

Broward County Board of County Commissioners

**ENVIRONMENTAL BENCHMARKS REPORT**



**November 2006**

ENVIRONMENTAL PROTECTION 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 Department is using benchmarks to demonstrate environmental improvements and impacts. This document presents benchmarks which represent the state of the resource (Air, Water, Land, and Marine), the pressures 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 Commission Goal 8 "Environmental Preservation." The general trends in the benchmarks are shown in Table E1. A narrative is provided below.

This year's benchmark report contains numerous improvements. We have added flow charts to help demonstrate how a given resource is impacted by a specific pressure and the responses that directly address those pressures. Narratives have been added in places where quantitative data is not available. A number of the sections have been expanded to include benchmarks on more of the natural resources we protect. The endnotes section contains more information than ever before and often provides web pages to visit for more information. We hope you find the 2006 Benchmarks Report user-friendly and valuable in understanding the status of Broward's environment and the efforts to protect it.

## Air

In April, 2005 Broward County along with Miami-Dade and Palm Beach Counties commemorated the achievement of 10 years of formal designation as an ozone attainment area by the Environmental Protection Agency. In calendar year 2005, the outdoor air quality was rated as "good" 87 percent of the time. Pressures on our air quality from vehicular and industrial emissions continue to increase. The total vehicle miles traveled in a day continues to increase, an indication that as our population continues to grow, more cars are on the road. However, the vehicle miles traveled per 1,000 people continues to decrease, indicating that as individuals we are driving less. The federal government is implementing regulations for cleaner vehicles and fuels. For further local improvements, county government and municipality 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 previous generations of 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 ridership increased by 3.5 percent as a result of improved services. The number of community shuttles and their ridership also increased to reduce high traffic congestion in downtown areas. Residents are using more electricity

thereby increasing our need for power generation. In 2005, power outages associated with Hurricane Wilma contributed to a temporary reduction in power usage. Broward County values public education as a vital link in building local community support for efforts that enhance the quality of life for its residents. Public outreach events such as Clean Air Month and Car Care Month 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 positive. The quality of urban stormwater runoff continues to improve. Licensing, renewals, redevelopment requirements, public education and outreach have been an important part of the County's efforts to conserve water and prevent pollution. Over 1000 acres have been redeveloped over the past few years resulting in net increases in water quality treatment provided. In 2005, many strides were made in protecting water resources. More than 4,000 Broward County residents attended Water Matters Day. The Broward Everglades Working Group implemented a plan for reducing phosphorus in urban stormwater. The NatureScape Irrigation Service saved 43 million gallons of water. Broward County was recognized as a Community Wildlife Habitat and 400 properties were certified as NatureScapes. At the same time, we have seen increasing pressures on the major source of our drinking water, the Biscayne Aquifer. Chloride concentrations in groundwater monitoring wells have shown a slow, but steady westward migration of salty water at certain monitoring sites. This last year, two stations showed significant changes. To better understand the effects of various climatologic stresses and water management operations on saltwater intrusion, the Water Resources Division 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 groundwater 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. We are seeing an increasing trend in solid waste production; however, the per capita solid waste produced has decreased. A number of local programs address many of the concerns of these pressures. Broward County Environmental Protection Department runs State delegated programs which have cleaned up 40.2% of local contaminated sites. Due to the continuing maturation of EPD's e-inspection program, the number of hazardous materials facilities inspected this year has increased by 6%. Furthermore, the rate of those facilities determined to be in compliance has remained at 79%.

## 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 the 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 the condition of our reefs, beaches, and listed wildlife. High population density and coastal build-out put pressure on these resources in the form of elevated numbers of boaters; commercial maritime traffic; inlet-caused beach erosion; beachfront and waterfront development and redevelopment; nutrient-laden waters pumped offshore and flushed to tide; and increasing numbers of residents and visitors. Add to these anthropogenic impacts, the naturally occurring cycles of storms, oceanic temperature and water quality fluctuations, and harmful algae blooms, and it is clear that these fragile resources are at risk. Trends with respect to these impacts are sometimes difficult to discern due to natural variability and the confounding effects of large-scale events. In some cases, it is also 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 continue to be used to identify areas of environmental concern and to highlight the effectiveness of environmental protection programs and regulations. For other aspects of the quality of life in Broward County and public perceptions regarding key environmental issues, please see the Broward Coordination Council's PRC survey (<http://www.sfrpc.com/ftp/pub/ccb/2006PRCReport.pdf>).

<b>a. AIR RESOURCES BENCHMARKS.</b> This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Decreasing ■ No trend ■ Increasing ■
<b>Air Quality</b>			
Percentage of days when the outdoor air quality was good			
Average annual ozone concentration			
Average annual particulate matter concentration			
<b>Mobile Sources Pressures</b>			
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			
<b>Regulated Stationary Source Pressures</b>			
Regulated stationary sources		Narrative	
Emissions from power plants, tons/year			
Total electricity consumption, billions of kilowatt hours/year			
Per capita electricity consumption, kilowatt hours/year			
<b>Other Source Pressures</b>			
Other Sources		Narrative	
<b>Mobile Sources Responses</b>			
Number of air quality outreach events			
Number of mass transit passenger trips, million of trips/year			
Number of alternative fueled vehicles in government fleet			

<b>a. AIR RESOURCES BENCHMARKS.</b> This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Decreasing ■ No trend ■ Increasing ■
Community shuttle ridership, thousands of trips/year			
<b>Regulated Stationary Sources Responses</b>			
Air quality compliance inspections			Narrative
Florida Power and Light's Alternative Fuel Program			Narrative
<b>Other Source Responses</b>			
Open burning regulations			Narrative

<b>b. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
<b>Surface Water Quality</b>			
Everglades water quality - phosphorus concentrations at the S-9 pump station			
Fresh water quality - percent improvement in C-13 canal			
Estuarine water quality - percent improvement in C-13 & C-14 canal			
<b>Ground Water Quality</b>			
Percent of potable water wells meeting drinking water standards			
<b>Ground Water Quantity</b>			
Percentage of monitoring wells with changing groundwater levels			

<b>b. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
<b>Surface Water Quality Pressures</b>			
Urban stormwater runoff		Narrative	
Building permits - number of all new structure/non residential addition approvals issued			
Percent of developed land not subject to surface water management regulation			
<b>Ground Water Quality Pressures</b>			
Percent saltwater monitoring wells with changing chloride concentrations, 2000 baseline			
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			
<b>Ground Water Quantity Pressures</b>			
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	
<b>Surface Water Quality Responses</b>			
Miles of streets swept			
Total number of certified Naturescape sites			

<b>b. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
C-11 Canal Basin/ Broward Everglades Working Group Activities			Narrative
Active construction sites within BC jurisdiction with surface water management licenses			
Total surface water management construction licenses issued since 1989			
<b>Ground Water Quality Responses</b>			
Local surface water management			Narrative
Net gain/loss in septic system wastewater flow, thousands of gallons/day			
Percent of solid waste recycled			
Percentage of contaminated sites cleaned up to state standards			
Number of licensed hazardous material sites inspected/year			
Percent licensed hazardous material sites inspected and found to be in compliance			
<b>Ground Water Quantity Responses</b>			
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			



<b>c. LAND RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
<b>Natural Land Quantity</b>			
Acres of protected land			
Acres of unprotected (developable) land			
Everglades Water Conservation Areas		Narrative	
<b>Natural Land Quality</b>			
Natural land quality		Narrative	
<b>Urban Landscape</b>			
Urban landscape		Narrative	
<b>Natural Land Quantity Pressure</b>			
Broward County population, millions			
Building permits - number of all new structure/non residential addition approvals issued			
Wetlands impacted by development, acres			
Mitigation leaving Broward County, acres			
<b>Natural Land Quality Pressure</b>			
Invasive exotic vegetation		Narrative	
Natural lands under hydrologic stress		Narrative	
Fire Suppression		Narrative	
<b>Urban Landscape Pressure</b>			
Number of tropical storms			
Number of tree related complaints			



<b>c. LAND RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
Reduction of wildlife habitat		Narrative	
Number of trees licensed for removed			
<b>Natural Land Quantity Responses</b>			
Public dollars spent to preserve natural land, millions			
Environmental review		Narrative	
Acres of mitigation licensed			
Mitigation on public lands		Narrative	
<b>Natural Land Quality Responses</b>			
Percent of municipal natural land sites with management plans			
Comprehensive Everglades Restoration Plan		Narrative	
Acres of natural lands rehydrated		Narrative	
Acres subject to controlled burn or alternative management methods		Narrative	
<b>Urban Landscape Responses</b>			
Public education- Right tree, Right place		Narrative	
Storm preparedness and response		Narrative	
Broward Beautiful Projects, thousands of dollars spent			
Active tree trimmer licenses			
Tree related enforcement actions			
Replacement trees required by licensing			
Trees funded for planting thru the Tree Trust Fund			
Certified Naturescape sites, total			

<b>d. MARINE RESOURCES.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
<b>Reef Quality</b>			
Percentage of healthy corals			
<b>Reef Quantity</b>			
Percent live coral cover			
Octocoral and sponge density			
<b>Beach Quality</b>			
Blue Wave beaches	Narrative		
Percent of beach water quality results rated "Good"			
<b>Beach Quantity</b>			
Average beach width at high tide, feet			
Percent of non-critically eroded beaches			
<b>Marine Wildlife</b>			
Number of sea turtle nests			
Percent of sea turtle nests left in place			
Percent of sea turtle nesting success			
Florida West Indian manatee population			
<b>Reef Resources Pressures</b>			
Saltwater fishing licenses issued in Broward County, thousands			
Number of days when water temperature was not optimal for corals			

<b>d. MARINE RESOURCES.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
Percent of reef monitoring sites impacted by algae			
Number of times ship damage impacted Broward's reef			
<b>Beach Resources Pressures</b>			
Presence of Inlets		Narrative	
Days of small craft advisories			
Number of structures within 50 feet of the beach			
Number of visitors to Broward County, millions			
Trash on the beach		Narrative	
<b>Marine Wildlife Pressures</b>			
Beaches without turtle-friendly lighting		Narrative	
Number of sea turtle nests destroyed by predators			
Number of sea turtle hatchling disorientation events			
Number of vessels registered in Broward County			
Manatee mortality in Broward County			
Number of boat slips in Broward County			
<b>Reef Resources Responses</b>			
Marine protected areas		Narrative	
Coastal water quality monitoring		Narrative	
Algal bloom monitoring effort		Narrative	
Boulder reefs, thousands of square feet			

<b>d. MARINE RESOURCES.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements. 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.	<b>RESOURCES</b> Declining ■ No trend ■ Improving ■	<b>PRESSURES</b> Increasing ■ No trend ■ Decreasing ■	<b>RESPONSES</b> Declining ■ No trend ■ Improving ■
Number of shipwreck reefs			
Modular reefs, thousands of square feet			
Anchorage regulatory review			Narrative
Marine debris clean-up campaigns, pounds of litter collected/participant/event			
Number of mooring buoys			
<b>Beach Resources Responses</b>			
Sand bypass			Narrative
Beach nourishment			Narrative
Monitoring the condition of the beach			Narrative
Regulatory comment			Narrative
Litter clean-up campaigns, pounds of litter collected/participant/event			
<b>Marine Wildlife Responses</b>			
Percent of sea turtle nest relocations			
Beach nourishment			Narrative
Regulatory comment on beach resources			Narrative
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 Department (formerly the Department of Planning and Environmental Protection) initiated the Benchmarks Program to demonstrate environmental improvements. 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 improvements in the environment. These benchmarks continue to be used as part of the recently developed Commission Goal 8 - Environmental Preservation.

