood and cause lift stations to back up. Damage has occurred as a result of recent hurricanes. This site may be reviewed in the future. For the Wiles Road Cypress Dome and Alpha 250, the County will apply for funds in the next round of grants from the Integrated Water Resources Plan to install the pump while still under their management. The City of Coconut Creek may take over the Wiles Road site in the future. The Alpha 250 Cypress Dome is being managed by the Water and Wastewater Services. The Holmberg Road (County Park Sites) water level target is to fill the deepest "bowl", although eventually the elevation may be raised to flood ½ acre, using 0.3 million gallons per day.

Water use permits have been obtained for all projects. Environmental Resource Permits are still required. Negotiations are underway with most cities for permitting requirements. Design of Tradewinds ESL will be added to the master site plan for existing park. Negotiations are occurring between the city and private lake owners for withdrawal for the Forman site. Water to the Holmberg Road site is difficult due to water availability and is on hold. Coconut Creek, Alpha 250, Wiles Road Dome remain the same.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

CONTROLLED BURN OR ALTERNATIVE MANAGEMENT METHODS

Narrative: Pineland communities are considered fire climax communities and are dependent upon periodic fires to encourage the germination of pines and grasses while decreasing the competition of hardwoods such as oaks.

Explanation: The following are three potential approaches to maintaining a mesic flatwood plant community: (1) prescribed burning alone, (2) chopping and then prescribed burning, and (3) chopping only. The first option of prescribed burning may have the highest ecological value, but it is the most difficult to conduct in urban settings, and carries risks due to the intensity of the burn. The second option, chopping and then prescribed burning, provides a desirable level of ecological benefit, reduces the height of fuel loads and the flame lengths making a planned fire easier to control. This option expands the range of conditions in which burning may be conducted, but it still carries some of the risks and difficulties of burning in an urban setting. The third option of chopping only has a greatly reduced and perhaps questionable ecological value but is easy to conduct. It should be stressed that any of these choices would be conducted in limited areas of project site, providing other areas as wildlife refugia during the burns and to help maintain site aesthetics.

Trends: Broward County will continue to seek opportunities to conduct prescribed burns on acquired natural lands to ensure the integrity of the resources is retained.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

OUR LAND RESOURCES – URBAN LANDSCAPE

URBAN LANDSCAPE

Narrative: The urban landscape of Broward County is influenced by a wide combination of natural and anthropomorphic inputs including natural lands left undeveloped, groups of trees preserved through development, trees planted by residents, trees that were dispersed and matured naturally, and landscape trees planted pursuant to site plan requirements. This includes native and non-native species. Changes to the urban

landscape can occur from natural causes, such as hurricanes or tropical storms, and human causes, such as additional development or unauthorized tree removal. Improving the urban landscape by planting trees appropriate for this area can help mitigate effects from storms, as they are better-equipped to withstand storm impacts. Broward County code related to tree trimmer and removal licensing, and protection of trees from construction helps to mitigate effects of human-caused impacts.

Explanation: Native trees are an important part of a healthy urban landscape. In addition to the aesthetic value they provide to communities, they offer a variety of additional benefits. The Florida Urban Forestry Council (<http://www.fufc.org/>) describes a host of benefits that trees provide, including energy conservation, reduction in air pollution, reduction in stormwater runoff, value to wildlife, and economic value for homes and businesses. A healthy tree canopy can reduce energy costs by providing natural cooling through shade. Trees remove carbon dioxide from the air and contribute oxygen, improving air quality. They reduce stormwater runoff by retaining rainfall, which can help limit erosion as well. Native trees are very important for wildlife, providing food sources, nesting sites for birds, and stopover roosting sites for migratory birds. Trees also add economic value to homes and businesses. According to the Florida Urban Forestry Council, a home with healthy, mature trees may add from 5-7% to the sale price. They also provide reduction of noise pollution, character and privacy to neighborhoods.

Trends: The Citrus Canker Eradication Program and hurricanes in 2004 and 2005 caused considerable damage to the urban landscape. A number of programs including Broward Beautiful and NatureScope Broward can help mitigate some of the impacts.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

PRESSURES ON URBAN LANDSCAPE

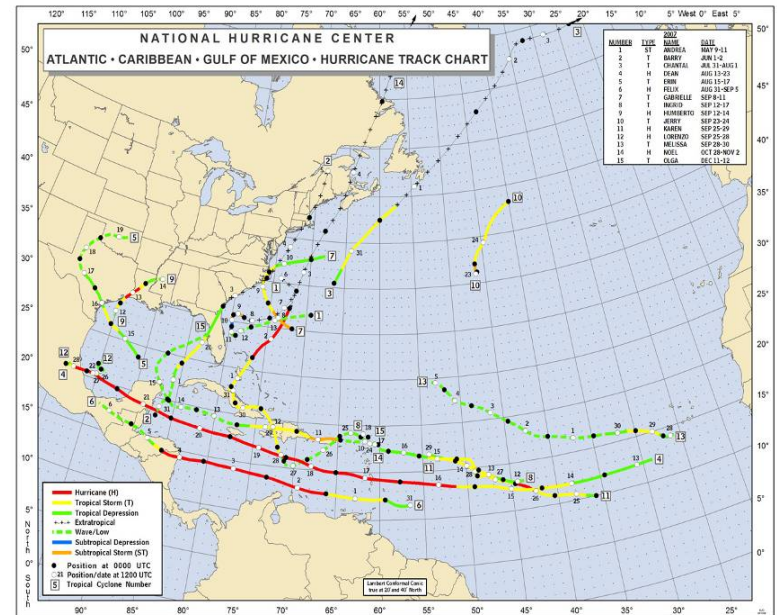
NUMBER OF TROPICAL STORMS

Measurement: The number of all tropical cyclones (hurricanes and tropical storms) whose centers passed within 65 nautical miles of Broward County.

Explanation: As a peninsula of land projecting out between the Atlantic Ocean and Gulf of Mexico, Florida is in the potential path of tropical storms and hurricanes as history has recorded. The destruction to the urban landscape of Broward County caused by Hurricane Wilma in October 2005 highlighted the need to plant the right trees in the right places and to maintain them properly. To date, Broward County Parks has spent \$5 million to replant the “right” trees in Park areas severely damaged by hurricanes. This represents the planting of 10,000 trees, with an additional \$1 million budgeted, allowing for another 3,000 trees scheduled for planting in the coming year.

Trends: Climate scientists suggest that the Atlantic Ocean Basin will experience increased hurricane and tropical storm activity during the next several decades.

Data source: Calendar year data. National Oceanic and Atmospheric Administration 2007, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305



REDUCTION OF WILDLIFE HABITAT

Narrative: Continued development and redevelopment across Broward County further reduces natural lands and vacant areas needed to provide habitat for wildlife. The indirect consequences of habitat loss and fragmentation may be less obvious but often carry grave consequences for animal welfare and for conservation.

Explanation: Habitat can be destroyed or degraded in two basic ways: quantitative and qualitative losses. Quantitative losses involve a reduction in the amount of habitat area. For example, if a wetland is paved over, then there has been a quantitative loss of wetland. Qualitative changes involve a change or degradation in the structure, function, or composition of the habitat. For example, a paper company discharging chemicals into a waterway and poisoning the water creates a qualitative loss. Sometimes a combination of quantitative and qualitative loss occurs as when a forest is fragmented or divided into many patches (from conversion to agricultural or residential land) providing less benefits to species than an intact forest. If species are unable to tolerate extensive habitat modifications they may become threatened or endangered, even extinct. The loss of species reduces biological diversity and can also have economic, recreational, and aesthetic impacts.

Trends: Protected areas are essential for maintaining many forms of wildlife. However, not all land can be protected from human activity. Thus, our challenge is to create managed landscapes and alter our activities to provide for the survival of the maximum number of species, including our own.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

EMERGING PEST PROBLEMS

Narrative: Pest problems contribute pressures to urban landscapes in South Florida. We can expect new pests each year to enter our area through hurricanes, imported items, nursery trade, and human activity. In addition, naturally occurring wet and dry season weather patterns, longer-term climatologic conditions, such as drought, and hurricane activity may affect pest populations and the extent of their damage. It is unrealistic to strive for an insect, disease and weed-free yard or landscape.

Explanation: Broward County has been inundated over the past few years with blights, plagues and pest infestations with notable impacts to our landscapes. The detrimental effects have perhaps been compounded by diminished vegetative coverage and loss mature tree canopy following the 2005 hurricane season. An additional factor contributing to the extent impacts is the lack of diversity in plant materials represented in our landscapes, such that when one plant type is affected the observed impacts tend to be widespread. Selection of inappropriate plant material in landscape design poses another problem. Choosing the wrong plant for the wrong place leaves plant material stressed and susceptible to disease and less resilient to pests. In response, landscape managers and homeowners frequently intervene with control measures, most often, pesticides. However, pesticides kill more than the targeted pest, contributing to the demise of beneficial insects and the natural system of balance which can exacerbate the problem and allow pest populations to further increase. There is also concern about the casual use of incorrect or ineffective pesticides, which allows pests to develop resistance to certain pesticides, compounding the problem.

Trends: Broward County landscapes bare the impacts of a growing number of plant pests and plagues. Most recently, the Fig Whitefly has moved into local landscapes, causing complete defoliation of extensive ficus hedges and mature trees in a matter of months. Specific ornamental, turf and landscapes pests and diseases that have impacted Broward landscapes in the past 3 years include, but are not limited to, the following:

Pests

Citrus White Fly
Lobate Lac Scale
Sri Lanka Weevil
Pink Hibiscus Mealy Bug
Red Palm Mite
Softscale (specific to crotons)
Fig Whitefly
Africanized Honey Bee

Diseases

Citrus Canker
Citrus Greening
Lethal Yellowing
Cabbage Palm Disease
Queen Palm Death
Bay Wilt

Data source: Florida Department of Agriculture and Consumer Services and its agricultural regulatory unit, Division of Plant Industry, keep track of insects and diseases that have recently arrived in Florida and those that are expected to make an appearance. Information on the pests and treatments are available on their website and through materials. Additional Florida pest information is available on the University of Florida's (UF/IFAS) Pest Alert website: <http://pestalert.ifas.ufl.edu/>.

Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

NUMBER OF TREE RELATED COMPLAINTS

Measurement: This measure tracks the number of tree abuse, tree removal or tree trimming licensing complaints received during each calendar year.

Explanation: The three complaints that the Tree Preservation Section responds to are tree abuse, unlicensed tree removal or tree trimming without a license. Tree abuse is basically improper tree trimming, unlicensed tree removal is removing trees without a Tree Removal License and tree trimmer licensing complaints are generally tree trimming without a license or advertising as a tree trimmer without a license. A search was done of the licensing database to determine the number of complaints received per year.

Trends: The number of complaints in 2007 was down somewhat from the previous year.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

NUMBER OF TREES LICENSED FOR REMOVAL

Measurement: This measurement tracks the number of trees licensed for removal in each of the last five years. Tree removal is good indicator of development pressure.

Explanation: Trees are licensed for removal in a Tree Removal License when they meet the removal criteria listed in the Broward County Tree Preservation Ordinance. The removal criteria include such factors as unavoidable construction impacts, property damage and safety issues. A search was done of the licensing database to determine the number of trees licensed for removal per year.

Trends: The number of trees licensed for removal was down in 2007. This was an indirect result of Hurricane Wilma as a substantial number of trees were removed after the hurricane. Another contributing factor was the fact that smaller projects involving less tree removals were licensed in 2007.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

RESPONSES TO PRESSURES ON URBAN LANDSCAPE

PUBLIC EDUCATION

Narrative: In response to urban forestry issues following Hurricane Wilma, the Broward County Environmental Protection and Growth Management Department (EPGMD) created the "Trees After the Storm - Replanting Storm-Safe Trees" web-site to answer frequently asked tree questions, sponsored the Broward Beautiful Trees & Hurricane Impact Summit, purchased and distributed 30,000 Florida Urban Forestry Council brochure posters "Right Tree Right Place - Selecting and Planting Trees for the South Florida Urban Forest" brochures, and created the NatureScape publication "Gone With The Wind...Storm." Additionally, the Natural Resources Planning and Management Division implements the NatureScape Broward program designed to help people create and maintain attractive low maintenance, low impact, healthy landscapes that reflect and help Florida's natural resources. The goal of NatureScape Broward is to protect water quality and quantity, and create natural wildlife habitat through appropriate landscaping practices, the prudent use of water resources, and the planting of native, non-invasive, and other drought tolerant plants in Broward County.

Explanation: Broward County experienced Category 2 hurricane conditions due to Hurricane Wilma in October 2005. Qualitative estimates of tree canopy loss due to Wilma range from 20% to 30%. Following hurricane Wilma, EPGMD made a focused effort to provide accurate public information to mitigate negative perceptions of trees as hurricane hazards, and to reinforce, encourage, and support positive actions towards replacing trees and also provide a wider perspective beyond "hurricane-resistant species" to include tree grades, selection, planting, care, and the principle of "right tree right place." The NatureScape Broward program has been an important part of this effort, promoting "Florida Friendly" yards and landscaped areas with plants that are selected and planted in appropriate locations based on their function and growth requirements. The NatureScape Broward program also encourages adherence to established landscape best practices such as efficient irrigation, and the minimal and proper use of fertilizers, pesticides and chemicals. This approach to landscaping can help ensure the long-term sustainability of healthy Broward landscapes. NatureScape programs are offered in the classroom, through regularly scheduled classes and at the request of interested groups, such as garden clubs and community associations and events.