## 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.

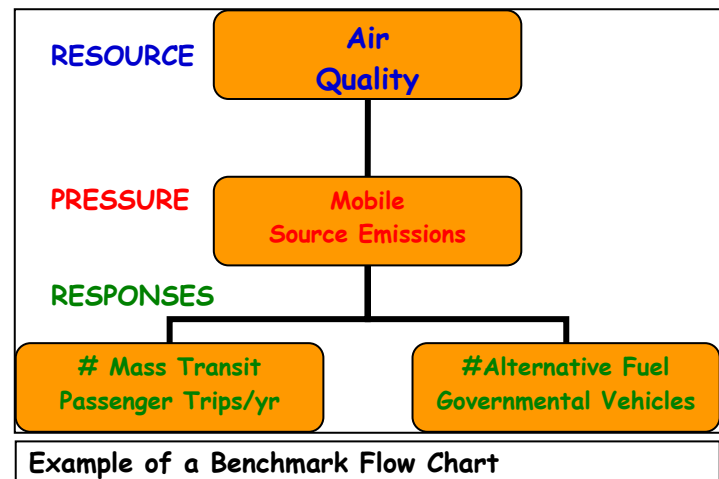
## RESOURCE-PRESSURE-RESPONSE CONCEPT

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 alternative-fueled vehicles" in use.

## NATURAL RESOURCE CATEGORIES

The Benchmarks Program concentrates on four primary natural resources; *air, water, land* and *marine* resources. 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. We have added narratives to explain trends in policies, regulation or issues that can not currently be quantified to give a broader perspective on the status of the resources. The flow charts at the top of each benchmarks 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, 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.

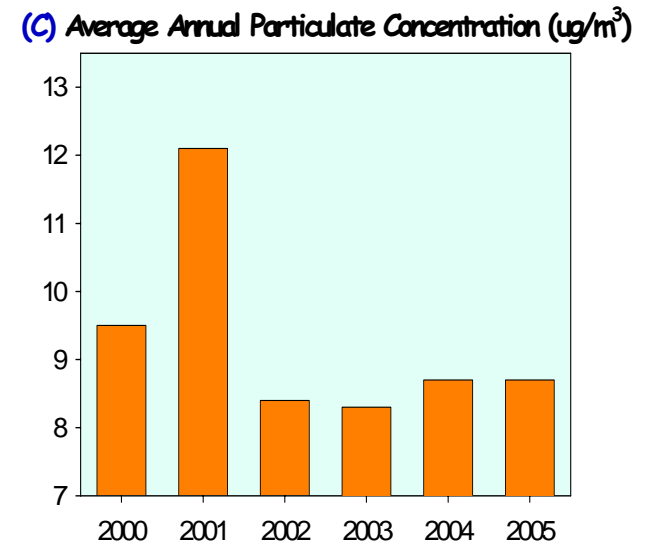
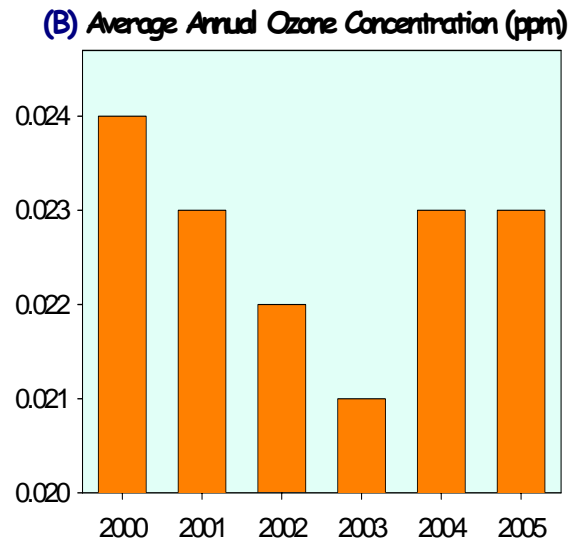
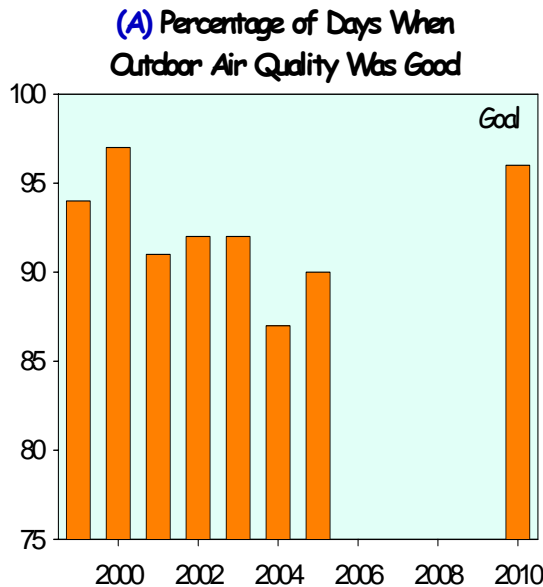
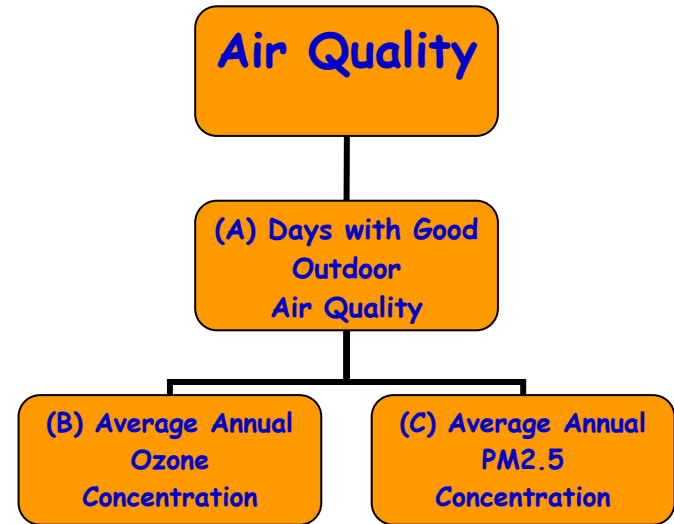
### ENDNOTES

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 Division at (954) 519-1241 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 Department ([www.broward.org/environment/](http://www.broward.org/environment/)).

# AIR RESOURCES

**Air is essential for life.** We determine the quality of the air resources by measuring parameters which have the potential to impact our health and the ecosystem around us. A number of different parameters are used to generate an air quality index - a single number which tells us if the air quality is healthy or not. Two of the major parameters which influence that number are the concentration of the gas ozone and the amount of particles of a specific size (PM2.5) in the air.



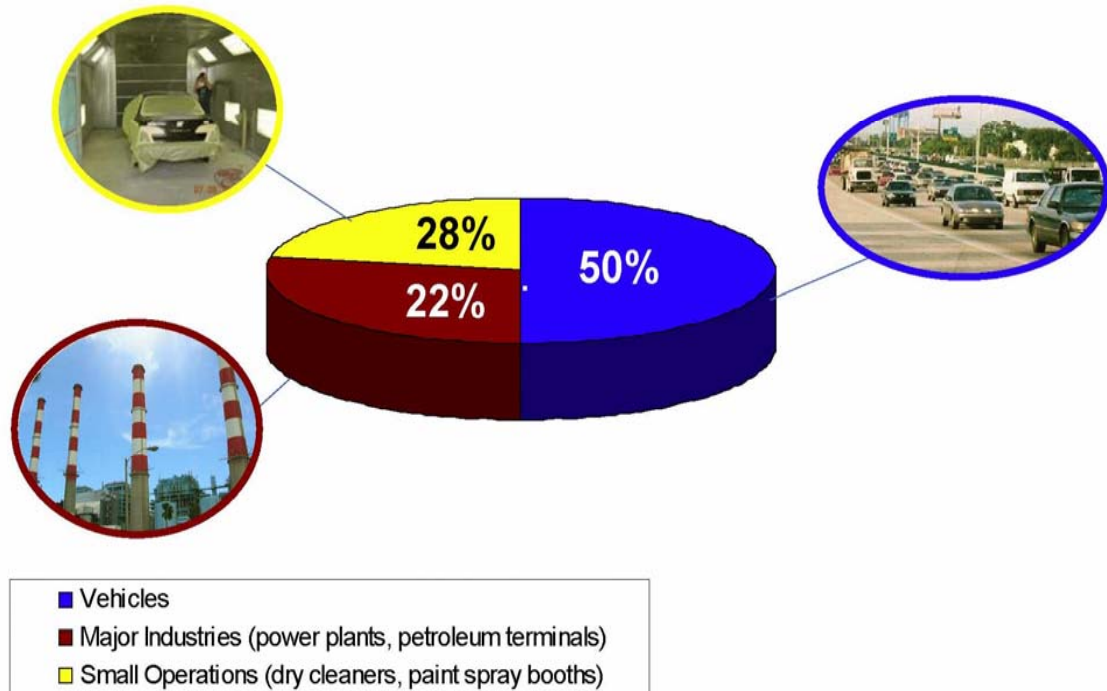
Endnotes for the Air Quality Resource Benchmarks are on pages 50-51.

# PRESSURES ON AIR QUALITY

**What influences air quality?** The main culprits are emissions from vehicles, emissions from factories and power plants, and local area sources such as auto repair paint booths. However, infrequent events such as fires and the transport of Saharan dust can have a significant impact as well. We have a number of benchmarks for mobile sources and for regulated stationary sources. We also discuss other sources.

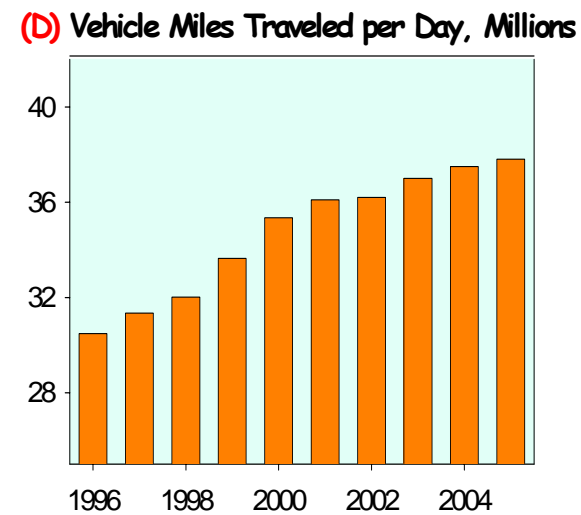
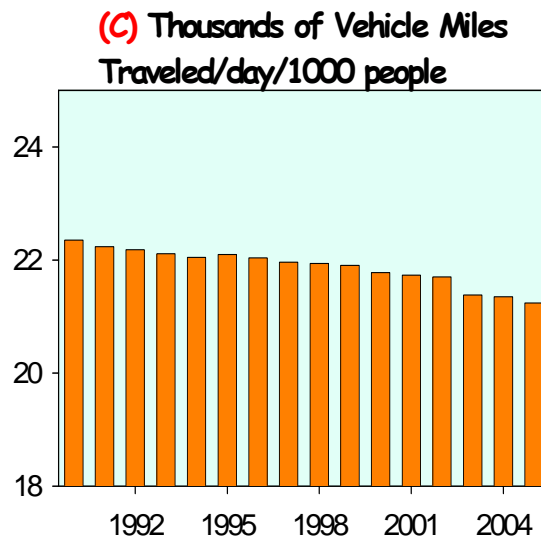
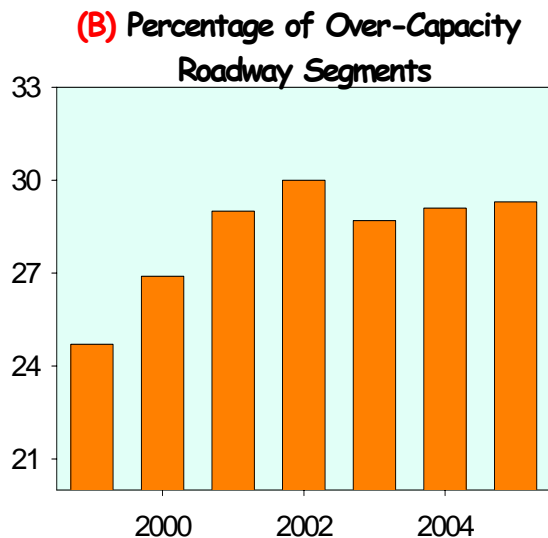
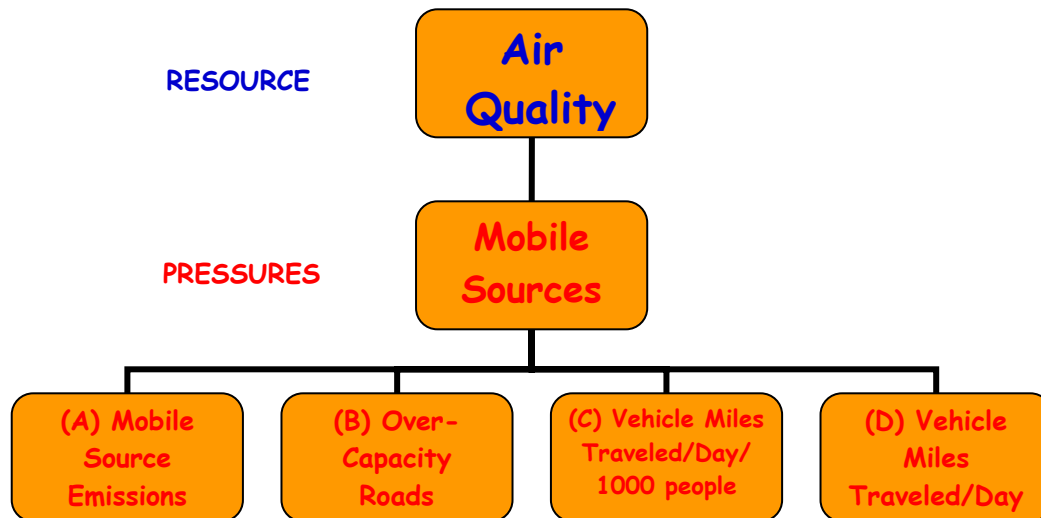
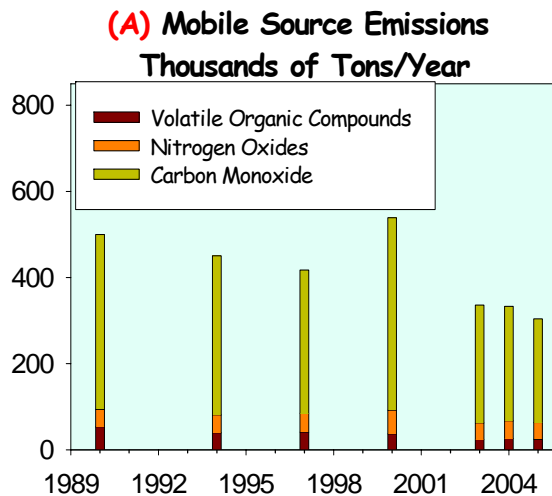


## What Causes Air Pollution in Broward County?





# PRESSURES ON AIR QUALITY - Mobile Sources

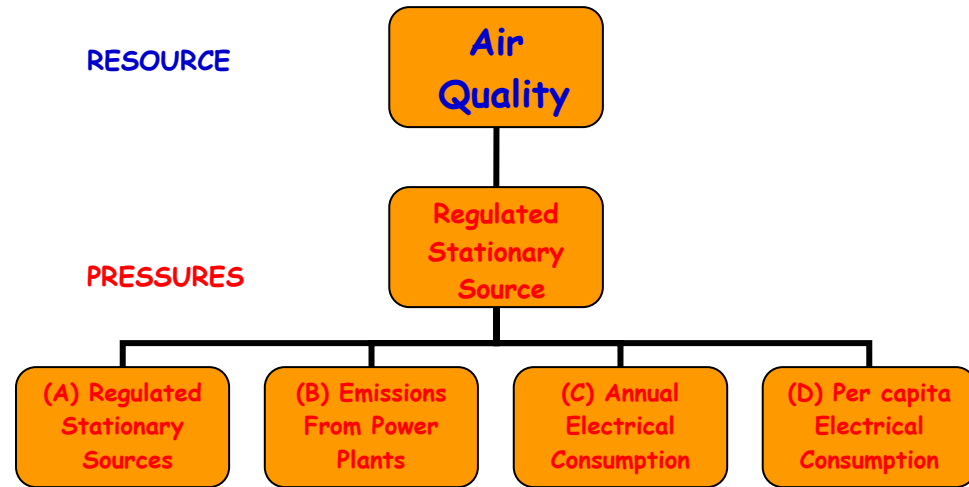


Endnotes for the Air Quality Mobile Source Pressure benchmarks are on pages 51-52.

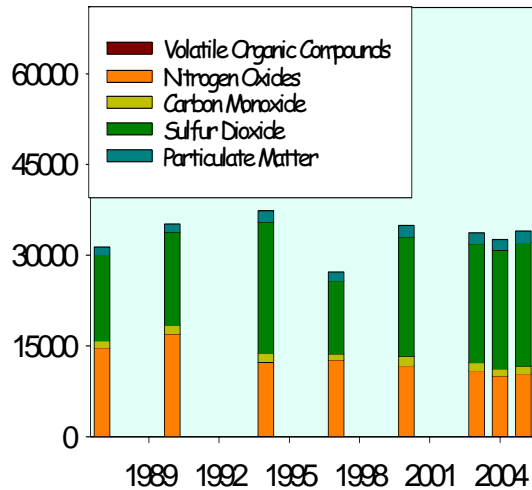
# PRESSURES ON AIR QUALITY - Regulated Stationary Sources

## (A) Regulated Stationary Sources

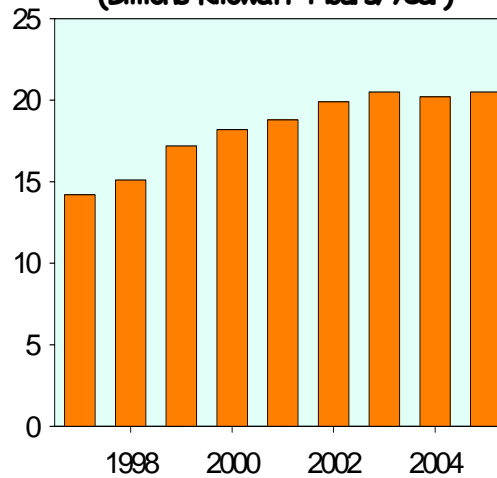
- Air pollution sources are subject to regulation by local, state and federal agencies. They include a variety of industries from power plants to auto body paint shops. The number of sources operating here provides a guideline for the potential emissions. To learn more, see the endnote on page 53.



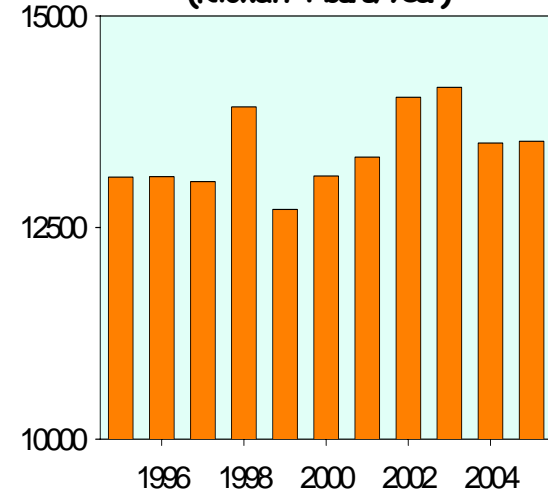
## (B) Emissions From Power Plants (Tons/Year)



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



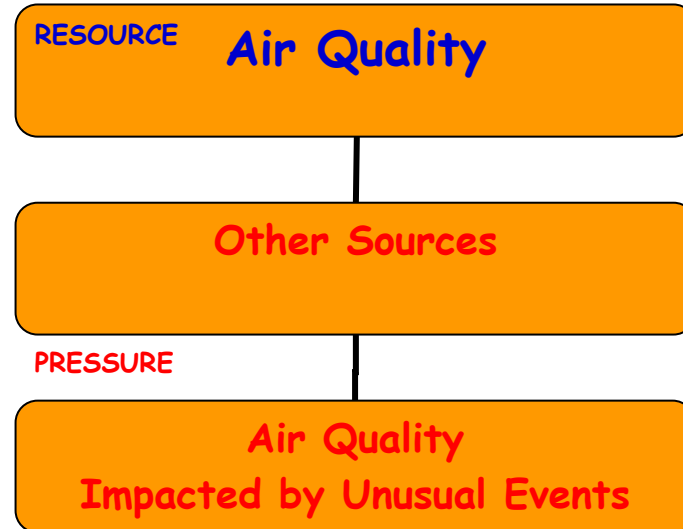
## (D) Per Capita Power Consumption (Kilowatt-Hours/Year)



Endnotes for the Air Quality Regulated Stationary Source Pressure benchmarks are on page 53-54.

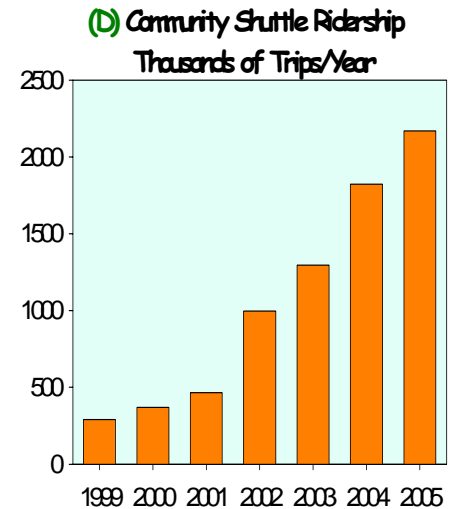
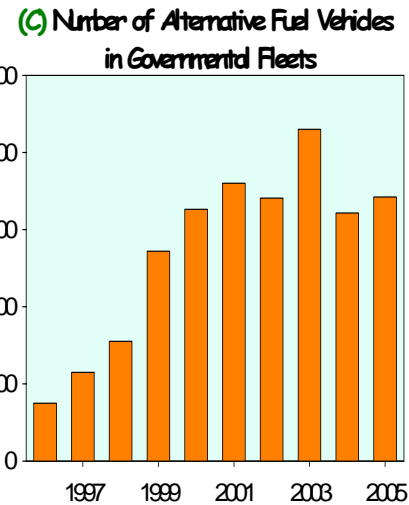
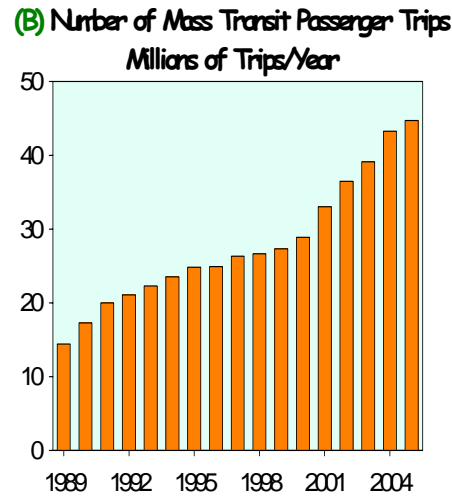
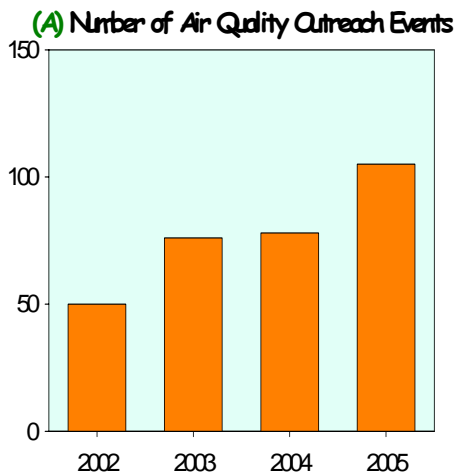
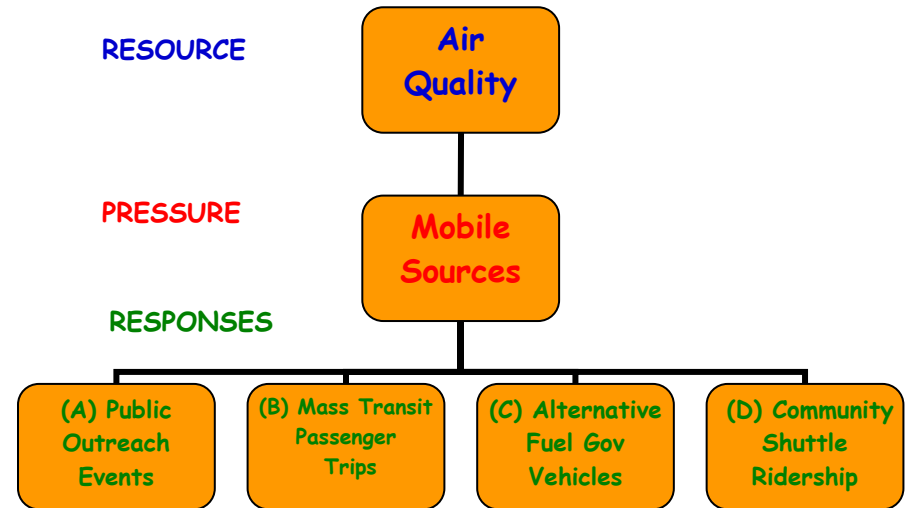
# PRESSURES ON AIR QUALITY - Other Sources

**Air Quality Impacted by Unusual Events -** 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. We have begun tracking these events and will report on the numbers next year. To learn more, see the endnote on page 54.