Trends: Broward County's tree canopy continues to recover from Hurricane Wilma and future storm activity is likely in the next decade. Right Tree Right Place public education will continue to be a priority. As a result of the NatureScape Program, over 2026 backyards, along with schoolyards, workplaces, public properties and homeowner communities have been certified as NatureScapes in Broward County.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

TREES PLANTED IN BROWARD COUNTY PARKS AFTER STORM EVENTS

Narrative: Trees provide many benefits to Broward County's Park system. They provide shade and scenery for park users as well as provide habitat to wildlife. In recent years, Broward County Parks have suffered a severe loss of tree canopy due to tropical storms. This is a loss that must be mitigated to maintain the value and enjoyment of the park system.

Explanation: The Broward County Parks and Recreation Division has undertaken an aggressive tree planting program to replace trees lost due to tropical storms. Since 2005, over 10,000 trees have been planted. An additional 3000 trees will be planted in the near future. The trees planted will provide more tree canopy at maturity than what was lost. The tree species utilized should also be able to better withstand future storms, providing a more viable long lasting resource.

Data source: Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

STORM PREPAREDNESS AND RESPONSE

Narrative: Broward County has felt the effects of several tropical storms over the past several years. The storms had a large impact on the County's tree canopy, destroying and damaging many trees. The following is the County's response to that damage.

Explanation: A number of tropical storms, most notably Hurricane Wilma, have caused extensive damage to the County's tree canopy. Many trees were uprooted or had major crown damage. Many trees needed pruning to restore the health of the trees and to alleviate hazardous conditions. There is also a great need for new trees to replace lost tree canopy.

Broward County responded immediately after Hurricane Wilma by suspending the Broward County Tree Trimmer Licensing Ordinance. This ordinance requires that all commercial tree services obtain a Broward County Tree Trimmer License. Suspending the ordinance for two months allowed out-of-county tree services to come in and remove and trim hazardous trees. Once the immediate concerns were addressed, the ordinance was reinstated.

The County also undertook several educational initiatives immediately after the storm. These included the "Trees After the Storm Replanting Storm-Safe Trees" web-site, and the "Gone With The Wind...Storm" Brochures. The County also held a Broward Beautiful Trees & Hurricane Impact Summit. In addition, funds from the County Tree Preservation Trust Fund are being utilized to replace tree canopy lost from the storms.

Data source: Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

BROWARD BEAUTIFUL PROJECTS, THOUSANDS OF DOLLARS SPENT

Measurement: The Broward Beautiful program provides matching grants to non-profit organizations for environmentally-friendly landscape projects through various grant programs. The Broward Beautiful Committee is an advisory board to the Broward County Board of County Commissioners established July 13, 1993 to initiate, develop, coordinate, and direct programs for county-wide beautification in cooperation with citizens, local governments, and businesses of Broward County. The Broward Beautiful Trust Fund replaced the Highway Beautification Trust Fund and inherited \$100,000 from the predecessor fund. Grant programs were first funded in FY98 at \$149,000/yr. Funding was increased in FY01 to \$299,000/yr and remained at that level through FY06. Additional funding was secured through the Tree Preservation Trust Fund beginning in FY03 for the Greening Gateways program and the GreenSHADE grants program and in FY06 an additional \$100,000 was allocated from the Commission Reserve Fund to fund additional Community Grants following Hurricane Wilma. Typically, the Broward Beautiful committee allocates \$200,000 of their total \$300,000 annual budget to the Community Grants program. The remaining \$100,000, and funding from the Tree Preservation Trust Fund, supports other Broward Beautiful programs including the Adopt-A-Street Program, the Butterfly Garden Grants program, and various Special Project grants (e.g. Greening Gateways, Kids Ecology Corps, Marine Industries Association of South Florida Waterway Cleanup, and Ocean Watch Foundation Reef Sweep). Funding for Broward Beautiful grants was reduced in FY07 to \$230,000. The Broward Beautiful committee allocated the entirety of this funding and an additional \$116,000 in carryover dollars to the Community Grants Program funding a \$316,000 in community grants.

Explanation: The figures reported represent County dollars approved for grant projects in the indicated calendar year. Because the grant programs require an applicant match, these figures represent approximately half of the actual impacts of these grant projects.

Trends: Funding for Broward Beautiful grant programs has steadily declined over the past two years due to exhaustion of the Tree Preservation Trust Fund that funded the Broward Beautiful GreenSHADE program and Greening Gateways program and reductions in the general fund allocation to Broward Beautiful programs. The FY08 budget allocated \$130,000 for Broward Beautiful grants. On January 8, 2008, the Board approved the creation of Broward Beautiful Foundation as a not-for-profit organization to receive funds and engage in beautification projects. The Board will provide \$120,000 in start-up money to fund staff positions for the Foundation for the first year.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

CERTIFIED NATURSCAPE SITES, TOTAL

Measurement: This measure tracks the total number of properties that have been certified as NatureScapes based on the creation and maintenance of landscapes in a manner consistent with the NatureScape Broward program principles (<http://www.broward.org/naturescape/>).

Explanation: Landscape design and maintenance have the ability to exert tremendous influence on the quantity and quality of Broward's water resources. Landscape irrigation is estimated to account for as much as 50% household water consumption and landscape runoff is identified as a major source of water pollution. In 2002, NatureScape Broward program was created as an environmental initiative with the goals to conserve water quantity, protect water quality, and create wildlife habitat through environmentally-friendly landscape practices that include the use of native and other drought tolerant plants and the prudent use of our water resources. NatureScape properties adhere to the principles of Right Plant, Right Place, Get the Water Right, and other landscape best management practices (including integrated pest management and the use of low and no phosphorus fertilizers). In 2005, Broward County achieved recognition by the National Wildlife Federation (NWF) as a Certified Wildlife Habitat based in large part on the number of certified NatureScapes registered by the County and the environmental standards by which landscapes are evaluated. The County's certification program serves to recognize those properties that exemplify the NatureScape principles and includes those properties certified under similar programs administered by the NWF and Florida Yards and Neighbors Program. NatureScapes include residential, commercial, public, and educational properties, and can range in size from several tens of feet to many acres in total area. In 2006, Broward County and the School Board of Broward County entered into an historical partnership agreement to NatureScape certify all school properties as an environmental goal. Planning for certification of five schools began in 2007.

Trends: The total number of NatureScape certified sites reached 2026 in 2007. The number of certified NatureScapes in Broward County has steadily increased since program inception, with annual increases of 38% in 2003, 85% in 2004, 50% in 2005, 24% in 2006, and 36% in 2007.

Data source: Calendar year data. Data maintained by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

GREATER FT. LAUDERDALE FLYWAYS CITIES COALITION

Narrative: The Greater Ft. Lauderdale Flyways Cities Coalition is a collaborative effort between the National Wildlife Federation and the NatureScape Broward program with the goal to bring together diverse groups in a common mission to protect wildlife and regional habitats. As part of the Flyways Coalition, the National Wildlife Federation will work with new cities each year to develop coalitions throughout the United States; the Greater Ft. Lauderdale area was chosen as the pilot site for launching this new initiative due to the already established NatureScape Broward program and the existing partnership between Broward County and the National Wildlife Federation. The Greater Ft. Lauderdale Flyways Cities Coalition celebrated a kick-off event in May 2008 and will be meeting regularly to develop strategies and implement projects designed to preserve, enhance and create wildlife habitat and migratory corridors.

Explanation: Flyways are pathways of bird migration from southern wintering grounds to northern breeding grounds. These migration routes are stopover points that offer food, shelter, and areas of congregation for migrating animals. In Broward County, we can expand the concept of flyways to include waterways as we have migratory marine animals, such as manatees and sea turtles.

The two major goals of the Flyway Cities Coalitions are:

1) To increase the quantity and quality of key habitats within the flyways corridors so that we can measure increases in native plants and populations of migratory and resident wildlife.

2) To foster a committed base of active citizens, including businesses, like-minded conservation groups, government agencies, and other people dedicated to sustain and expand the coalition over time.

These goals are focused on individual as well as community-based actions and can include efforts to create and/or maintain tracts of land that are connected and conducive to wildlife (including parks, right-of-ways, refuges, and even golf courses), school-based habitats reflective of district-wide commitments to provide education through the preservation of urban ecology, and businesses/commercial efforts to integrate green infrastructure in site development and/or rehabilitation.

Through activities of the NatureScape Broward program, the County will strive to achieve a 5-10% increase in the number of certified wildlife habitats in Broward County, and will work to protect, restore and preserve native habitats within the flyways and waterways.

Trends: Population growth and urban development present challenges in the preservation of natural areas and wildlife habitat. The effects of global climate change are expected to create additional challenges for resident and migratory wildlife as ecological zones shift and critical habitat is further diminished. Such stressors contribute to the fragmentation of natural ecosystems, isolated populations of plants and animals, and the lack of connectivity of green space and wildlife habitat along critical migratory paths. Through the Flyways Coalition, governments, environmental groups, volunteers, schools, and others are now joining in coordinated efforts to ensure the preservation of wildlife habitat that contributes to healthier communities and is essential in maintaining the continued presence of resident and migratory wildlife.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

EDUCATIONAL EVENTS TO REDUCE PEST PROBLEMS

Measurement: NatureScape Broward programming is delivered as part of professional and public education in the form of formal workshops, training sessions, presentations, educational booths, and participation in community events. The number of events is counted throughout the twelve month period ending September 30th of the year listed.

Explanation: The quality of Broward's landscapes is substantially influenced by the various exotic pests and new infestations of insects and diseases documented in recent years. The extent of these impacts is dependent upon the type and diversity of plant material in the landscape, the condition of the plant material, and the landscape practices implemented on-site. The NatureScape Broward program is focused on the enhancing the quality of our urban landscapes, protecting our water resources, and creating wildlife habitat through the use of native and other drought tolerant plants, the prudent use of our water resources, and the use of landscape best management practices, including right plant right place principles and integrated pest management. Staff in the NatureScape Broward program work with property managers, homeowners, maintenance personnel, municipalities and the Broward School District to help guide the creation and maintenance of hardy Florida-friendly landscapes. These Broward NatureScapes promote the use and proper placement of native plants that are uniquely adapted to South Florida's extreme conditions, efficient irrigation, minimal and proper use of fertilizers and other chemicals, and the use of the least toxic controls in managing pests and disease. As a result, NatureScapes are better equipped to endure the pressures of pests and disease that threaten landscapes with ill-suited, compromised, or monoculture plant material. NatureScape Broward, consistent with the recommendations of various state and local agencies, promotes the following actions to address emerging pest problems:

- Use of native plants and removal or management of exotic species;
- Targeted use of plants not subject to pest populations;
- Introduction of biological control agents such as predatory insects, including native and non-native species;

- Implementation of integrated pest management practices to reduce the need for pesticides;
- Accurate identification of the problem to determine the correct treatment. Some diseases can be controlled through mechanical or cultural methods rather than pesticides; and
- Education and understanding of beneficial insects and a more natural control of pests and weeds.

These environmentally friendly approaches will help to control the populations of present pests, maintain high quality urban landscapes, and reduce the need for future pesticide use. Reducing the amount of pesticides used in landscapes is an important part of the County's efforts to protect the quality of our surface waters and ground waters.

Trends: The primary audiences for NatureScape programs in the fiscal years 06 and 07 were homeowners and licensed professionals. The anticipated partnership with the School Board of Broward County will contribute to an increase in NatureScape staff as well as an increase in outreach to a more diversified audience of students, maintenance staff, and educators.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

ACTIVE TREE TRIMMER LICENSES

Measurement: This measures the number of tree trimmer licenses that are active in each year. This is a good indicator of how well the program is progressing.

Explanation: Tree Trimmer Licenses are required for all commercial tree services and governmental entities which do tree trimming. In order to get a license, training, insurance and other requirements must be met. The number of active tree trimmer licenses was calculated using the Tree Trimmer Licensing database.

Trends: The number of active tree trimmer licenses increased slightly in 2007. This is a result of the program becoming more established and also due to a continued number of enforcement actions related to Tree Trimmer Licensing.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

TREE RELATED ENFORCEMENT ACTIONS

Measurement: This measurement tracks the number of enforcement actions issued per year. Measuring the number of enforcement actions issued is an effective indicator of the enforcement efforts concerning tree related complaints and violations.

Explanation: The Department issues three types of enforcement actions: Warning Notices, Citations and Notices of Violations. Warnings and Citations are used for less serious violations, while Notices of Violation are used for the more serious violations. The three types of enforcement actions were counted per year using the database.

Trends: The number of enforcement related actions increased slightly in 2007. This was due to the fact that enforcement continued on the Tree Trimmer Licensing Program. This program relies on warning notices and citations for enforcement. Note that the data for 2001 is incomplete, as the Department was switching to a new database.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

REPLACEMENT TREES REQUIRED BY LICENSING

Measurement: This measurement calculates the number of replacement trees required by licensing per year. This is a good measurement to show the response to the loss of tree canopy.