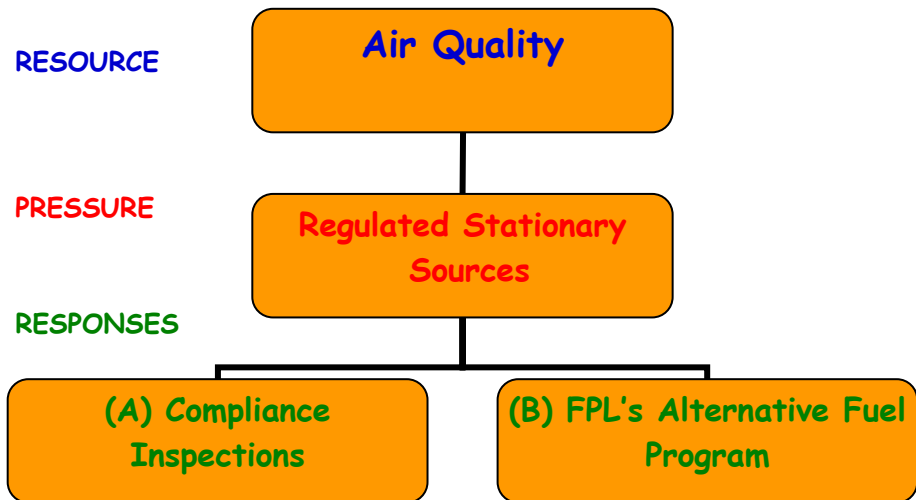
# RESPONSES TO THE PRESSURES ON AIR QUALITY - Mobile Sources

**Mobile Sources** - To reduce the impacts of mobile sources on air quality, the public needs to understand the problems and potential solutions. Using mass transit and reducing the use of fossil fuels is a start.



Endnotes for the Air Quality Mobile Source Response benchmarks are on pages 54-56.

# RESPONSES TO THE PRESSURES ON AIR QUALITY - Stationary Sources

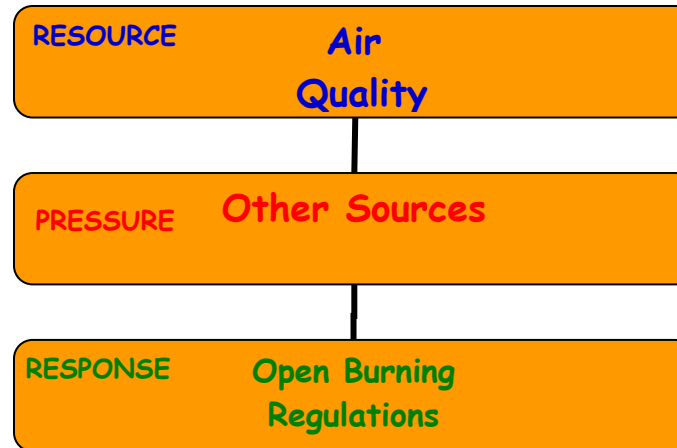


**(A) Air Quality Compliance Inspections** - While Federal, State and local regulations dictate allowable emission levels, ensuring compliance with these regulations is the key to environmental protection. Regular inspection of facilities helps increase compliance. To learn more, read the endnotes on page 56.

**Florida Power and Light's Alternative Fuel Program** - FPL offers 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 are funding the development of solar energy facilities in Florida. To learn more, read the endnotes on page 56.

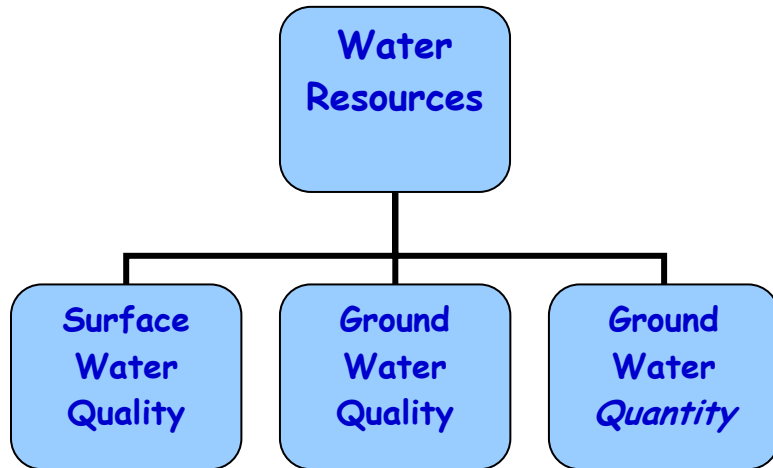
# RESPONSES TO THE PRESSURES ON AIR QUALITY - Other Sources

**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 Division issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases. For more information, please see the endnotes on page 57.





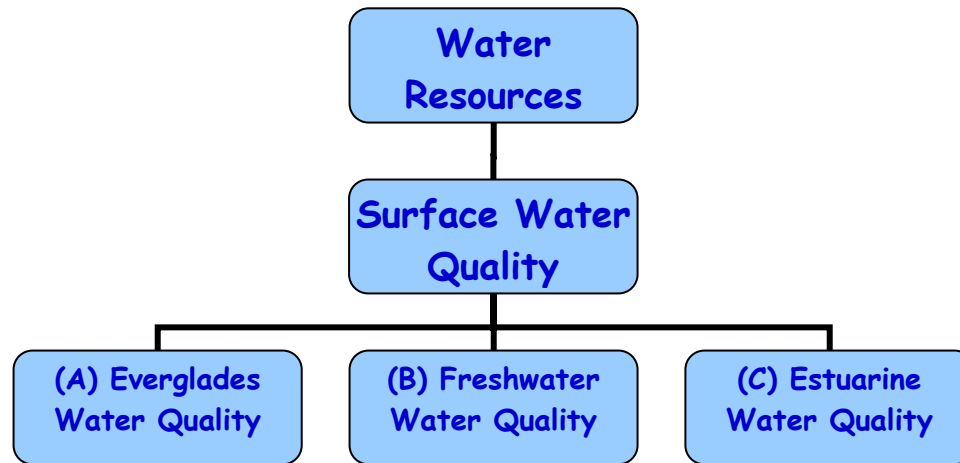
# WATER RESOURCES



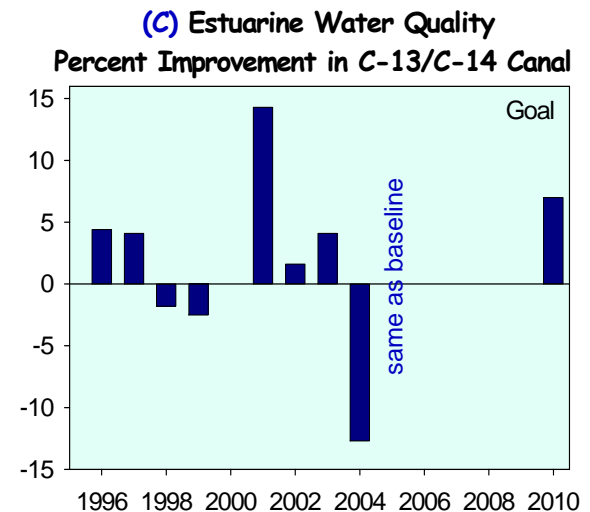
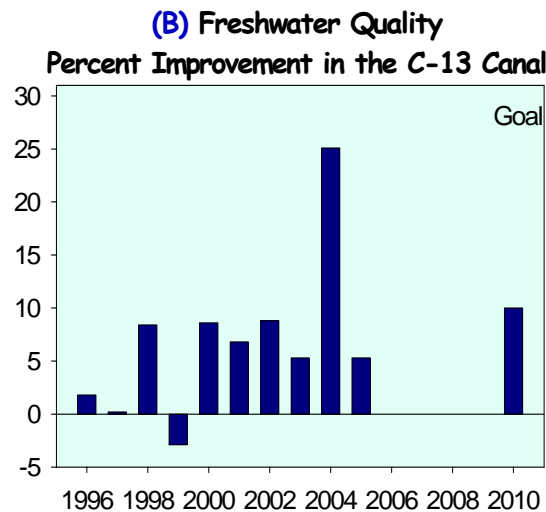
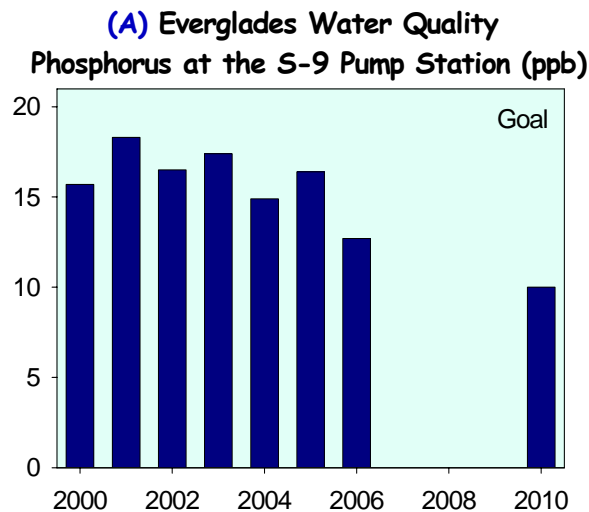
**Water** is what makes our planet unique. The availability of an adequate supply of clean water is one of the primary criteria that allow human and ecological communities to exist in a given location. South Florida hosts a network of canals, an underground source of drinking water called the Biscayne 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



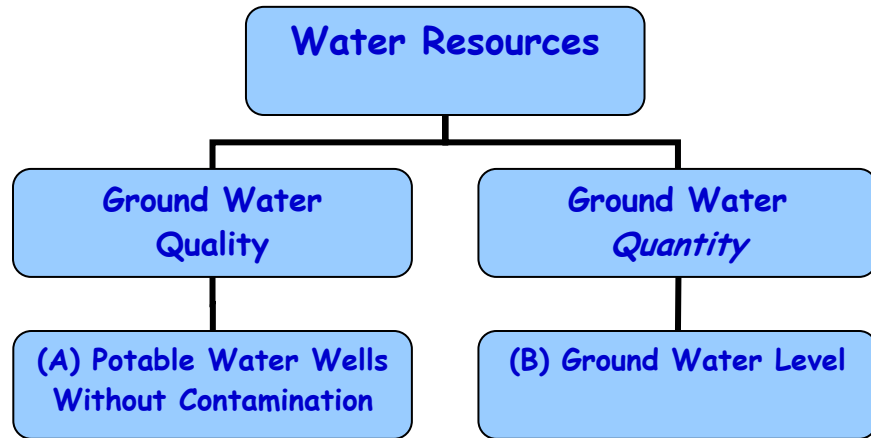
**Surface Water** - Surface water includes our vast network of canals, lakes, the tidal rivers, Intracoastal Waterway, the coastal ocean and the Everglades. The water quality requirements and standards differ among these different environments. In this section, we see how the existing water quality compares to the 2010 goal.



Endnotes for the Surface Water Resource benchmarks are on pages 57-59.

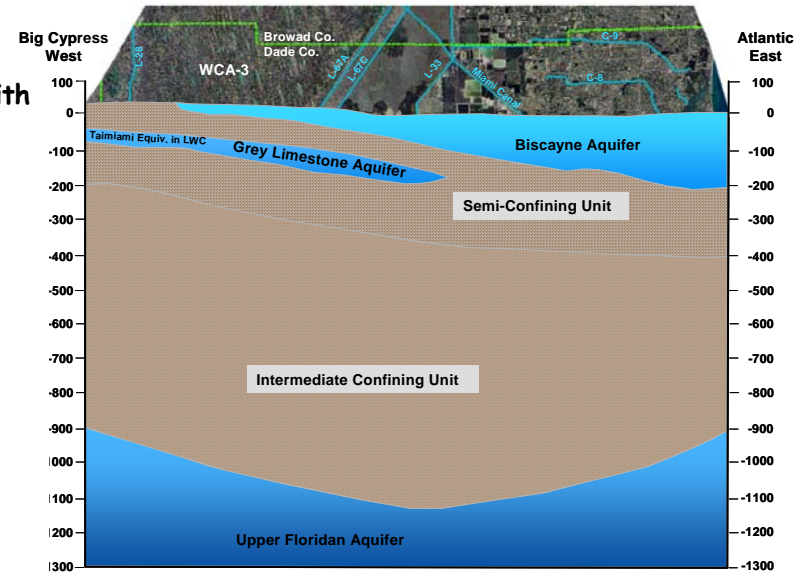


# WATER RESOURCES - Ground Water

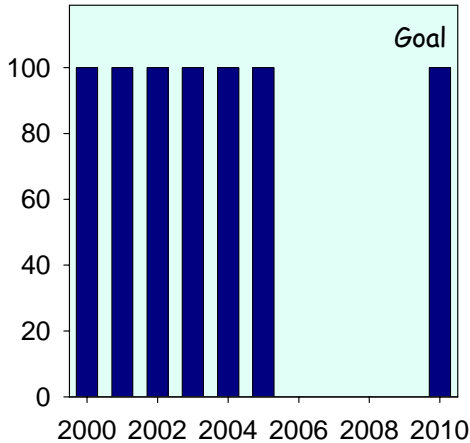


**Ground Water** - The overwhelming majority of our drinking water comes from the Biscayne Aquifer. Protecting the quality of that drinking source from hazardous materials and other pollutants is paramount. Ground water levels must be maintained to prevent impacts to wetlands, to hold back salt water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

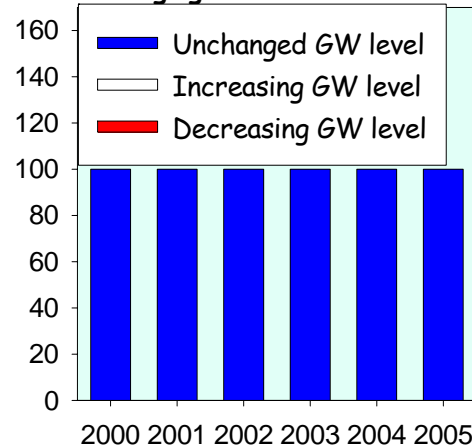
**Generalized Cross Section of Our Geology**



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

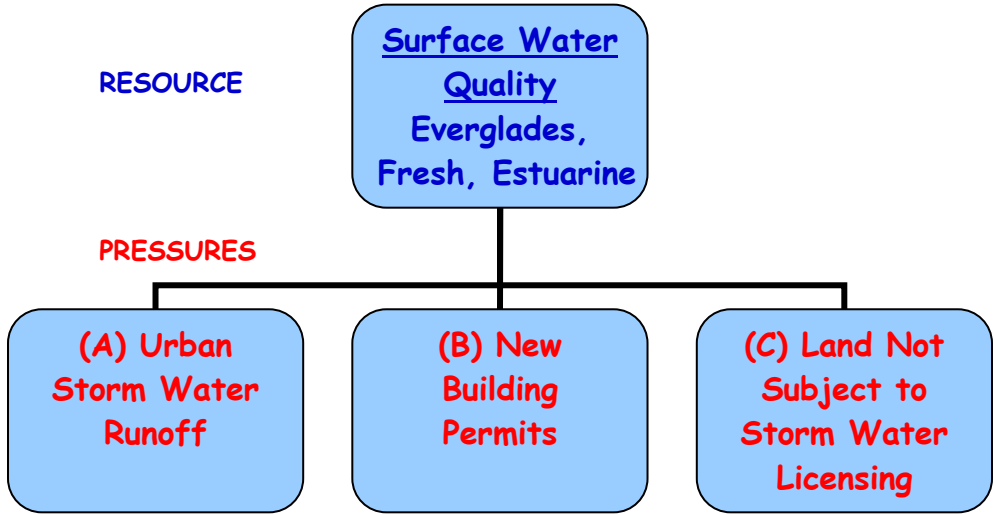


**(B) Percentage of Monitoring Wells With Changing Groundwater Levels**



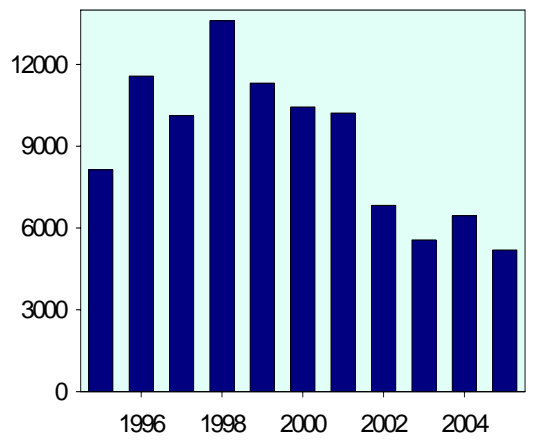
Endnotes for the Groundwater Resource benchmarks are on pages 59-60.

# PRESSURES ON WATER QUALITY - Surface Water

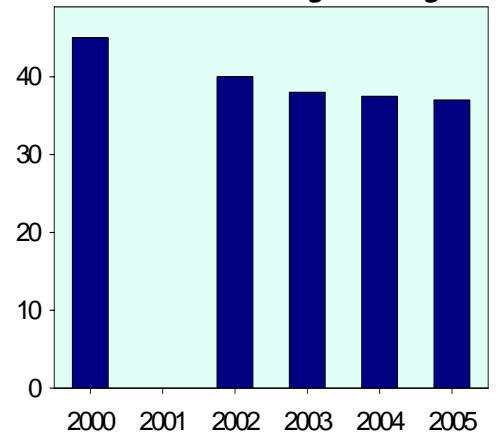


**(A) Urban Storm Water Runoff -** Urban storm water is a major contributor of pollutants to our waterways. Fertilizers, pet waste, roadways, and poorly managed construction sites are part of the problem. In addition, older areas of the County were built without the infrastructure to clean up the runoff before it enters our waterways. For more information, read the endnote on page 60.

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

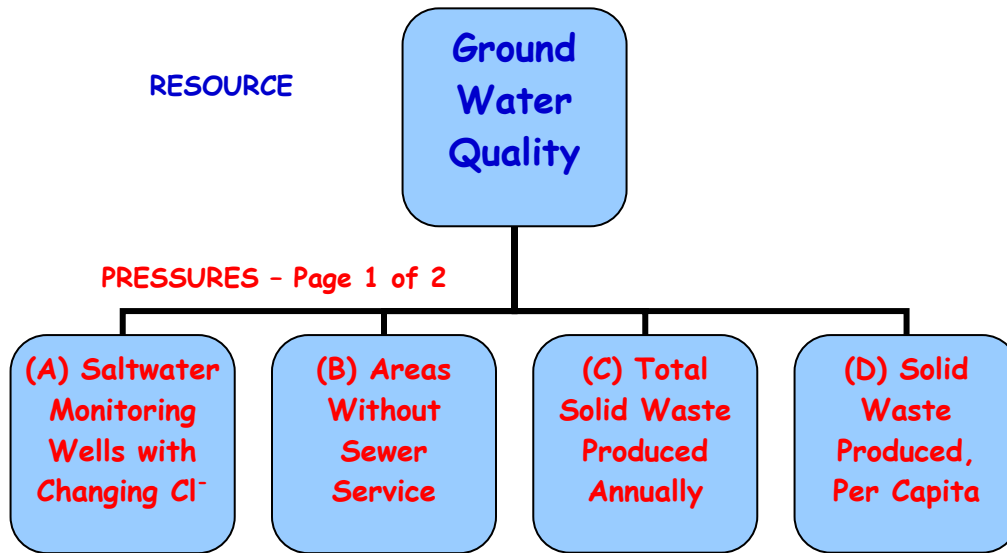


**(C) Percentage of Developed Land Not Subject to Surface Water Management Regulation**

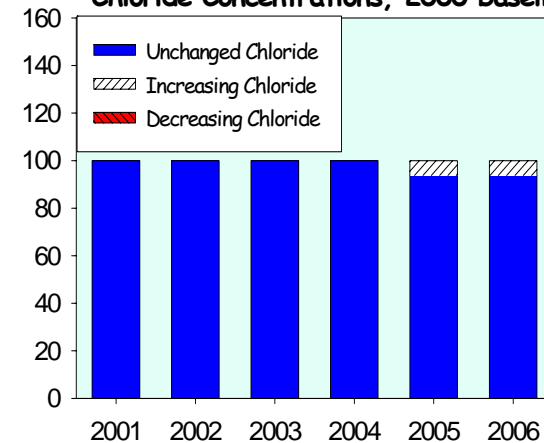


Endnotes for the Surface Water Pressures benchmarks are on pages 60-61.