Explanation: As a condition of obtaining a Tree Removal License, licensees are required to plant replacement trees to compensate for trees being removed. The number of replacement trees required per tree removed varies depending on the size, species and condition of the tree being removed. This number was based on determining the number of Tree Removal Licenses issued per year, and then adding up the number of replacement trees per each license.

Trends: The number of replacement trees required decreased in 2007. The primary reason for the decrease is that less trees were licensed for removal, thus tree less tree replacement was required.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

TREES FUNDED FOR PLANTING THRU THE TREE TRUST FUND

Measurement: This measurement tracks the number of trees funded for planting by the Tree Preservation Trust Fund. This is a good measurement to show the response to the loss of tree canopy.

Explanation: The Tree Preservation Trust Fund is a Trust Fund set up as part of the County Tree Preservation Ordinance. Tree Removal Licenses require replacement trees to replace lost tree canopy. In cases where there is not sufficient room on site for replacement trees, a contribution into the trust fund in lieu of replacement trees is required. The Trust Fund is used to pay for the installation of trees on public lands.

Trends: The number of trees funded for planting has varied over the past five years. The main factors affecting this number are the amount of funds available in the trust fund and the number of projects proposed. Available funding in 2007 was limited due to the fact a good portion of the funding available in the Tree Preservation Trust Fund has been encumbered in previous years and that most of the remaining funds are tree removal license contributions which can only be spent in the city that they were collected in.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation Division, Peter Burke, (954) 519-1224

OUR MARINE RESOURCES - REEF RESOURCES

Reef Quality

PERCENT HEALTHY CORALS

Measurement: Selected areas in each of Broward's three reef terraces are visited annually to determine the percentage of stony corals affected by disease or bleaching. Coral health is reported for ten sites on the first reef, eight sites on the second reef and seven sites on the third reef. Using SCUBA, divers assessed a 20 meter x 1.5 meter transect established at each site sequentially along one side of the transect and then along the other side with a 0.75m² quadrat. All stony corals are censused and those with disease or that are bleached are noted. This measurement is used to characterize the relative health of coral reef communities. Twenty-three sites were established in 2000 and two new sites were added in 2004.

Explanation: Coral reef communities and associated sea life of those communities are an important natural resource for recreational fishing and diving industries in Broward. The sound ecological condition of the reef community is a key indicator of the general condition of all marine resources adjacent to the Broward coast. This indicator bears watching to determine if recent concerns over reef decline in the western Atlantic is warranted for Broward's reef communities.

Trends: Relative health of stony coral colonies was high for all years with an insignificant decrease in 2003. The percent of healthy colonies at

all 25 sites examined rose from 98% to 100% from 2006 to 2007.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

NUMBER OF FISH SPECIES OBSERVED ON THE REEF

Measurement: Selected areas in each of Broward's three reef terraces are visited annually and standardized fish counts are conducted. Two thirty-meter long transects for fish counts and one fifteen meter diameter cylinder for fish point count are conducted at each site. Populations of fishes are counted one meter on either side of the transect line and two meters above the line.

Explanation: Fish population census can allow management to determine if there are subtle changes or significant changes in abundance or species composition over time on the reef habitats throughout the offshore area. Changes in fish populations on the reef could be an indicator of larger scale changes in habitat composition or relative health of the reef community.

Trends: The number of individual fish counted varies from year to year and from reef tract to reef tract and may be dependant on the time of year that the fish counts are conducted. The fish count transects are conducted from September through December or January each year and may vary significantly in species composition and number of individuals throughout this time period showing a possible seasonal trend. Comparison among the reef tracts consistently shows a greater number of individuals and species on both the second and third reef tract compared to the first reef tract.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

Reef Quantity

PERCENT LIVE CORAL COVERAGE

Measurement: Selected areas in each of Broward's three reef terraces are visited annually to determine the percentage of the bottom which is covered by stony corals. The average coral cover is reported for ten sites on the first reef, eight sites on the second reef and seven sites on the third reef. Using SCUBA, divers assessed a 20 meter x 1.5 meter transect established at each site sequentially along one side of the transect and then along the other side with a 0.75m² quadrat. This measurement is used to characterize the relative health of the coral reef communities. Twenty-five sites were monitored starting in 2005.

Explanation: Coral reef communities and associated sea life of those communities are an important natural resource for recreational fishing and diving industries in Broward. The sound ecological condition of the reef community is a key indicator of the general condition of all marine resources adjacent to the Broward coast. This indicator bears watching to determine if recent concerns over land-based sources of pollution and harmful algae blooms are impacting the reef communities.

Trends: Average live coral cover on the first reef and on the third reef increased slightly but insignificantly during the 2007 survey compared to 2006, while the percent cover on the second reef decreased slightly.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

OCTOCORAL AND SPONGE DENSITY

Measurement: Octocoral and sponge density are measured during the annual coral transect measurement events. The data is recorded as the number of colonies per square meter. Each transect covers 30 square meters of bottom habitat.

Explanation: Fluctuations in the population density of octocorals and/or sponge colonies can be used to assess the general health of the reef community in a similar way that fish populations or stony coral colonies counted and assessed at reef community study sites can also be used to describe the general well being of the reef community.

Trends: Octocoral and sponge density both increased between 2006 and 2007.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

NUMBER OF FISH SURVEYED ON THE REEF (ABUNDANCE)

Measurement: Selected areas in each of Broward's three reef terraces are visited annually and species counts are done to the lowest taxon that conditions allow. Two thirty-meter long transects for fish counts and one fifteen meter diameter cylinder for fish point count are conducted at each site. Populations of fishes are counted one meter on either side of the transect line and two meters above the line.

Explanation: Fish population census can allow management to determine if there are subtle changes or significant changes in abundance or species composition over time on the reef habitats throughout the offshore area. Changes in fish populations on the reef could be an indicator of larger scale changes in habitat composition or relative health of the reef community.

Trends: The number of individual fish counted varies from year to year and from reef tract to reef tract and may be dependant on the time of year that the fish counts are conducted. The fish count transects are conducted from September through December or January each year and may vary significantly in species composition and number of individuals throughout this time period showing a possible seasonal trend. Comparison among the reef tracts consistently shows a greater number of individuals and species on both the second and third reef tract compared to the first reef tract.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

PRESSURES ON REEF RESOURCES

SALTWATER FISHING LICENSES ISSUED IN BROWARD COUNTY, THOUSANDS

Measurement: The total number of saltwater fishing licenses issued annually (July 1 of the previous year to June 30 of the year indicated) encompassing resident and non-resident saltwater licenses of all ages and duration periods, including lifetime and senior licenses and lifetime sportman's licenses. It also includes charter vessel licenses and saltwater fishing pier licenses.

Explanation: Recreational and commercial fishing activities exert a direct impact on our marine resources. State regulations require a saltwater fishing license to fish in marine waters. This number serves as a proxy for pressures on Broward County marine resources. More information about saltwater fishing licenses may be found at <http://marinefisheries.org/license.htm>. Since the Florida saltwater fishing license was adopted in 1989, significant changes in licensing procedures have evolved. The creation of the 5-year license, lifetime and comprehensive license programs skews the number-of-license statistics. For example, a 5-year license or a comprehensive hunting and fishing license are only counted in the year in which it is issued. State fishing license sales figures show how many licenses and stamps were sold in the County, but do not necessarily represent the number of anglers who fish in Broward County. Anglers are quite mobile and many of them fish in multiple places on both coasts. Also, residents fishing from shore do not have to purchase this license as well as others who qualify under the other types of exemptions to the Florida Saltwater Fishing License.

Trends: Between 1999 and 2004, total numbers of licenses steadily declined. Since 2005, the numbers have been relatively stable with a slight increase in 2006 due to the issuance of more fresh/salt combination licenses and an increase in the number of five year licenses issued, a decrease in 2007 in the number of one year resident saltwater licenses, and another small decrease in 2008.

Data source: State fiscal year data. Florida Fish and Wildlife Conservation Commission, Tallahassee, (850) 488-3641

NUMBER OF DAYS WATER TEMPERATURE WAS NOT OPTIMAL FOR CORALS

Measurement: The number of days when water temperatures are less than 16°C (60.8°F) or greater than 29°C (84.2°F).

Explanation: Reef-building corals worldwide tolerate water temperatures between 16°C and 36°C, but thermal stress resulting from sustained temperatures greater than normal maximum temperatures (29°C [84.2°F]) can cause bleaching of corals and low temperatures can result in mortality. Bleaching results when the coral polyps expel the algae (zooxanthellae) that normally live in their tissues and give the colony color. Studies have shown that temperatures of only 1-2 °C (1.8-3.6 °F) above normal maxima sustained for a few weeks are enough to drive a 'mass bleaching' event (Spalding MD, Ravilious C, and Green EP, 2001. *World Atlas of Coral Reefs*. Prepared at the UNEP World Conservations Monitoring Centre. University of California Press, Berkeley, USA, 424p).

Trends: Data collection at the 12 sites (see table below) began on July 13th, 2000. We report the number of days when the mean daily water temperature for each reef tract was equal to or greater than 29°C or less than 16°C. The mean daily water temperature was never below the thermal minimum of 16°C through 2006. There were periodic times when specific data loggers were being serviced or failed, however, with exception of 5/25/01-6/11/01, 7/4/02, 12/23/02-12/31/02, and 1/1/03-11/30/03, at least one data logger on each reef tract was functioning during each day of the years reported. It should also be noted that data reported for 2000 represents only half of the year. The years 2000 and 2002 were nearly identical on each reef tract. On all reef tracts 2001 appears to have been considerably cooler than the other years. The number of warm-water days was higher in 2005 and 2006. The causes of this are unknown. Data for 2007 is only available from March thru July, therefore, maximum seasonal temperatures, which normally occur in Aug-Sept are not available.

Data source: Calendar year data. 2002-2007 (Jan, Feb) Broward County Environmental Protection and Growth Management Department*, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207. Data from March-Jul 2007, Nova Southeastern University Oceanographic Center, David Gilliam, PhD, (954) 262-3634

Thermographs (HOBO Water Temp Pro, Onset Corporation, Accuracy: ±0.2°C at 0 to 50°C [± 0.36°F at 32° to 122°F], Resolution: 0.02°C at 25°C [0.04°F at 77°F]). Site information:

Site Name	Description	Depth (ft)	Latitude (dd mm)	Longitude (dd mm)
HW1	Hollywood 1st reef	-15	26 02.1117'	-80 11.2007'
HW2	Hollywood 2nd reef	-40	26 02.1170'	-80 09.5290'
HW3	Hollywood 3rd reef	-50	26 02.0458'	-80 08.8225'
JUL8	John U Lloyd 3rd reef	-50	26 08.3262'	-80 08.4983'
JUL7	John U Lloyd 2nd reef	-40	26 08.2725'	-80 09.5535'
JUL6	John U Lloyd 1st reef	-15	26 08.1867'	-80 10.3710'
FL1	Fort Lauderdale 1st reef	-15	26 10.2167'	-80 10.1817'
FL2	Fort Lauderdale 2nd reef	-25	26 10.2235'	-80 09.3598'
FL3	Fort Lauderdale 3rd reef	-70	26 10.2598'	-80 08.2492'
FTL1	Fort Lauderdale 1st reef	-15	26 15.8905'	-80 09.5792'
FTL2	Fort Lauderdale 2nd reef	-40	26 15.9952'	-80 08.2537'
FTL3	Fort Lauderdale 3rd reef	-50	26 15.8638'	-80 07.7343'

NSU Thermographs (HOBO Water Temp Pro, Onset Corporation, Accuracy: $\pm 0.2^{\circ}\text{C}$ at 0 to 50°C [$\pm 0.36^{\circ}\text{F}$ at 32° to 122°F], Resolution: 0.02°C at 25°C [0.04°F at 77°F]). Site information:

Site Name	Description	Depth (ft)	Latitude (dd mm)	Longitude (dd mm)
BC1	Ft Lauderdale 1st reef	-15	26° 08.872'	-80° 05.758'
BC2	Ft Lauderdale 2nd reef	-40	26° 09.597'	-80° 04.950'
BC3	Ft Lauderdale 3rd reef	-50	26° 09.518'	-80° 04.641'
BCA	Ft Lauderdale ridge complex	-20	26° 08.985'	-80° 05.810'

PERCENT REEF MONITORING SITES IMPACTED BY ALGAE

Measurement: The percentage of the 25 Broward County annual reef monitoring sites significantly impacted by the cyanobacteria, *Lyngbya confervoides* and *L. Polychroa*.

Explanation: Bottom-dwelling cyanobacteria (primitive algae) can form prominent mats and blooms in tropical and subtropical coral reef habitats worldwide. A *Lyngbya* bloom on the reef tract offshore of Broward County was first noted in 2002 (Paul VJ, Thacker RW, Banks K, and Golubic S, 2005. Benthic cyanobacterial bloom impacts the reefs of South Florida. *Coral Reefs* 24: 693-697). This bloom is a concern because it smothers octocorals and other invertebrates and negatively impacts the reef community. Some believe blooms are caused by excess nutrients in the water, but this has yet to be determined.