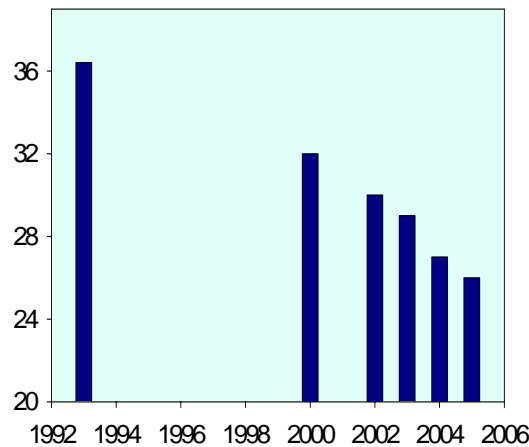
# PRESSURES ON WATER QUALITY - Ground Water



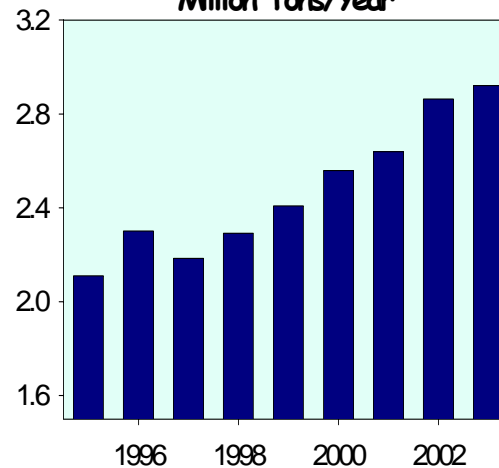
(A) Percent Saltwater Monitoring Wells with Changing Chloride Concentrations, 2000 baseline



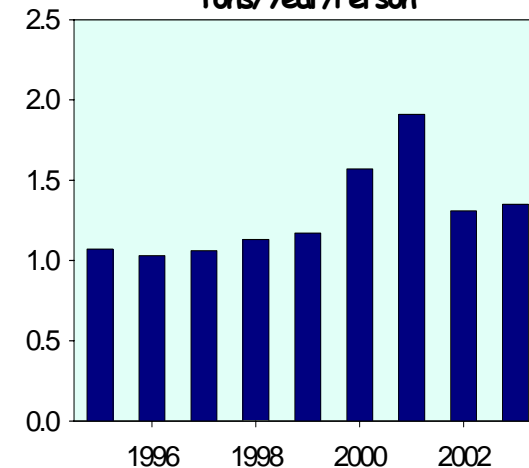
(B) Percent Broward County Where Central Domestic Sewer Service is Not Available



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

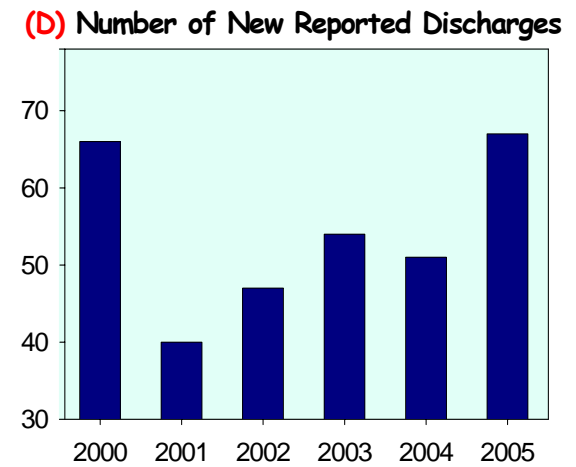
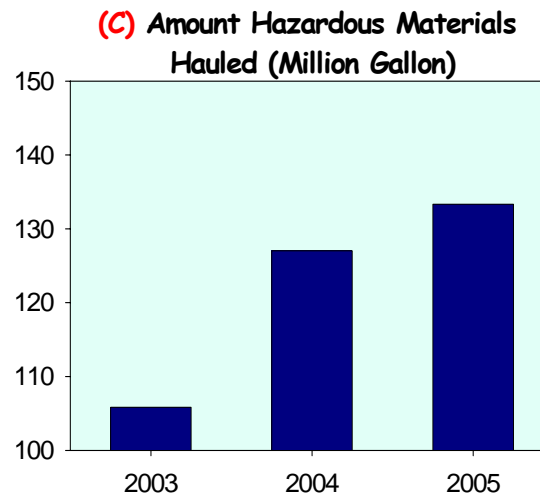
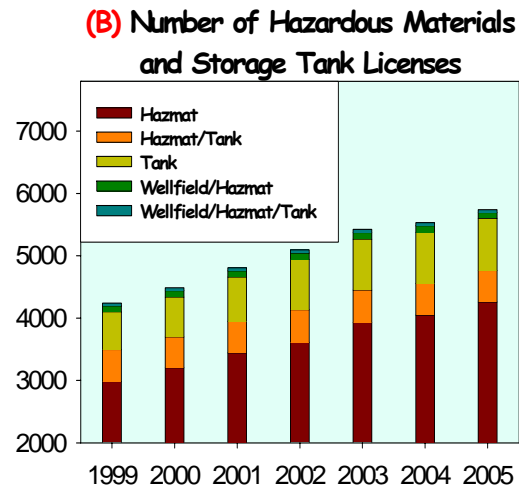
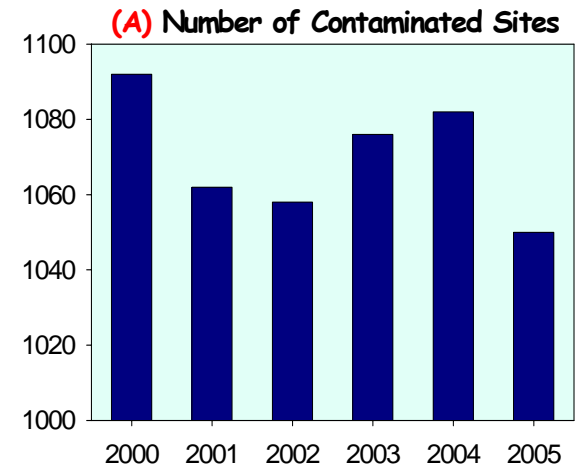
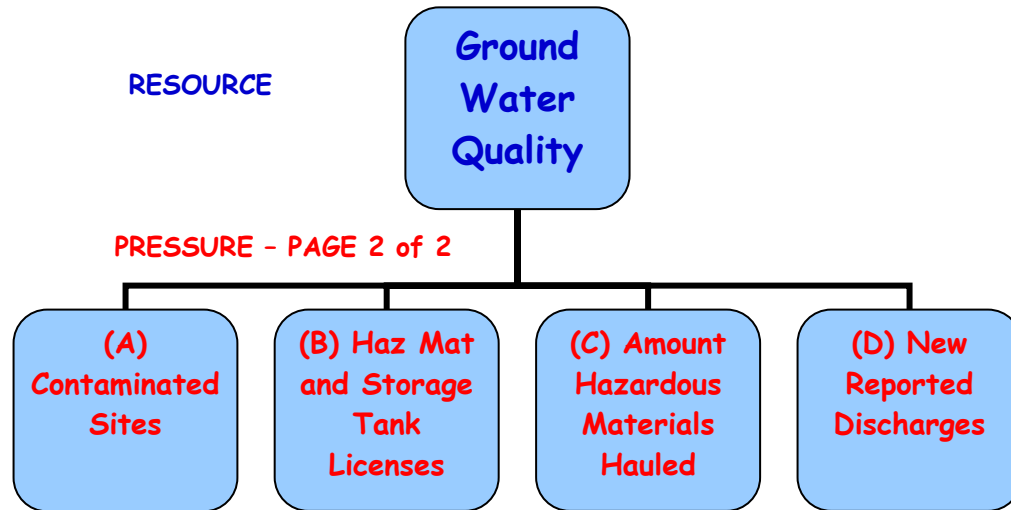


(D) Solid Waste Produced, Tons/Year/Person



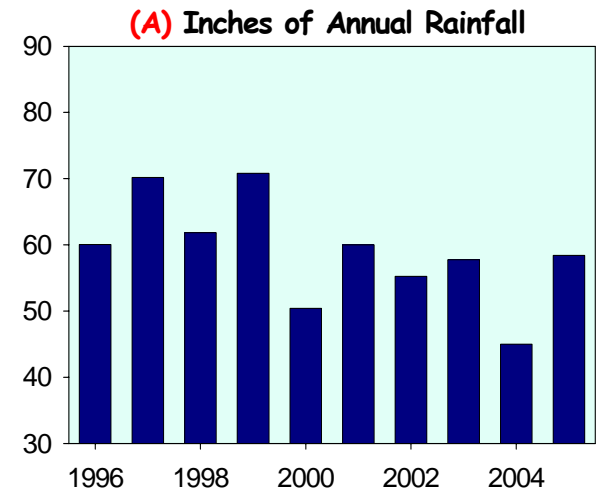
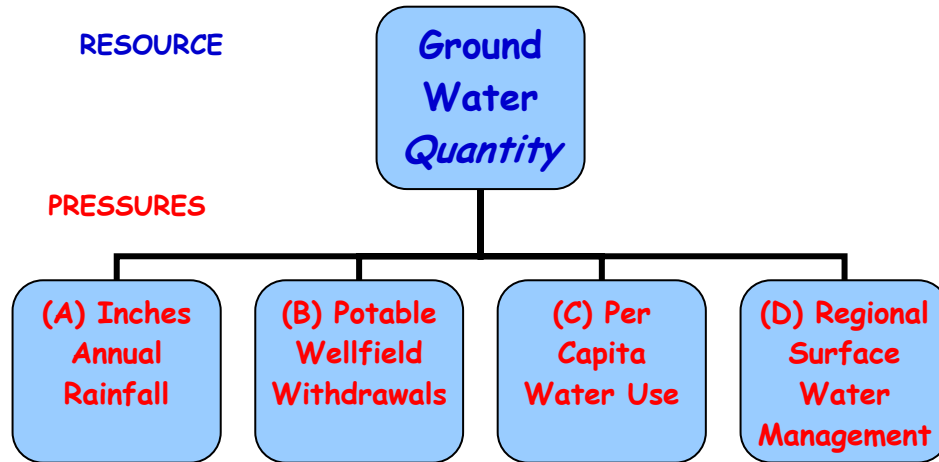
Endnotes for the Groundwater Quality Pressures benchmarks are on pages 62-64.

# PRESSURES ON WATER QUALITY - Ground Water

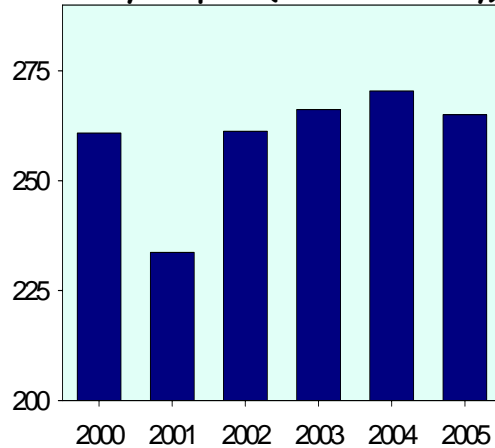


Endnotes for the Groundwater Quality Pressures benchmarks are on pages 62-64.

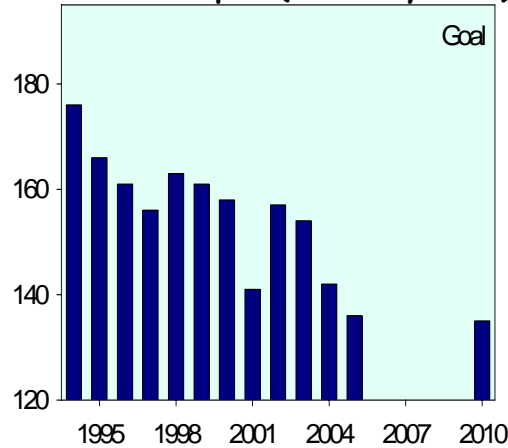
# PRESSURES ON WATER QUANTITY - Ground Water



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



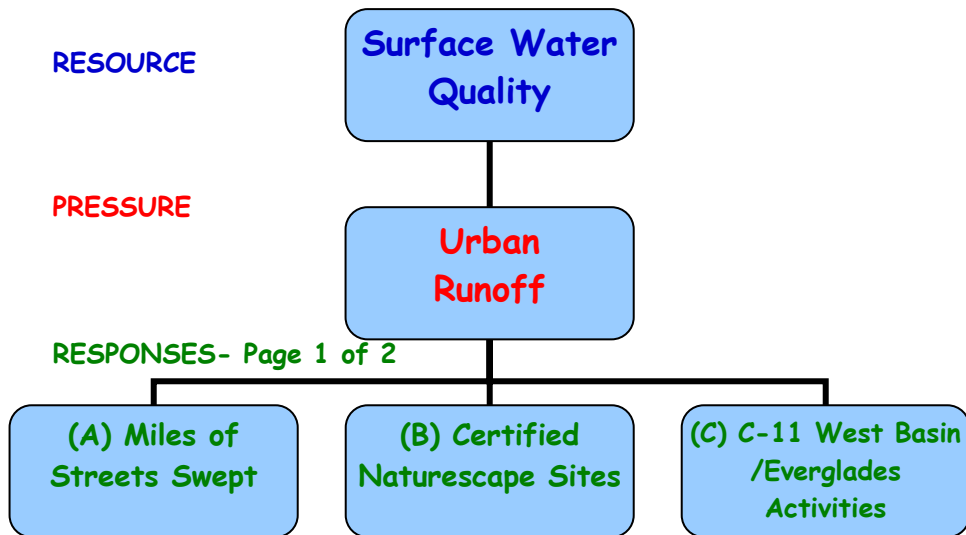
**(C) Broward County Water and Wastewater Services Water Consumption (Gallons/Day/Person)**



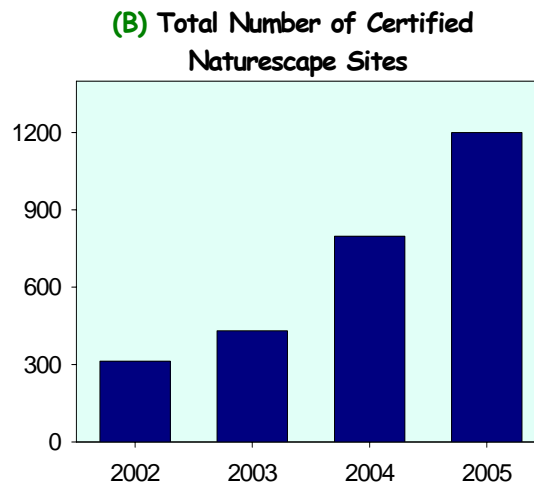
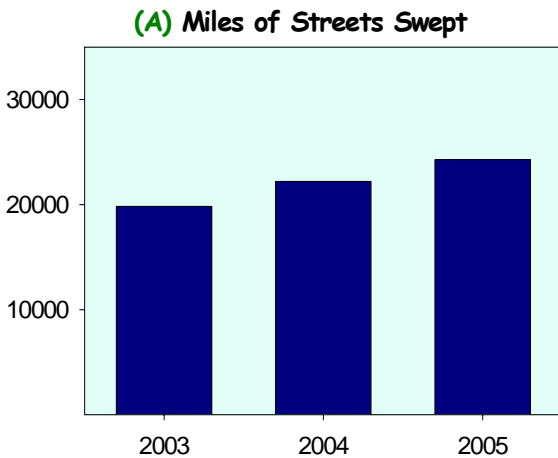
**(D) Regional Surface Water Management - The Comprehensive Everglades Restoration Plan and recent policy changes at the SFWMD are reducing freshwater flows into urban Broward County. This may have impacts on local groundwater levels, urban wetland systems and salt water. To learn more, read the endnote on page 66.**

Endnotes for Ground Water Quantity Pressures may be found on pages 64-66.

# RESPONSES TO THE PRESSURES ON WATER QUALITY - Surface Water



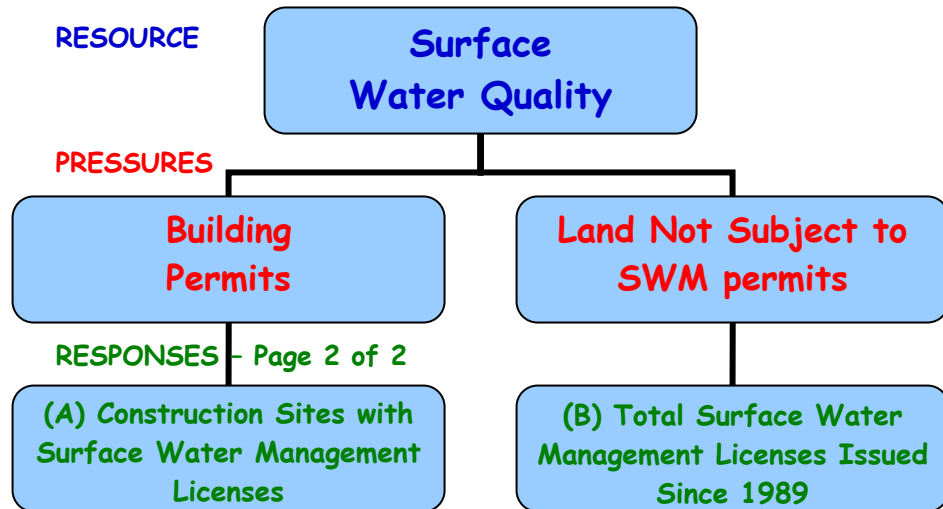
**Surface Water Quality Responses**  
 - Surface water quality is impacted by urban run-off, construction activities, and a lack of pre-treatment of the storm water in areas built before surface water management regulations came into effect. The responses to these pressures are discussed on the next two pages.



**(C) C-11 West Basin/ Broward Everglades Working Group** - 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 68.

Endnotes for Surface Water Quality Response benchmarks may be found on pages 67-70.

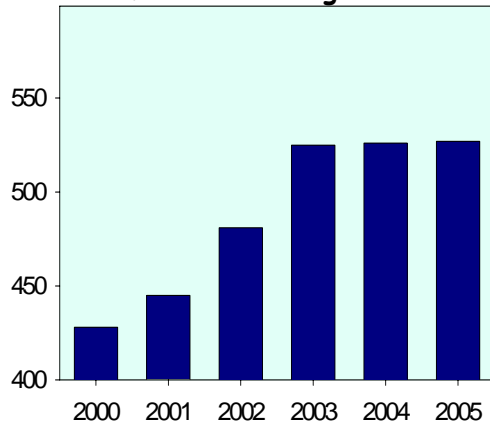
# RESPONSES TO THE PRESSURES ON WATER QUALITY - Surface Water



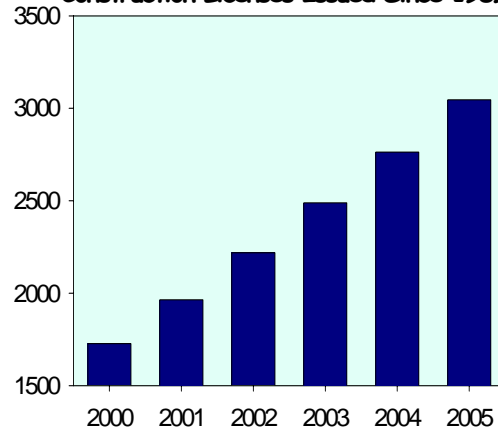
## Construction Activities and Surface Water Management (SWM) Licenses

- 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



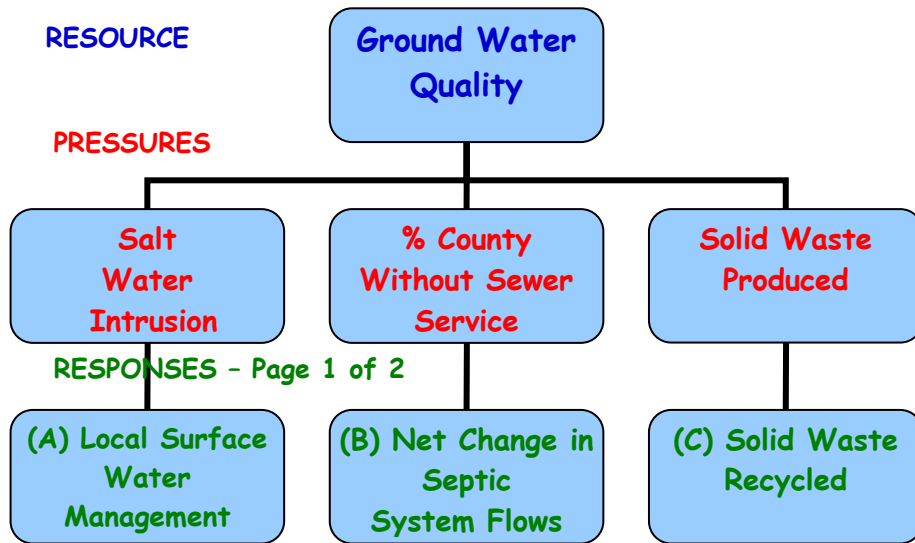
(B) Total Surface Water Management Construction Licenses Issued Since 1989



Endnotes for Surface Water Quality Response benchmarks may be found on pages 67-70.

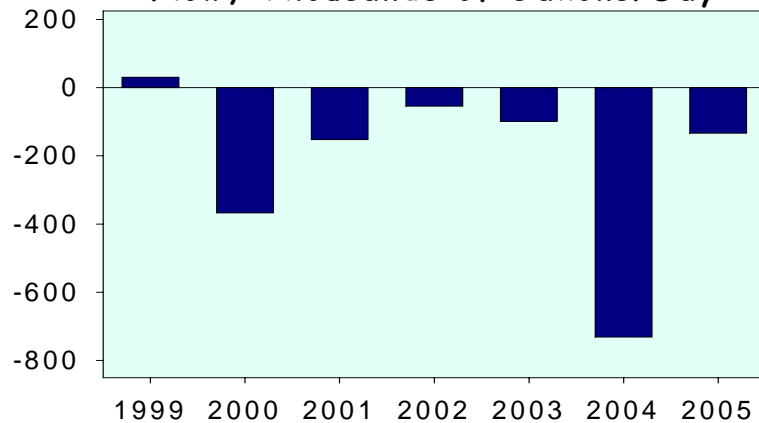


# RESPONSES TO THE PRESSURES ON WATER QUALITY - Ground Water

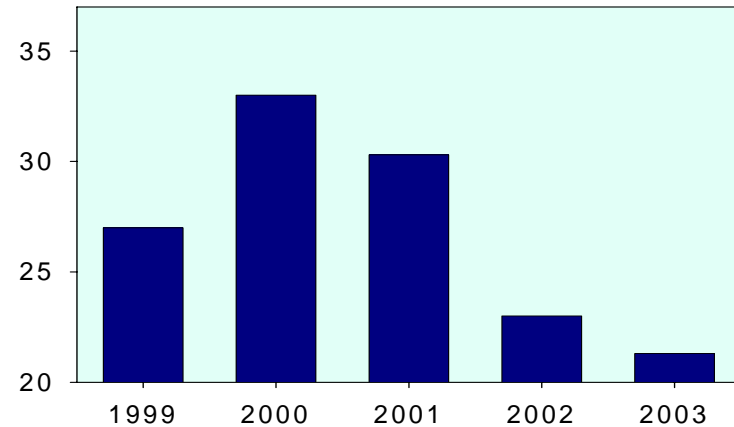


**(A) Local Surface Water Management -** Broward County has been investigating innovative ways to improve surface water management to increase storage and water quality treatment within the secondary canal system. Such improvements reduce pollutant loads to the Everglades and coastal ecosystems and serve to increase aquifer recharge. To learn more, read the endnote on page 70.

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



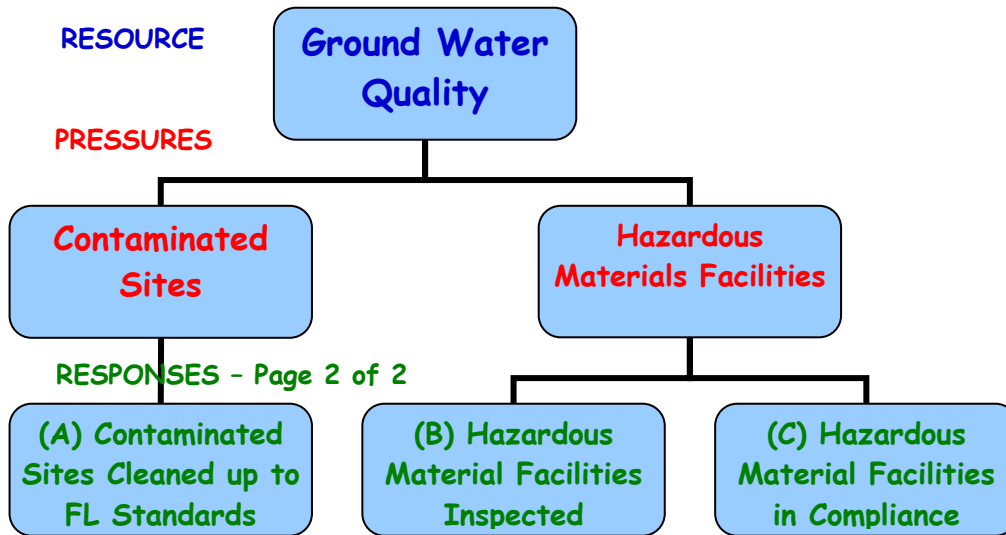
**(C) Percent of Solid Waste Recycled**



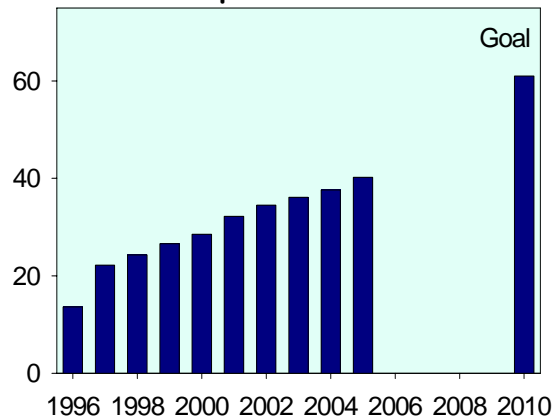
Endnotes for Ground Water Quality Response benchmarks may be found on pages 70-72.