Trends: The proportion of sites affected by algal blooms increased from 4% in 2002 to 72% in 2003 and then returned to 4% in 2004. Levels subsequently increased to 12% in 2005 and 2006. Within 2005 and 2006, higher frequency boom and bust cycles were observed. The cause of these cycles by water quality or population dynamics of the grazing sea hare, *Stylocheilus* spp. is not known. In 2007, 21% of reef mapping study sites were affected by persistent cyanobacteria coverage.

Data source: Calendar year data collected during September and October each year. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207. 2007 data provided by Nova based on reef mapping sites. Nova Southeastern University Oceanographic Center *Lyngbya* presence/absence survey at Broward County Environmental Protection and Growth Management Department biological monitoring sites:

SITE NAME	DEPTH (ft)	LAT (N)	LONG (W)
JUL2	50	26 00.2593'	-80 05.3010'
JUL1	35	26 00.3014'	-80 05.8134'
HH2	15	26 00.6946'	-80 06.7572'
JUL8	50	26 04.9957'	-80 05.0990'
JUL7	25	26 04.9635'	-80 05.7321'
JUL6	12	26 04.9120'	-80 06.2226'
FTL6	18	26 08.9850'	-80 05.8070'
FTL5	18	26 08.8710'	-80 05.7580'
FTL4	18	26 08.2080'	-80 05.8440'

FTL3	55	26 09.5183'	-80 04.6406'
FTL2	40	26 09.5971'	-80 04.9522'
FTL1	18	26 09.5343'	-80 05.7475'
POMP6	52	26 14.5660'	-80 04.3980'
POMP5	31	26 14.5660'	-80 04.7310'
POMP4	19	26 12.7320'	-80 05.2010'
POMP3	50	26 11.2141'	-80 04.3650'
POMP2	40	26 11.3289'	-80 04.8039'
POMP1	14	26 11.4356'	-80 05.2256'
HB3	47	26 16.4255'	-80 03.8189'
HB2	35	26 16.5350'	-80 04.2620'
HB1	18	26 16.8357'	-80 04.5390'
DB3	57	26 18.6828'	-80 03.5764'
DB2	42	26 18.6280'	-80 04.0262'
DB1	15	26 18.5869'	-80 04.3928'
BOCA	30	26 20.8030'	-80 03.8830'

NUMBER OF TIMES SHIP DAMAGE IMPACTED BROWARD'S REEFS

Measurement: The number of groundings or ships anchored outside of the officially designated commercial ship anchorages that have been reported to the County by the State or by the public, regardless of whether a responsible party has been determined or any restoration has been completed.

Explanation: The proximity of the Port Everglades associated commercial ship anchorages to shallow reefs resulted, until 2008, in numerous ship groundings and ships disregarding the established anchorage by anchoring outside of its bounds, thus damaging reef resources. Many groundings required intervention by the United States Coast Guard (USCG) for removal and were, therefore, reported to the Florida Fish and Wildlife Conservation Commission (FWCC) or the Department of Environmental Protection (FDEP). Many anchor incidents, in which ships anchor outside of the anchorages, are reported to USCG. When a responsible party can be identified, the State can proceed with the assessment of penalties. This results in the identification of a responsible party (RP) and the initiation of reef restoration activities. Often ships ground briefly and free themselves or anchor on resources but it is not reported so no restoration occurs. Increased enforcement by USCG could result in a decrease in anchor damage to coral reefs. The offshore anchorage configuration was changed in 2008 to eliminate the shallow anchorage with the intent to minimize groundings. It will not address, however, that lack of enforcement of the commercial anchorage that result in unreported incidences of ships anchoring on the reef.

Trends: For the years 1994 to present, the number of grounding or anchoring incidents reported are, 1994 - 2, 1998 - 2, 2003 - 1, 2004 - 4, 2006 - 6, 2007 - 2, and 2008 - 0 (to date). Many incidents of anchoring on reef outside of anchorage likely occur that are not reported.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

CUMULATIVE ACRES OF REEF IMPACTED BY DESTRUCTIVE ACTIVITIES

Measurement: The acreage of reefs directly impacted by human-related activities, including amount of reef impacted versus amount of mitigation and habitat creation for other reasons.

Explanation: Human-related impacts include dredging for navigational inlet maintenance and beach nourishment, ship grounding and anchor damage, fiber optic cable installation, natural gas pipeline construction, etc. Impacts shown here include permitted direct impacts, as well as accidental direct impacts. Indirect impacts, such as turbidity and sedimentation, are not included. Constructed mitigation for these impacts and artificial reefs constructed of boulders or modules are included as separate metrics. The net acreage of reef impacted is equal to the amount impacted vs the amount created as mitigation or for other reasons. The intent of this category is to provide insight into cumulative direct physical impacts to the reefs offshore Broward County. It is important to recognize that reefs recover to some extent from impact and artificial reefs, while providing certain resource services, do not necessarily ever provide the same ecological functions as the natural reef. Therefore this metric is a picture of net reef area impacted, not net cumulative environmental impact. It should also be recognized that restoration activities may have occurred on some of the impacted reefs and this has not be considered in the metric.

Trends: Trends are episodic due to the occurrence of coastal construction projects or vessel impacts. Groundings have resulted in a net impact because no mitigation has been completed for any event. From 2005-2007, a net loss of 28.1 acres of hard bottom occurred as a result of equilibration of the Broward County Segment III Beach Nourishment Project. Some of this hard bottom may be re-exposed from normal littoral sediment transport processes in the future, and this is being monitored. 1.6 acres of mitigation for hard bottom impacts resulting from the Hillsboro Inlet dredging project (2005) are being completed in 2008.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

RESPONSES TO PRESSURES ON REEF RESOURCES

MARINE PROTECTED AREAS (MPAs)

Narrative: This benchmark describes Broward offshore areas officially designated as marine protected areas (MPA) by Florida Fish and Wildlife Conservation Commission.

Explanation: MPAs are used as a management tools to protect, maintain, or restore natural and cultural resources in coastal and marine waters. As used herein, MPA is defined to mean an area of coastal shelf designated as permanently closed to all fishing and other extractive uses with limited exceptions for research. They have been used effectively both nationally and internationally to conserve biodiversity, manage natural resources, protect endangered species, reduce user conflicts, provide educational and research opportunities, and enhance commercial and recreational activities. In 2001, an area of 566km² in the Dry Tortugas, Florida, was designated as a no-take marine reserve. Subsequent monitoring of this area showed that the number of fish species remained stable in the first 4 years after formation. The abundance of several exploited and non-exploited species increased, and there was a shift to more, larger individuals of exploited species (Ault et al 2006). Preliminary results of monitoring the Dry Tortugas reserve in 2008 indicate that stocks have slowly begun to recuperate since the implementation of no-take status. In particular, there were improvements in numbers of snapper, grouper, and coral recruits (Ault, personal comm.). In addition, preliminary evidence found by Burton et al (2005) indicated that spawning aggregations of mutton snapper were reforming at Riley's Hump in the protected Dry Tortugas.

References:

Ault JS, Smith SG, Bohnsack JA, Luo J, Harper DE, McClellan DB, 2006. Building sustainable fisheries in Florida's coral reef ecosystem: positive

signs in the Dry Tortugas. *Bulletin of Marine Science*, 78(3): 633-654.

Burton ML, Brennan KJ, Muñoz RC, Parker Jr. RO, 2005. Preliminary evidence of increased spawning aggregations of mutton snapper (*Lutjanus analis*) at Riley's Hump two years after establishment of the Tortugas South Ecological Reserve. *Fisheries Bulletin*, 103: 404-410.

Trends: To date, no MPAs have been designated offshore Broward County.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

COASTAL WATER QUALITY MONITORING

Narrative: Broward County has initiated a Coastal Water Quality Monitoring Program to generate baseline data to better understand how stormwater flows from inlets and other discharges influence the water quality reaching the reefs.

Explanation: The reef system along the southeast coast of Florida is ecologically dynamic and economically important. The reefs provide habitat for a diverse biological community, attract tourism and support substantial commercial and recreational fisheries estimated in 2001 to generate \$2.1 billion in revenue in Broward (<http://www.broward.org/environment/bri01714.pdf>). The close proximity of the reefs to heavily developed urban areas increase the risk of exposure to land based sources of pollution (terrestrial runoff, sewage effluent, etc.). The objectives of the monitoring program include: (1) establishing long term monitoring sites so future trends in water quality can be evaluated to determine if water quality along the reef tracts of Broward County is improving, worsening or remaining the same; (2) assessing the water quality of Broward County's coastal waters relative to Federal, State and local water quality guidelines; (3) describing geographic and temporal patterns of water quality, as they relate to nutrients and chlorophyll in the waters over the reefs of Broward County; and (4) assessing water quality as it relates to the initiation and persistence of blooms of various species of phytoplankton and macroalgae and their impacts on reef community structure and diversity.

Trends: Coastal water quality monitoring began at four sites in December 2005. As of Fall 2008, these four sites have been sampled 19 times and those data are available on request. Monitoring up to twelve times per year at these sites will continue.

Data source: Broward County Environmental Protection and Growth Management Department, Environmental Monitoring and Enforcement Division, Nancy Craig, PhD, (954) 519-1411

ALGAL BLOOM MONITORING EFFORTS

Measurement: The percentage of the 25 Broward County annual biological monitoring sites significantly impacted by the cyanobacteria, *Lyngbya confervoides* and *L. Polychroa*.

Explanation: Bottom-dwelling cyanobacteria (primitive algae) can form prominent mats and blooms in tropical and subtropical coral reef habitats worldwide. A *Lyngbya* bloom on the reef tract offshore of Broward County was first noted in 2002 (Paul VJ, Thacker RW, Banks K, and Golubic S, 2005. Benthic cyanobacterial bloom impacts the reefs of South Florida. *Coral Reefs* 24: 693-697). This bloom is a concern because it smothers octocorals and other invertebrates and negatively impacts the reef community. Blooms may be caused by excess nutrients in the water, but this has yet to be scientifically demonstrated.

Trends: The proportion of sites affected by algal blooms increased from 4% in 2002 to 72% in 2003 and then returned to 4% in 2004. Levels subsequently increased to 12% in 2005 and 2006. Within 2005 and 2006 higher frequency boom and bust cycles were observed. The causes of these cycles may be water quality or population dynamics of the grazing sea hare, *Stylocheilus* spp. In 2007, 21% of reef mapping study sites were affected by persistent cyanobacterial cover. In July 2008, a very large bloom of *Lyngbya confervoides* and *L. Polychroa* occurred at Broward Study site, JUL7, on the inner reef offshore John U. Lloyd State Park

Data source: Calendar year data collected during September and October each year. Nova Southeastern University Oceanographic Center (NSU) *Lyngbya* presence/absence survey at Broward County Environmental Protection and Growth Management Department's 25 biological

monitoring sites in 2005 and 2006. 2007 data provided by Maureen Trnka of NSU is a study of spatial distribution of cyanobacterial cover. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

ACRES OF CONSTRUCTED HABITAT:

ACRES OF BOULDER REEFS

ACRES OF MODULAR REEFS

NUMBER OF SHIPWRECK REEFS

Measurement: This measure tracks the numbers of three types of artificial reefs. The three types of reefs include those constructed of natural boulders, molded-concrete modules and purposely sunken decommissioned ships. The data reported is for the fiscal year indicated ending September 30th.

Explanation: A study was completed (sponsored by the National Marine Fisheries Service) to census and determine seasonal dynamics of the fish assemblages on the county's *natural* reefs. Currently, a very large artificial reef is being constructed from limestone boulders. Monitoring of this and nearshore reefs will provide comparison data which may give insight into the development of reefs that function more like natural reef systems. We may redefine the performance measures to consider this information. In 2003, the square footage of boulder reefs jumped from ~3,000 to ~440,000 due to the placement of 10 acres of boulders for beach re-nourishment mitigation.

Trends: The construction of artificial reefs is primarily dependent on the status of permits and available grant funding or donations of materials. However, over the past five years, the lengthy process of renewing artificial reef permits has delayed their construction. As a result, no artificial reefs have been constructed since the 10 acres boulder reefs in 2003. Re-permitting of artificial reef sites was completed in 2008. The deployment of ships will be de-emphasized in favor of limestone based materials or modules in the future due to permitting constraints. In addition, the major funding source for artificial reef construction, the Broward Boating Improvement Program (BBIP), will no longer be available for the construction of artificial reefs due to rule changes. This will have a major impact on the artificial reef program.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

ACRES OF REEF MITIGATED FOR COASTAL CONSTRUCTION ACTIVITIES

Measurement: This measure tracks the acreage of artificial reef created for mitigation of direct physical impacts to reefs/hardbottom.

Explanation: Permitted or unpermitted human activities which cause direct physical impacts to reefs and/or hardbottom are often mitigated for by creation of artificial habitat. This mitigation may be *a priori* (for construction impacts) or compensatory (for unpermitted impacts). Structures deployed are usually limestone boulders or pre-fabricated concrete/limestone modules.

Trends: The construction of mitigative artificial reefs is episodic depending on incidents, such as vessel groundings, or the issuance of coastal construction permits for projects, such as dredging, natural gas pipeline construction, or fiberoptic cable installation. Ideally, construction of *a priori* mitigation takes place years before impacts to allow functioning of the mitigative structures. Compensatory mitigation may take place years after impacts.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

ANCHORAGE REGULATORY REVIEW

Narrative: The proximity of the Port Everglades associated commercial ship anchorages to shallow reefs has resulted in numerous ship groundings with subsequent resource damage.

Explanation: The offshore anchorages north of Port Everglades Inlet were originally established to prevent ships from anchoring on the reef.

The proximity to relatively shallow reef areas and the lack of enforcement by the United States Coast Guard has resulted in several groundings and numerous cases of anchoring outside the anchorage on reef, respectively.

Trends: A new anchorage configuration, eliminating the shallow anchorage, was implemented in 2008. It is anticipated that this will minimize groundings. Lack of enforcement of the new anchorage boundaries will continue to result in violations and ships anchoring on reefs.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

MARINE DEBRIS CLEAN-UP CAMPAIGNS, POUNDS OF LITTER COLLECTED/PARTICIPANTS/EVENT

Measurement: This measure tracks the pounds of debris and trash removed from the reefs and beaches during the Ocean Watch Foundation's annual Reef Sweep event. This measure indicates a level of effectiveness of Broward County's efforts in supporting community-based initiatives that promote good stewardship of our marine resources.

Explanation: Broward County, along with local businesses, sponsors this annual event. Civic organizations, school groups, and environmentally concerned citizens come together each year to help clean up our reefs and beaches. The goal of this community sponsored cleanup is to remind people that trash and debris are damaging to both our marine and coastal environment. Since its inception in 1989, the Ocean Watch Foundation's annual Reef Sweep has removed more than 33 tons of harmful marine debris, collected by over 9,000 volunteers, from the reefs offshore of Broward County. Each year this cleanup event includes removal of trash and debris from the ocean environment by scuba divers and from the shoreline by beach walkers. Ocean Watch Foundation Inc. is a non-profit, local volunteer organization involved in conservation and educational projects to help raise awareness and encourage thinking about ways to ensure the long-term protection of our reefs. Continued sponsorship for this event will educate the public about the damaging effect of marine debris on our coastal environment and help promote responsible waste management.

Trends: The amount of debris collected and the number of volunteers that participate in this event varies each year. Approximately 5000 pounds of trash and debris are removed from the coastal zone annually. Since 2004, the trend indicated that the amount of trash volunteers collect each year is decreasing. This is encouraging and hopefully indicates an increased public awareness and effort to keep our marine resources clean.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, David Stout, (954) 519-1452

NUMBER OF MOORING BUOYS

Measurement: Broward County has installed and maintains buoys along popular diving and fishing portions of our coral reef system. The goal is to maintain the buoys that are in place and add more in the future if the need exists and adequate funding is available. The count for the indicated year is as of September 30th.

Explanation: Coral reefs and their associated benthic communities are an important natural resource for recreation and the fishing and diving industries. We intend mooring buoys to reduce the impacts associated with anchoring of boats on the reefs. We have not done a quantitative analysis, but use of the mooring buoys currently in place seems high and presumably that use is eliminating some anchor damage. We would like to increase the number of mooring buoys in the more popular areas as we secure funds for installation and maintenance. A total of 122 buoy installations are available to boaters when visiting the reef. For information on the use and location of the buoy network, please go to <http://www.broward.org/bio/mooringbuoy.htm>.

Trends: In 2008, Broward County received a grant from the National Fish and Wildlife Foundation to install new mooring buoys, update the mooring buoy use guide, and help fund the buoy maintenance program for one year. As a result, 21 new mooring buoys were placed at Suzanne's Ledge, located offshore of Pompano Beach. However, at the same time 21 moorings were removed from the network; 12 from the nearshore mitigation reefs located in Hollywood and Hallandale and 9 from Anglin's Ledge. The decision to remove these buoys was made to control the

escalating maintenance costs at a time of budget cutbacks. Broward County will continue to monitor offshore resource use as well as mooring buoy use patterns by boaters to determine the best locations for the buoys.

Data source: County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, David Stout, (954) 519-1452

NUMBER OF TIRES REMOVED FROM THE REEF ZONE

Measurement: The number of tires removed from the reef zone in a given year.

Explanation: An artificial reef made of one to two million tires was built in the 1970s and early 1980s off the coast of Broward County. Instability of the tires during storms resulted in substantial damage to adjacent natural reefs. A small tire retrieval program (1600 tires) was conducted by a researcher at Nova Southeastern University in 2001 using a grant from the National Oceanic and Atmospheric Administration (NOAA). More recently, a joint project to remove these tires has been initiated among the US military, Florida Department of Environmental Protection and Broward County Environmental Protection and Growth Management Department. In the summer of 2006, 30 sample tires were retrieved to test various issues with removal, transportation and disposal. Military salvage divers worked for 3 weeks in June 2007 to develop the most effective means of retrieving these tires, removing over 10,000 tires. The removal project began in earnest in 2008 with the removal of approximately 45,000 tires.

Trends: A dense field of tires offshore Ft Lauderdale will be removed during the period 2008-2011. Production will depend on availability of military divers and weather constraints.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Ken Banks, PhD, (954) 519-1207

OUR MARINE RESOURCES - BEACH RESOURCES

Beach Quality

PERCENT OF BEACH WATER QUALITY RESULTS RATED "GOOD"

Measurement: This performance measure tracks the percentage of beach water quality measurements rated as satisfactory, based upon weekly enterococci and fecal coliform testing at fifteen public beaches in Broward County. The reporting period ends on June 30th of the indicated year.

Explanation: The Broward County Health Department, with the State Department of Health, initiated a program in 1998 to provide scientific information on the quality of coastal beach bathing waters to the public. The program involves monitoring of enterococci and fecal coliform bacteria levels at fifteen locations along Broward County's Atlantic coast. The density of enterococci and fecal coliform bacteria as indicator groups in seawater show a relationship to swimming-associated gastroenteritis. The annual goal is to maintain the beach water quality at or above 92% of water sampled in the satisfactory/good range. More information on the Florida Healthy Beach Program may be found at <http://esetappsdoh.doh.state.fl.us/irm00beachwater/>.

Trends: Over the past four years the percentage of satisfactory/good beach water samples is averaging 95.87% with a range from 93.2% to 98.2%. This year's result, 97.8%, is 1.93% above the four year average. This positive gain may be the result of a dry year with few major rainfall events.

Data source: State fiscal year data. Broward County Health Department and Florida Department of Health, Phong Nguyen, (954) 467-4846

Beach Quantity

AVERAGE BEACH WIDTH AT HIGH TIDE, FEET PERCENT OF NON-CRITICALLY-ERODED BEACHES

Measurement: This is a measure of the ability of Broward County's beaches to provide storm protection and recreational beach area. Critically-eroded beaches are those beaches where the width at high tide is deemed inadequate to provide storm wave damage protection and/or acceptable recreational opportunities. For the purposes of this survey, the threshold width which defines a critically-eroded beach is 75 feet. This definition is different from that used by the State of Florida in determining critically-eroded beaches. Florida Department of Environmental Protection survey monuments are used for beach measurements. These monuments are sometimes located in roads or yards, or on sidewalks or seawalls, but for comparison purposes "beach width" includes the distance from the monument to the water's edge. Distance measurements are derived from the most recent countywide beach surveys and/or aerial photomaps. Caution is advised when interpreting the data given the dynamic nature of the sandy beach. The percentage of non-critically eroded beach refers to the proportionate length of shoreline which meets the 75 foot minimum width criterion.

Explanation: Broward's beaches serve two critical functions: to provide storm wave protection for upland property, structures, and infrastructure, and to drive our recreational economic engine. Vital to the beaches' storm protective function is their width. Adequate beach width allows storm waves to break and dissipate energy harmlessly; however, in so protecting the upland, storm waves cause some net erosion of beach sand. Broward County's beaches protect almost \$4 billion in upland structures and property and generate more than \$600 million in annual spending in the County. Maintenance of beach width adequate to protect against a moderate frequency storm event is very important. Beach acreage is a useful measure because it indicates the amount of recreational space available to beach users. As a \$600 million to \$1 billion annual contributor to Broward County's economy, the beaches are a foundation of our tourist economy. Our beaches also provide critical nesting habitats for several threatened and endangered species of sea turtles and adequate acreage is necessary for this purpose. We measure beach width from the shorefront reference monument (established by the State of Florida) to the water's edge. Acreage is based on 24 miles of beachfront in Broward County. No survey was conducted in the year 2000. More information about the Broward County Beach Management Program may be found at <http://www.broward.org/bio/beaches.htm>.

Trends: The long-term trend in beach adequacy is typically downward over the years because of chronic beach erosion. Erosion is caused by shorefront development too close to the shoreline, thereby displacing the dunes, which are natural reservoirs of sand; stabilized inlets, which interrupt the alongshore flow of sand; and storms or high wave events, which can move large quantities of sand offshore and alongshore. Most beaches in Broward County are either stable or erosive. South of Port Everglades, the beaches are sand-starved due to the impoundment of sand by the north jetty of the Port. These beaches are restored periodically by infusions of sand dredged from offshore. Such a project was completed in spring of 2006. Approximately 2 million cubic yards of sand were placed onto the beaches of Hallandale Beach, Hollywood, Dania Beach, and John U. Lloyd Beach State Park. In addition, a series of erosion control structures were built at the north end of John U. Lloyd State Park to stabilize the sand at that very dynamic location. The beaches south of Hillsboro Inlet and north of Port Everglades are assisted by sand bypassing at Hillsboro Inlet and by the blockage of alongshore drift at Port Everglades, but beaches along the central portion of the segment are stable to mildly erosive and too narrow to provide optimum protection or recreational space. These beaches are scheduled for restoration in 2010. The beaches from the Broward/Palm Beach County line to Hillsboro Inlet likewise are stable throughout most of the City of Deerfield Beach to increasingly eroded in southern Deerfield Beach and northern and central Hillsboro Beach. The City of Deerfield Beach's shoreline benefits occasionally from sand bypassing at Boca Raton Inlet, and by sand drifting southward from beach restoration projects at south Boca Raton. Since the completion of the 2005-06 project in Hallandale Beach, Hollywood, Dania Beach and John U. Lloyd Beach State Park, those beaches have been narrowing through equilibration of the newly placed fill and due to background erosion rates.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265

PRESSURES ON BEACH RESOURCES

PRESENCE OF INLETS

Narrative: Stabilized inlets are a major cause of beach erosion, particularly in areas where sand supplies are not abundant, such as southeast Florida. The reason that stabilized inlets are erosion-makers is that sand moves along the beach in response to wave action, as well as moving onshore and offshore. In southeast Florida, the predominant direction of sand movement is north to south. Stabilized inlets, which by definition include jetties and dredged channels, interrupt the net southward movement of sand, causing a buildup on the updrift (north) side of the channel with erosion and recession on the downdrift (south) side of the channel.

Explanation: Stabilized inlets are estimated to cause 80% of the erosion in the State of Florida. In order to mitigate the erosion caused by inlets, several actions can be considered: Sand Bypassing (capturing sand that would build up on the updrift beach or be lost offshore and mechanically moving it to the downdrift beach); beach nourishment (obtaining compatible sand from remote sources and placement onto the downdrift beach); construction of erosion control structures along an eroding beach in order to reduce or eliminate erosion; or some combination of these methods.

Trends: Broward County has two stabilized inlets, Hillsboro Inlet and Port Everglades. At Hillsboro Inlet, sand bypassing has been ongoing since the 1950's, mainly to keep the channel clear of sand, but since the material is placed on the downdrift beaches at Pompano Beach, that shoreline benefits for several miles south. Since a beach nourishment project in 1983 restored the beaches of Pompano Beach and Lauderdale-By-The-Sea, the bypassing operation at Hillsboro Inlet has contributed to the reduction of erosion of those beaches. A renourishment of certain areas of Pompano Beach, Lauderdale-By-The Sea, and Fort Lauderdale is planned for 2010. No sand bypassing operation currently exists at Port Everglades, so the primary mitigative measure to offset the erosion downdrift has been by nourishment of the beaches to the south. A 1.9 million cubic yard beach nourishment project along John U. Lloyd Beach State Park, Dania Beach, Hollywood, and Hallandale Beach was completed in spring of 2006. The County is currently in the engineering/design and permitting stages of constructing a sand bypassing operation at Port Everglades. Construction is scheduled for 2009.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265

DAYS OF SMALL CRAFT ADVISORIES

Measurement: A small craft advisory is a type of warning issued by the National Weather Service, most frequently in coastal areas. It is issued when winds have reached, or are expected to reach within 12 hours, a speed marginally less than that which is considered gale force. Exact parameters for what wind speed triggers the advisory have been changed over time. Until the late 1960s, a range of 32 to 38 miles per hour (or 28 to 33 knots) was observed; then the lower limit was reduced to 23 miles per hour (20 knots). Today, however, it is more common in most places to use 23 miles per hour (20 knots) as the standard, thus falling within the range of force 6 on the Beaufort scale. Monthly wind records were reviewed for Fort Lauderdale-Hollywood International Airport. Days which experienced wind velocities of 23 mph or more were considered to be days when Small Craft Advisories were issued by the National Weather Service.

Explanation: High waves are a major cause of sand movement along beaches. The sand moves alongshore in the direction of wave travel, moves offshore, and to a lesser extent, onshore during high wave events. This movement of sand generally results in loss of beach sand, both alongshore and offshore. Small craft advisories are a measure of high wave events, however, since regular records of these advisories could not be found, the metric of wind speed of 23 mph or greater was chosen.

Trends: Recent (2006, 2007, and 2008) data appear to point to an increase in the number of days when a small craft advisory is issued. This trend implies a general increase in the frequency of windy (greater than 23 mph) days, and consequent high waves and increased beach erosion.

Data source: Calendar year data. National Weather Service (<http://www.nws.noaa.gov/climate/>), Broward County Environmental Protection and

NUMBER OF VISITORS TO BROWARD COUNTY, MILLIONS

Measurement: The total number of visitors to Broward County in the calendar year including foreign and domestic tourists. Visitor estimates are determined by creating a statistical model from a number of different sources. Information comes from Tourism Industries, Visit Florida, Smith Travel Research, DK Shifflet & Associates, Ft. Lauderdale/Hollywood Intl Airport, and Port Everglades which is reviewed and analyzed to determine the estimates for the top International Origin Markets and Top Domestic Origin Markets.

Explanation: While tourism is critical to Broward County's economy, tourist put pressure on the local environmental resources. In addition to the citizens of Broward County, the visitors take cruises, use the beaches, dive on the reefs, and fish in the local waters. Florida remains a popular tourist destination. On December 21, 2003, Port Everglades set a world record by hosting nearly 45,000 passengers. More statistics on Broward tourism may be found at <http://www.sunny.org/> by clicking "partners" on the bottom of the page and looking under market research.

Trends: An upward trend in year-round visitors continued in 2004 with 9.4 million annual visitors to Broward County with an impact of more than \$7.9 billion to Broward's economy. In 2005, more than 10 million visitors came attracted by more than 600 hotels, sun, surf, sand and inland waterways, blockbuster exhibitions such as King Tut at the Museum of Art Fort Lauderdale. In 2007, the number of visitors rose to 10.65 million. 76% of the increase from the previous year was domestic visitors.

Data source: Calendar year data. Greater Fort Lauderdale Convention and Visitors Bureau, (954) 765-4466

OVERDEVELOPMENT

Narrative: Overdevelopment too close to the beach along an ocean coast, especially coasts prone to hurricanes and winter northeast storms, can place lives and property at risk. Local governments, which are primarily tasked with adopting and enforcing building code and zoning ordinances, are learning to control the density of development and redevelopment, despite the strong attractions of increased tax base and tourism revenues. It is slowly being recognized that placing lives, natural resources, and high investment values at risk puts a growing burden on the taxpaying public through higher insurance rates, lower quality of life, and rising property taxes. Controlling development and redevelopment in beachfront and coastal areas leads to sustainable economies and environmental resources.

Explanation: Structures located too close to the active sandy beach often replace the beach itself. In many cases, the structures are built on and replace the dunes which would otherwise provide a reservoir of sand during erosion events. Beach-adjacent structures also preclude or force seaward the vegetation which stabilizes the beach and dunes, and which help dunes grow. Finally, new or newly redeveloped structures directly adjacent to the beach are frequently high-density, and lead to increased population of the beach. This in turn can result in increased trash on the beach and further degrade vegetation and dunes. Conversely, structures in close proximity to the beach may be vulnerable to damage from storm waves and surges. Much of the rationale for maintaining a wide healthy beach is to buffer the upland structures and infrastructure from waves and storm surge. Beaches being dynamic, however, even a wide beach can erode and place structures in jeopardy if they are located too close to the active sandy beach.

Trends: While redevelopment of Broward County's shorefront continues to maintain and increase density along the coast in most municipalities, strict enforcement of the State of Florida's Coastal Construction Control Line building standards has resulted in structures that are more resilient and less prone to damage from a given frequency storm.

Data source: Annual aerial photography by the Broward County Property Appraisers Office. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265

TRASH ON THE BEACH

Narrative: Trash is deposited on Broward County beaches by careless people, wind transportation from upland sources, and ocean-going vessels. Weekends and holidays are exceptionally troublesome, as canisters and dumpsters are often overwhelmed by the overabundance of beachgoers.

Local municipalities maintain their beaches through motorized beach rakers, numerous trash canisters, and strategically placed dumpsters. Successful as these efforts may be, sizable amount of trash remain that is not disposed of properly. Natural areas are often the final resting place for trash, as it becomes lodged in vegetation. Trash cleanup events such as the Ocean Conservancy's International Coastal Cleanup, sponsored and coordinated locally by Broward County, assist in gathering the remaining trash and specifically target areas where trash collection is infrequent. Cleanup events also serve as superb public awareness campaigns whereby residents are educated on the problems trash causes to the environment.

Explanation: Trash deposited on the beach, by any means, may impact marine resources. Examples include monofilament fishing line, rope, and six-pack rings that may entangle birds, sea turtles, and other organisms. Plastic bags and other materials are also often ingested by marine organisms that mistake them for natural food sources.

Trends: Data are not available on the amount of trash regularly deposited or collected from our beaches by Broward County or local municipalities, however, the International Coastal Cleanup trash/volunteer statistics can serve as a metric for the amount of trash on Broward beaches at a specific point (3rd Saturday in September) during each year. Ocean conditions prior to the event can also have a great influence. Rough wave conditions in 2004 may have delivered more debris to the beach. Weight of debris collected in 2004 was increased due to collection of fishing lead around Anglin's Pier in Lauderdale-by-the-Sea. During the 2005 Coastal Clean-up event, 4575 lbs. of trash was collected by 2506 volunteers. The 2006 Coastal Cleanup suffered from a lack of promotional materials normally supplied by Ocean Conservancy resulting in a diminished turnout of 1091 volunteers. However, these volunteers collected 4021 lbs. of trash without the addition of an underwater site. This amount was nearly equivalent to 2005, yielding a much higher trash/volunteer ratio. The Cleanup in 2007 took place at 13 sites along the coast and resulted in 4503 lbs. of trash being removed by 1420 volunteers. Additional information can be found on the Ocean Conservancy's International Coastal Cleanup web page at http://www.oceanconservancy.org/site/PageServer?pagename=press_icc.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn (954) 519-1218

RESPONSES TO PRESSURES ON BEACH RESOURCES

SAND BYPASS

Narrative: Sand bypassing is conducted to reduce erosion of beaches that are impacted by stabilized inlets. Sand bypassing is the act of capturing sand which would otherwise accumulate on the updrift side of a stabilized inlet or be lost into the channel and mechanically move the sand to the downdrift beach.

Explanation: Sand bypassing is one of a suite of erosion-management strategies to employ in areas of high beach erosion. Sand generally moves alongshore in response to wave action, in the case of southeast Florida, from north to south. There is an active sand bypassing operation ongoing at Hillsboro Inlet, which generally moves over 100,000 cubic yards of sand from the inlet channel and deposition basin to the beach at the City of Pompano Beach. There is no such operation at Port Everglades, where an annual average of approximately 40,000 to 60,000 cubic yards of sand per year is deposited on the beaches of Fort Lauderdale and into the port channel. Broward County is currently in the engineering, design, and permitting stages of construction of a sand bypassing operation at Port Everglades. The operation will consist of excavation of a sand deposition basin at the north jetty of Port Everglades entrance channel, removal of the shoreward portion of the spoil shoal north of the channel, and ancillary structures to protect infrastructure. Sand bypassing at Port Everglades is expected to move an annual average of 40,000 to 60,000 cubic yards per year to the beaches of John U. Lloyd Beach State Park, where the material could resume its southward journey and ultimately benefit the beaches of Dania Beach, Hollywood, and Hallandale Beach.

Trends: The quantity of material bypassed at Hillsboro Inlet increased following the Hillsboro Inlet's purchase of a larger dredge in 1984. In

2002, the channel at Hillsboro Inlet was deepened and widened to increase boater safety. One outcome of the project was a change in the bypassing frequency. We anticipate that over a period of years, annual average quantities of material bypassed will not change appreciably.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265

BEACH NOURISHMENT

Narrative: Beach nourishment is defined as the acquisition of remotely located sand and its placement upon an eroding or eroded beach. The sand, which is required to be similar in grain size, composition, and color to the recipient beach, is usually dredged from offshore locations and transported or pumped to the beach. Beach nourishment is generally intended to restore a beach to its historical configuration of width and slope. Beach nourishment is performed to provide increased storm damage prevention to upland structures and infrastructure, to provide increased recreational opportunities for residents and visitors, and to restore diminishing sea turtle nesting habitat. Endangered and threatened marine turtles require adequate beach width to allow for adult female emergence, nest site selection, successful egg chamber excavation and burial, and successful sea-finding behavior by emerging hatchlings. Areas of beach that have become critically eroded will result in a measurable increase of the number of unsuccessful emergences of nesting females (false crawls) and an overall reduction in the number of nests deposited. Nourishment of these critically eroded beaches replaces nesting habitat with sand that is of similar quality (grain size, percent carbonate, etc.) as the native sand that eroded away.

Explanation: In Broward County, ten beach nourishment projects have been performed since 1970, totaling almost 11 million cubic yards placed. In each case, sand was obtained from offshore of the County and pumped ashore through pipelines. The material was then spread and graded on the beach. The most recent project placed in 2005 and 2006 about 2 million cubic yards of sand obtained from offshore of the northern and central county onto the beaches of John U. Lloyd Beach State Park, Dania Beach, Hollywood, and Hallandale Beach. Those beaches were widened between 50 and 200 feet by the project. Monitoring of the project beaches continues. In addition, the municipalities of Deerfield Beach, Hillsboro Beach, and Fort Lauderdale have recently conducted small-scale truck-haul beach nourishment projects to address local "hot spot" erosion areas. These recent nourishments are a good illustration of marine turtle nesting habitat replacement. For example, the Hallandale Beach-Hollywood-Dania Beach-John U. Lloyd Park beaches were constructed during the 2005 sea turtle nesting season between May, 2005 and February 2006. In 2004 on Hollywood Beach, there were 71 nests and 191 false crawls surveyed on that beach. During the 2005 marine turtle season (ongoing construction of the beach) there were 107 nests and 154 false crawls surveyed. The increase in nests and decrease in false crawls is attributed, in part, to augmentation of available nesting habitat. The 2006 nesting season resulted in 97 nests and 184 false crawls. This decrease in nests and increase in false crawls as compared to the previous year may be cyclical or may be due to equilibration and scarping of the newly placed beach fill. In 2007, 103 nests were laid and 149 false crawls were noted.

Trends: Economically accessible sources of sand are now scarce offshore of Broward County. Future beach erosion control efforts will need to consider more remote sources of sand, which will increase costs. In addition, alternative means of reducing erosion are being considered, such as the use of erosion control structures and sand bypassing. Traditional beach nourishment will become less frequent in Broward County, replaced by smaller, more frequent placements of "sands of opportunity." It is clear that successful beach nourishment not only provides beach area for storm damage reduction and recreational purposes, but the increase in beach area also provides more sea turtle nesting habitat.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265 and Louis Fisher, (954) 519-1255

MONITORING THE CONDITION OF THE BEACH

Narrative: Monitoring the condition of the beach is essential to acquire an understanding of how the beach behaves over the long term. Some beaches appear to be eroding or accreting, but longer-term monitoring will show that these are not trends, but merely normal seasonal fluctuations in beach width, elevation, and slope. Monitoring consists of measuring the extent and elevation of the sand, both onshore and

offshore, with land and hydrographic surveying techniques. Comparing periodic surveys can illustrate the long-term prognosis for a stretch of beach.

Explanation: Broward County conducts annual monitoring of its 24 miles of beaches. The monitoring consists of both aerial photography and actual surveying. The aerial photography is obtained digitally and is ortho-rectified in order to allow accurate scaling. The upland portion of the beach is measured using high-order Global Positioning System coordinates from the reference monument out to wading depth, taking position and elevation readings at intervals and at grade breaks. For the submerged portions of the beach, a hydrographic survey vessel takes position and soundings along the survey line bearing from close to the shoreline (with overlap of the upland beach survey line) generally out to 30 feet of depth. The surveys are run along pre-established lines associated with Florida Department of Environmental Protection range monuments, located approximately every 1000 feet along the shore. For 2008, the County has updated the 2001 Laser Airborne Depth Survey (LADS) of the beach and seafloor out to 150 feet of depth, yielding highly accurate bathymetric data.

Trends: Monitoring surveys will continue to be performed on an annual basis or more often if circumstances warrant.

Data source: Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265

REGULATORY COMMENT ON BEACH RESOURCES

Narrative: Florida's Department of Environmental Protection (FDEP) administers the statewide Coastal Construction Control Line Program (CCCL). This regulatory program provides protection for Florida's beaches and dunes and their associated wildlife, while assuring reasonable use of private property. The State's Coastal Construction Control Line Program promulgates rules and issues permits for projects, activities, and events proposed to be located seaward of the Coastal Construction Control Line. Such projects, activities, or events, if conducted improperly, can damage or destabilize the beach/dune system. Once destabilized, these valuable natural resources are vulnerable to being lost along with their important values for recreation, upland property protection, and environmental habitat. Broward County has no equivalent regulatory authority.

Explanation: County staff serve as the local "eyes and ears" of the FDEP's CCCL program, referring prospective permittees to the proper contact points and providing information to potential developers of beachfront property regarding the state's CCCL permitting requirements. Part of the CCCL permitting review by the state includes review of the application by the Imperiled Species Section of the Florida Fish and Wildlife Conservation Commission for impacts to sea turtles and certain shorebirds. Applicants are required to avoid impacts to these animals. County staff sometimes serves as liaison between the state and the applicant in the County's role as state-permitted sea turtle conservation program administrators.

Trends: As potential developers of beachfront property become familiar with the state's requirements, partially due to the County's efforts, instances of unallowable impacts to beach wildlife become less frequent.

Data source: FDEP, Bureau of Beaches and Coastal Systems (<http://www.dep.state.fl.us/beaches/>), Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Stephen Higgins, (954) 519-1265 and Louis Fisher, (954) 519-1255

BEACH CLEANUP CAMPAIGNS, POUNDS OF LITTER COLLECTED/PARTICIPANTS/EVENT

Measurement: The pounds/participant/event is a measure of the quantity of litter collected per person during annual coastal cleanup campaigns. The Ocean Conservancy (formerly the Center for Marine Conservation), a nonprofit organization committed to protecting ocean environments, sponsors the International Coastal Cleanup annually on the third Saturday of September. There are twelve beach cleanup locations along the 24 miles of Broward County shoreline. The information gathered provides a snapshot in time of the types of debris being found on beaches and waterways around the world. The Ocean Conservancy then tailors their education campaigns to address reducing the most abundant types of litter found in each region.

Explanation: This is a measure of the effectiveness and public involvement in litter cleanup campaigns within the County. In the past, an approaching tropical storm did impede the efforts of volunteers participating in the event. For this reason, the results were calculated to reflect an average number of pounds of debris per person combining the total of beach walkers and divers. In 2004, the Coastal Cleanup included one underwater site located at the base of a fishing pier. This site significantly increased the annual pounds collected per event per volunteer due to the removal of lead weights found near the pier.

Trends: Total weight of debris collected can vary significantly during different years for various reasons. Ocean conditions prior to the event can also have a great influence with rough wave conditions delivering more debris to the beach. Weight of debris collected in 2004 was increased due to collection of fishing lead around Anglin's Pier in Lauderdale-by-the-Sea. During the 2005 Coastal Clean-up event, 4575 pounds of trash was collected by 2506 volunteers. The 2006 Coastal Cleanup suffered from a lack of advertising material normally supplied by Ocean Conservancy resulting in a diminished turnout of 1091 volunteers. However, these volunteers collected 4021 lbs. of trash without the addition of an underwater site. This amount was nearly equivalent to 2005, yielding a much higher trash/volunteer ratio. The 2007 Coastal Cleanup had more wide-spread advertising than the previous year and targeted high school environmental groups along with Girl Scouts and Boy Scouts. A total of 4503 lbs. of debris were collected by 1420 volunteers at 13 sites, including Dania Beach which had not been a site in the previous two years.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, (954) 519-1218

OUR MARINE RESOURCES - MARINE WILDLIFE - SEA TURTLES

NUMBER OF SEA TURTLE NESTS

Measurement: Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March 1 through October 31. We record the number of nests deposited and the Global Positioning System location of each. Those nests found at sites not amenable to successful hatchling entry into the surf are relocated to adjacent sections of beach where the ordinances designed to provide light management and thereby darker beaches are in effect. Open-beach hatcheries and chain-link hatcheries are no longer allowed by permit and are not in use.

Explanation: The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to Environmental Protection and Growth Management Department for beach renourishment projects. The goal of the program is to reduce the number of sea turtle nests that require relocation and maximize the survivability of nests left on the beach. We conduct the Conservation Program during non-renourishment years to allow for continuity of collection and analysis of data. We expect that the number of sea turtle nests requiring relocation in the year 2008 will continue to decrease due to the enactment of sea turtle lighting ordinances in the Cities of Pompano Beach, Deerfield Beach, Lauderdale-By-The-Sea, Fort Lauderdale, Hallandale Beach, and Hillsboro Beach. These ordinances require shading or suspension of beach lighting from sunset to sunrise during the nesting and hatching season. Compliance will allow additional nests to be left *in-situ*.

Trends: The overall number of nests has decreased again from 1902 nests in 2006 to 1867 nests in 2007. The percent of nests left in-situ increased significantly from 2006 to 2007 (63.1 % to 71.1%).

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

PERCENT OF SEA TURTLE NESTING SUCCESS

Measurement: Events where female marine turtles emerge and attempt to nest and subsequently return to the ocean without nesting are considered "false crawls". The ratio of successful nesting attempts to total number of crawls (successful nests plus false crawls) is used to calculate "nesting success percent".

Explanation: Increases or decreases of the nesting success percent from year to year may be used as an indicator of the level of disturbance to nesting females on a particular stretch of beach. The average nesting success in the following survey regions was calculated for the period 2000 to 2005. In Fort Lauderdale, the average is 49.1%. In Pompano Beach and Lauderdale-by-the-Sea, the average is 44.2%. In Hollywood and Hallandale Beach, the average is 47.8%, while in Hillsboro and Deerfield Beaches the average is 39.9%.

Trends: As long as the nesting habitat remains suitable in terms of an appropriate amount of nesting beach, we can expect that the nesting success percent will remain between 45-55%, on average. If the habitat is reduced (the beach erodes) then the number of false crawls will increase and the nesting success percent will decrease. Overall, the nesting success average percent decreased from 48.4% in 2006 to 46.4% in 2007.

Data source: Calendar year data. Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

PRESSURES ON MARINE WILDLIFE - SEA TURTLES

BEACHES WITHOUT TURTLE-FRIENDLY LIGHTING

Narrative: Although six of the eight coastal municipalities in Broward County have passed marine turtle-friendly lighting ordinances, most of the beach within those cities (Deerfield Beach, Pompano Beach, Lauderdale-By-The-Sea, Fort Lauderdale, Hallandale, and Hillsboro) has not yet complied enough to allow successful, ocean-orientated emergence of hatchlings turtles. Progress towards darkening the beaches in most of the County continues, however, much of the County remains without turtle-friendly lighting conditions as of the nesting and hatching season in 2007. Complete compliance with local lighting ordinances will contribute to a possible reduction in the disorientation of adult nesting female turtles. A measure of this would be revealed if the nesting success percent were to increase beyond the average range of 45-55%.

Explanation: Active enforcement of lighting ordinances continues throughout the cities that have enacted such legislation, however, even with that enforcement few areas of beach have enough light reduction to be considered "turtle friendly".

Trends: Although the lighting on the beaches in Broward County is not yet at a point when relocation of the nests can be eliminated as a conservation tool, additional enforcement of the lighting ordinances in all the coastal municipalities will contribute to a significant increase in natural incubation of the nests on our beaches.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

NUMBER OF SEA TURTLE NESTS DESTROYED BY PREDATORS

Measurement: Each nest surveyed in Broward County is numbered and tracked until the nest hatches approximately 45-55 days after deposition. If the nest or nest site is disturbed during that time by known or unidentified predators that observation is noted in the data record. If the disturbance is the result of a nest being disturbed by or poached by people then the Florida Fish and Wildlife Conservation Commission Law Enforcement Division is notified of the event.

Explanation: Eggs and hatchlings of marine turtle nests are preyed upon by several species of predators here on south Florida's beaches.

Predator prevention measures that are employed to reduce the number of nests taken by raccoons (*Procyon lotor*) include placing mesh cages and screens over the area of the egg chamber. This is a successful preventative measure except in efforts to protect eggs in relocated nests. Using olfactory cues, raccoons will find the egg chambers of every relocated nest they encounter. This was particularly true on the beach at John U Lloyd State Park in 2005 where raccoons have overpopulated the beach and dune area. A possible solution in the future to the raccoon overpopulation problem at the state park will be to trap and remove the entire raccoon population from the park through a cooperative effort between Broward County, the Florida Park Service and the US Dept of Agriculture Wildlife Services. Additional predators contributing to the take of hatchling marine turtles and eggs includes night herons (*Nycticorax nycticorax*), ghost crabs (*Ocypode quadrata*), foxes (*Vulpes vulpes*), feral dogs and cats, fire ants, and people.

Trends: The average number of nests taken by predators in Broward County is 218 each season. The 2007 season revealed a significant reduction in the number of nests taken by predators to 175.

Data source: Calendar year data. 2005 Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

OBSTRUCTED NESTING ATTEMPTS

Narrative: This will consist of a measure of any outside interference or obstruction that might be encountered by a female turtle attempting to deposit a nest. A standard marine turtle disorientation report form is used to report conditions observed by field personnel. It is noted on the form whether the female successfully nested or returned to the water without nesting.

Explanation: Crawl marks left by the nesting female can show the exact location she emerged from the water, where she crawled along the beach and whether she encountered any potential obstruction while making that crawl or attempted to nest. Sea walls, beach cabanas, trash cans, small sailing vessels, and artificial lights are some of the potential obstructions to successful nesting. At the end of the year an analysis of obstructed nesting attempts by city and type of obstruction will be conducted.

Trends: This is being measured and recorded and reported to the state Fish and Wildlife Conservation Commission for the first time during the 2008 nesting season.

Data source: Calendar year data. Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

NUMBER OF SEA TURTLE HATCHLING DISORIENTATION EVENTS

Measurement: When hatchling turtles first emerge from their nest egg chambers they are attracted, by visual cues, to the first brightest horizon that they sense. Hatchling sea-finding disruption is an important conservation problem throughout Broward County and anywhere that artificial light interferes with that sea-finding instinct. The 2005 survey resulted in 134 hatchling disorientation reports being filed while the 2004 survey produced 161 filed reports. The permit conditions under which the program was operated during the 2006 season prohibited the use of chain-link hatchery enclosures or open-beach hatcheries. Consequently, many more nests were left in natural egg chambers than were relocated to "darker, safer" beaches. This change in conservation strategy and implementation resulted in 385 disorientation events report during 2006 and 356 hatchling disorientation events during the 2007 season.

Explanation: The Sea Turtle Conservation Program (prior to 2006) was designed to minimize the conditions which produce hatchling disorientation events. This is accomplished by moving nests from areas that are too brightly lit for hatchling emergence (but were not so brightly lit that the site prevented nesting) to darker beach areas (open-beach hatcheries) or to enclosed hatcheries (limited use).

Trends: The trend will be for a significant increase in the number of disorientation events reported in the future because State and Federal agencies (Florida Fish and Wildlife Conservation Commission and United States Fish and Wildlife Service) that issue marine turtle activity permits for the 2006 nesting and hatching season are requiring a substantial reduction in the number of nests relocated because of lighting issues. This trend in increased numbers of hatchling disorientations will likely continue until compliance significantly increases with lighting

ordinances in the coastal areas.

Data source: Calendar year data. Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

NUMBER OF JUVENILE AND ADULT SEA TURTLES FOUND INJURED OR DEAD

Measurement: Dead or injured marine turtles, either juvenile or adult, mostly wash up on the beaches here in Broward County. The conservation program operators are charged with responding to each of these events. If the animal is found alive, it is measured, photographed, and transported to a rescue or rehab facility within reasonable driving distance (Miami Seaquarium or the Gumbo Limbo Nature Center in Boca Raton) and all reasonable and humane efforts are used to save the turtle. If the turtle is found dead, then the respondent takes appropriate measurements, records the location of the stranding using Global Positioning Systems (GPS), the possible cause of death if apparent, and whether the turtle is tagged. The discovery of fresh dead green or leatherback turtles is immediately reported to Florida Fish and Wildlife Conservation Commission (FFWCC) and arrangements for deep freeze storage of the turtle are made until it can be transported to the state facilities where a complete necropsy will be conducted. All stranding information in Broward County is submitted to the Florida Sea Turtle Stranding and Salvage Network (FSTSSN).

Explanation: The Endangered Species Act requires that an official recovery plan for each threatened and endangered marine turtle species be published and updated on a regular basis. These recovery plans include tracking the fate of dead or injured specimens and determining possible preventative action to reduce the number of stranded marine turtles throughout their range. Here in Broward County, the primary cause of dead or injured adult and juvenile marine turtles is collisions with boat hulls and propellers.

Trends: The average number of stranded juvenile and adult marine turtles over the previous five years in Broward County is 48 per calendar year. The number of strandings in 2007 was 49.

Data source: Calendar year data. 2006 Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

RESPONSES TO PRESSURES ON MARINE WILDLIFE - SEA TURTLES

PERCENT OF SEA TURTLE NESTS RELOCATED / PERCENT OF SURVEYED NESTS LEFT IN PLACE

Measurement: Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March 1 through October 31. We record the number of nests deposited and the location of each. In 2005, nests that meet the criteria of being threatened due to artificial lighting were moved to enclosed hatcheries or to open-beach hatcheries.

Explanation: The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to Environmental Protection and Growth Management Department for beach renourishment projects. The goal of the program is to reduce the number of sea turtle nests that required relocation and maximize the survivability of nests left on the beach. We conduct the Conservation Program during non-renourishment years to allow for continuity of data collection and analysis.

Trends: The recorded number of hatchlings released each year is calculated only from nests that are relocated to an enclosed chain-link hatchery at Hollywood Beach, Fort Lauderdale Beach, or Pompano Beach. Hatchlings that emerge from nests relocated to open-beach hatcheries are not counted as "released" because they are allowed to emerge and reach the surf on their own. The goal is to continue to reduce the need for restraining hatcheries and eventually eliminate their use altogether concurrent with reducing the number of nests relocated to open-beach hatcheries. During 2006, no restraining hatcheries were utilized by the program.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning

and Management Division, Louis Fisher, (954) 519-1255

LINEAR FEET OF BEACH WITH DIMMED LIGHTING

Measurement: Six of the coastal municipalities in Broward County have sea turtle lighting ordinances effective from March 1 through October 31 each year. Some of the beach areas in these cities are dark enough at night to allow the successful hatch and orientation of hatchling turtles toward the ocean. These areas of beach are listed in the marine turtle permit issued to Broward County as green zone recipient areas where nests can be left in their natural egg chambers without further manipulation. Adjacent to these areas are beach segments referred to as red zones in the permit. These are beach areas where nests have a very likely chance of disorienting due to excessive artificial light or they are beaches in cities that have not yet enacted a lighting ordinance.

Explanation: Red zone beaches are beaches where sea turtle nests may be relocated from and green zone beaches are areas where nests may be left in place and to where red zone nests may be relocated.

Trends: In 2005, less than 25,000 linear feet of beach were turtle-friendly, dark beach. In 2006 and 2007, the amount of linear beach with sea turtle-friendly lighting conditions increased to roughly 54,000 ft. With continued expansion of lighting ordinance enforcement within those six cities, this number is expected to continue to increase in future years.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

OUR MARINE RESOURCES - MARINE WILDLIFE - MANATEES

FLORIDA WEST INDIAN MANATEE POPULATION

Measurement: Manatees are counted statewide to determine manatee distribution, abundance and use of habitat. In Broward County, two types of surveys are conducted, aerial surveys and power plant surveys. The Environmental Protection and Growth Management Department participates in a statewide interagency team conducting winter aerial surveys during the months of December through March. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute coordinates these surveys. A second type of survey is conducted in Broward County by researchers from Eckerd College. The winter aerial surveys are conducted following the passage of cold fronts when weather is clear and wind is minimal. Under such conditions manatees, which have congregated around the power plant discharge, are commonly observed resting at the surface of the water in an effort to be warmed up by the sun. Favorable weather conditions affect the accuracy of these synoptic counts. This suggests aerial surveys, being used as a research tool to determine population, need to be improved. In some years, multiple surveys are conducted. The highest counts for a given year are shown here.

Explanation: The manatee is an endangered species whose existence is threatened by several human activities. The goal of the state and federal government is to increase the manatee population to a point where the U.S. Fish and Wildlife Service "Multi-Species Recovery Plan for South Florida" reclassifies them as "threatened" and eventually removes them from the endangered species list. The annual statewide count is important in identifying population trends. The Florida Fish and Wildlife Conservation Commission (FWC) did not conduct the annual statewide manatee synoptic survey in the winter of 2008, due to much warmer than average weather.

Trends: Aerial surveys are not an accurate representation of the Florida West Indian manatee population. Statewide numbers obtained through aerial surveys reflect the transient nature of manatees. The aerial survey is impaired by water clarity and weather conditions which may facilitate or obstruct surveys success. These counts vary by hundreds between surveys but may be used to demonstrate large scale trends in the population. The 2007 count is 9% lower than the previous year. Due to warmer than average weather, the annual statewide manatee synoptic

survey was not conducted in 2008.

Data source: Calendar year data. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute, Information and Education Office (727) 896-8626 and on the web at <http://www.floridamarine.org/> under manatees, population monitoring and aerial surveys, synoptic surveys

PRESSURES ON MARINE WILDLIFE - MANATEES

NUMBER OF VESSELS REGISTERED IN BROWARD COUNTY

Measurement: This information was obtained for the Florida Department of Highway Safety and Motor Vehicles (HSMV) annual revenue report which is posted annually on the web at http://www.flhsmv.gov/html/revpub/revpub_july07_june2008.pdf. The DMV provides total number of registered vessels including dealer registrations, pleasure craft and commercial vessels. This information is tracked on the State's fiscal year (e.g. July 1, 2006 through June 30, 2007).

Explanation: The number of registered vessels in the County provides an indirect measure of the fishing and diving pressures on the County's marine resources.

Trends: In 2006, the total number of registered vessels increased slightly. This was mainly due to a 9.3% increase in the number of pleasure vessel registrations. In 2007, dealer vessels increased by 2.5% but pleasure and commercial vessels decreased in number. In 2008, the number of registered vessels fell in all categories. This may have been due to the economic downturn in the area.

Data source: State fiscal year data. Florida Department of Highway Safety and Motor Vehicles (850) 922-9000

MANATEE MORTALITY IN BROWARD COUNTY

Measurement: West Indian manatee mortality statewide is monitored by the Florida Fish and Wildlife Conservation Commission's Marine Research Institute. The number of manatees is compiled across the state annually.

Explanation: The manatee is an endangered species whose existence is threatened by several human-related activities including boat and ship impacts, water control structures, habitat reduction, and water pollution. This summary database of individual manatee mortality allows users to search for information by county, cause of death, and date. Manatee deaths are broken down into eight categories based on gross, histological, and microbiological findings.

Descriptions of Manatee Death Categories:

- **Watercraft:** Manatees hit by boats, barges or any type of watercraft. Death may result from propeller wounds, impact, crushing, or any combination of the three.
- **Crushed/Drowned in Flood Gate or Canal Lock:** Manatees killed by crushing or asphyxiation in flood gates and canal locks.
- **Other Human-Related:** Manatee deaths caused by vandalism, poaching, entrapment in pipes and culverts, complications due to entanglement in ropes, lines, and nets, or ingestion of fishing gear or debris.
- **Perinatal:** Manatee less than 150 cm (5 ft.) in total length which were not determined to have died due to human-related causes.
- **Cold Stress:** Manatees which die as a result of exposure to prolonged cold weather. Animals are usually emaciated and in a general state of malnutrition.
- **Other Natural:** Manatee deaths resulting from infectious and non-infectious diseases, birth complications, natural accidents, and natural catastrophes (such as red tide poisoning).
- **Undetermined:** Manatee deaths in which the cause of death could not be determined.

Trends: Reduction of deaths from 2003 to 2004 was due to fewer watercraft related mortalities. In 2005, seven manatees died in Broward

County. Probable cause of four of those deaths was unknown. In 2006, twelve manatees died in this County, with watercraft related deaths doubling from the previous year from two to four. The total deaths in 2006 were the highest since 1999 when 15 manatees died here. In 2007, 4 manatees died, the lowest number since 2000. Only one of the mortalities was attributed to watercraft.

Data source: Calendar year data. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute, Information and Education Office (727) 896-8626 and on the web at <http://www.floridamarine.org/> under manatees

NUMBER OF BOAT SLIPS IN BROWARD COUNTY

Measurement: The number of boat slips in Broward County was determined through aerial surveys, site inspections, and historical use records. In the Boat Facility Siting Plan (BFSP) element of the Broward County Manatee Protection Plan (MPP), a slip is defined as *a space designed for the mooring or storage of a single watercraft, which includes wet or dry slips, anchorage, beached or blocked, hoist, seawall, floating platforms, davits, boat lifts, or the number of parking spaces for boat ramps. Piers, authorized only for fishing or observation, are not considered wet slips.*

The BFSP addresses public or private structures or operations where boats are moored and/or launched, including commercial, recreational, private, governmental, residential marinas, and boat ramps. While considered in the cumulative impact analysis for the BFSP, single-family slips are not regulated by this Plan. The only feasible means to enumerate single-family slips was by summing the number of parcels zoned for single-family use. Each single-family parcel adjacent to a navigable waterway is allotted one boat slip per 100 ft. of shoreline. Therefore, the number of single-family slips should remain relatively constant unless parcels are re-zoned for higher resident density. Docks utilized for transitory purposes were also counted as part of the existing slip count. Transitory uses include restaurants, shopping, fuel service, transportation services, parks and tourism.

Explanation: Boat slips represent a direct and indirect pressure on Broward County marine resources. Directly, slips impact the shoreline and benthic resources, such as mangrove and seagrass habitat. Slips are also associated with various pollutants including chemicals, fuel, lubricants, and municipal waste that may wind up in County waterways and adversely impact living resources. Indirectly, slips equate to boats, which may impact and kill manatees. The number and siting of boat slips is important to ensuring the sustainability of the federally endangered Florida population of the West Indian Manatee.

BFSP Zone	Existing slips	Proposed slip Increase
North	5,597	1,353
Center	6,381	619
South	10,242	1,033
Port Everglades	2	0
South Fork New River	4,653	471
Dania Cutoff Canal/C-10	3,415	806
Dania Cutoff Canal West	449	110
Total slips	30,739	4,392

Trends: Broward County had been under a marine facility permitting moratorium from 2004. However, with the Florida Fish and Wildlife Conservation Commission's approval in 2007 of Broward's BFSP component included in the Manatee Protection Plan (MPP), marine development of commercial and private facilities are again being permitted. The table below shows the existing slips and the approved increase listed in the approved MPP; a complete breakdown of slips of each type in each zone is presented in the MPP which can be downloaded at

http://www.broward.org/bio/mpp_1107.htm. The main focus for new marina facilities is located in the southern half of the County which entails the South Waterway Zone and the Areas of Special Concern: Port Everglades, South Fork of the New River, Dania Cutoff Canal Middle/C-10 Canal, and Dania Cutoff Canal West. 513 of the 4,392 proposed will be held for municipal development into public boat facilities. The breakdown of this reserve is: North - 200; Center - 0; South - 248; South Fork New River - 5; Dania Cutoff Canal Middle/C-10 - 60; Dania Cutoff Canal West - 0.

Data source: Calendar year data. Broward County Manatee Protection Plan, November 2007. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, (954) 519-1218

RESPONSES TO PRESSURES ON MARINE WILDLIFE - MANATEES

MANATEE PROTECTION

Narrative: In November 2007, Broward County completed drafting Broward County's Boat Facility Siting Plan (BFSP), which is the third and final element of the Broward County Manatee Protection Plan (MPP). The Boating Safety and Manatee Education and Awareness elements of the Plan were approved by the Broward County Commission in 1992 and were adopted into the Broward County Comprehensive Plan in 2001.

Explanation: The Boating Safety element of the Broward County MPP resulted in the installation of numerous speed zones throughout the County. Boater compliance to these zones is high, presumably resulting in decreased water-craft related manatee mortality. The Manatee Education and Awareness component of the Broward MPP is also in place. Broward County maintains numerous education and awareness efforts alone and in conjunction with other government and non-profit environmental agencies. The efforts include regular distribution of educational materials, public forums, informational kiosks, educator toolboxes, and a manatee webpage on the Broward County website (<http://www.broward.org/bio/manatees.htm>).

The BFSP element of the MPP was prepared to meet the requirements of Section 370.12(2)(t), Florida Statutes, which requires the counties identified in the Governor and Cabinet's October 1989 Policy Directive (Broward County was one of the counties identified) to develop Manatee Protection Plans (MPPs) consistent with Florida Fish & Wildlife Conservation Commission (FWC) criteria based upon Attachment K of the directive, and to submit such protection plans for review and approval by the FWC. The statute further states that each MPP include a BFSP as a required element.

The BFSP identifies appropriate dock densities for particular areas of the County while providing protection for State of Florida and federally protected manatees. A series of factors, including both manatee and human uses of waterways, were examined to create a map of proposed dock densities. This element will be used for boat facility development applications and modifications to existing boat facilities so that watercraft-related impacts to manatees and their habitats are addressed when applications are reviewed.

To offset the potential increased risk to manatees resulting from an increased number of boat slips and a greater number of boats on our waterways the BFSP provides for certain conservation measures. Conservation measures, as established in the element, provide for:

- One full-time marine law enforcement officer dedicated to the New River and Dania Cutoff Canal (manatee presence is more concentrated and the future volume of boat slips/traffic most dense).
- Regular helicopter aerial surveillance of manatees will entail weekly surveys during winter months (mid-November - March) and quarterly surveys during the remainder of the year.
- Development of an active signage system to let boaters know when high numbers of manatees are near the power plant discharges.
- Expanded manatee education and awareness efforts.

Trends: Manatee mortality in Broward County is low relative to other Florida counties. However, the fraction attributed to watercraft-related impacts is high thus deeming Broward one of the 13 key counties required to develop a MPP. This situation has not changed and mortality levels, with the exception of 2006, have remained relatively consistent (2003 = 5, 2004 = 1, 2005 = 2, 2006 = 6, 2007 = 1, and 2008 = 5 through September 30). From January-March 2006 six (6) water-craft related mortalities occurred in Broward. This is likely a random spike considering that neither boating activity nor manatee abundance have increased appreciably in Broward County. A longer term trend is necessary to attribute increased mortality to one of these factors.

Data source: Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, (954) 519-1218 and Mote Marine Laboratory Boating Traffic and Safety Study 2005, Jay Gorzelany