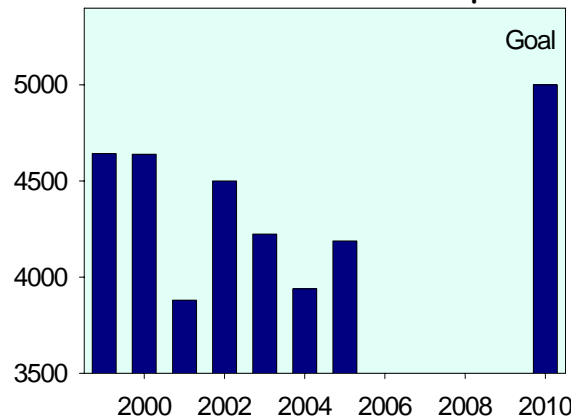
# RESPONSES TO THE PRESSURES ON GROUND WATER QUALITY



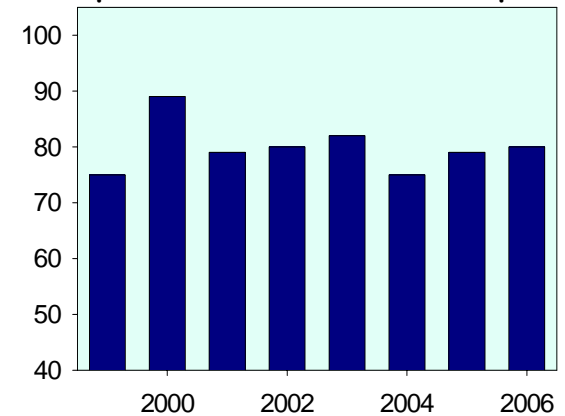
**(A) Percentage of Contaminated Sites Cleaned Up to State Standards**



**(B) Number of Licensed Hazardous Material Sites Inspected**

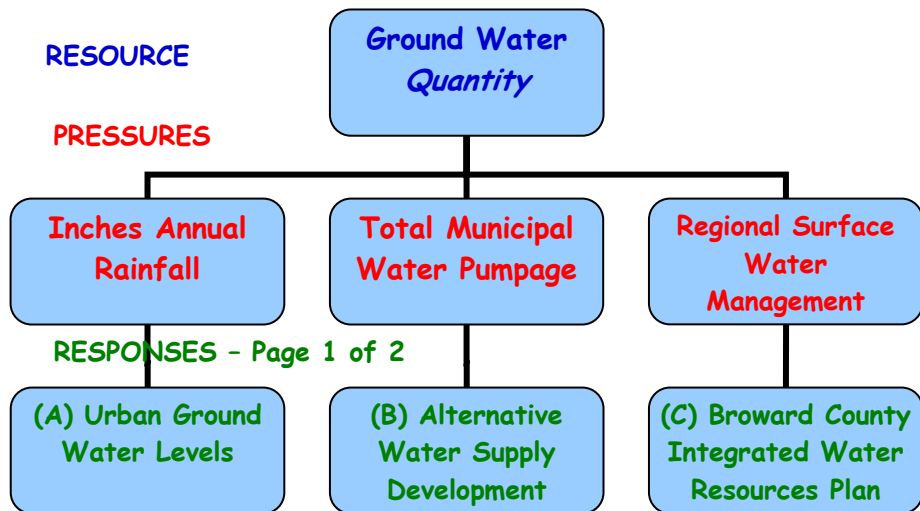


**(C) Percent Licensed Hazardous Material Sites Inspected and Found to Be in Compliance**



Endnotes for Ground Water Quality Response benchmarks may be found on pages 70-72.

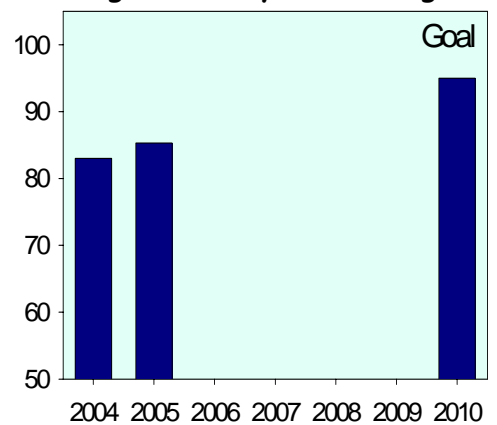
# RESPONSES TO PRESSURES ON GROUND WATER QUANTITY



**(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 full endnote on page 72.

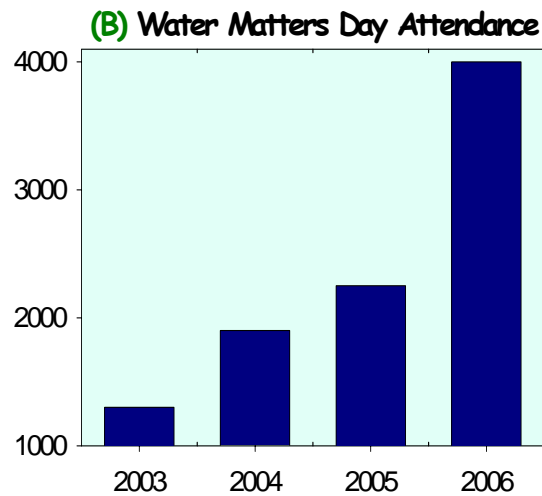
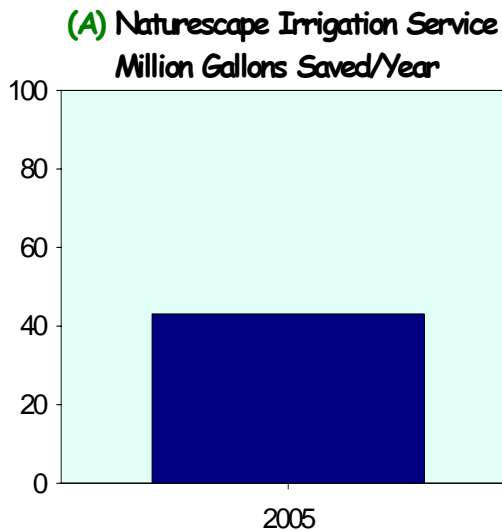
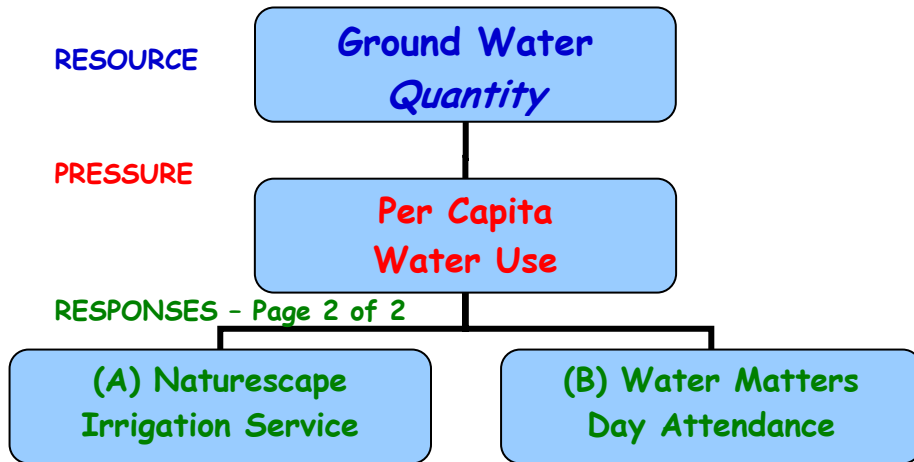
**(B) Alternative Water Supply Development** - Broward County will need a source of water to deliver an additional 100 million gallons of water each day to meet water demands projected for 2025. Due to the pressing need to reduce urban reliance on the Everglades system as a source of water, future water 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 72.

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



Endnotes for Ground Water Quantity Response benchmarks may be found on pages 72-75.

# RESPONSES TO PRESSURES ON GROUND WATER QUANTITY

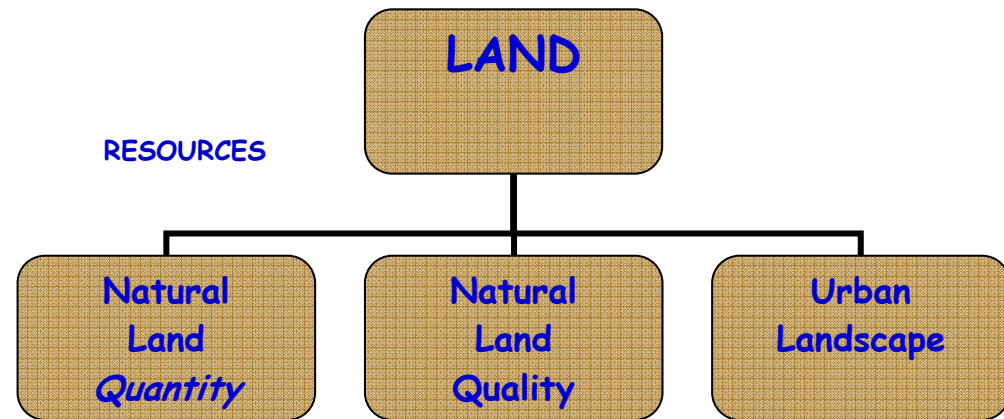


Endnotes for Ground Water Quantity Response benchmarks may be found on pages 72-75.

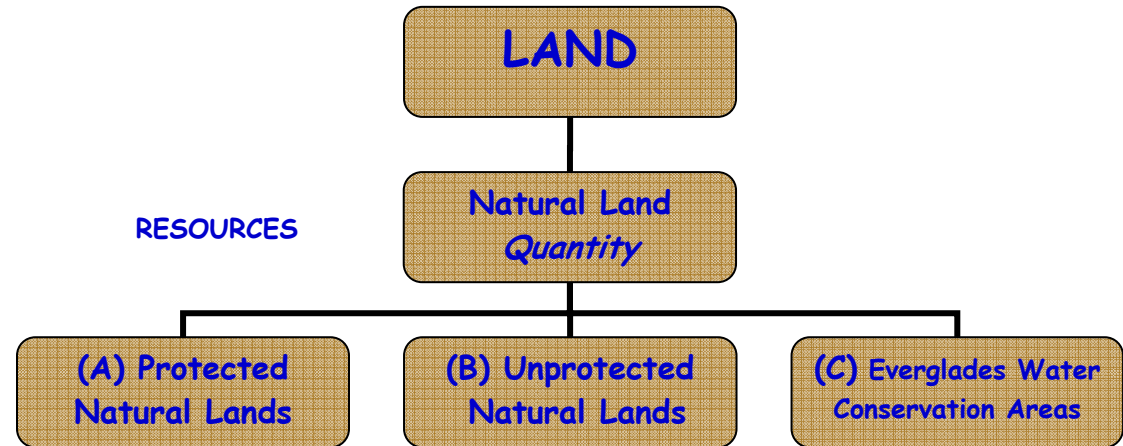


# LAND RESOURCES

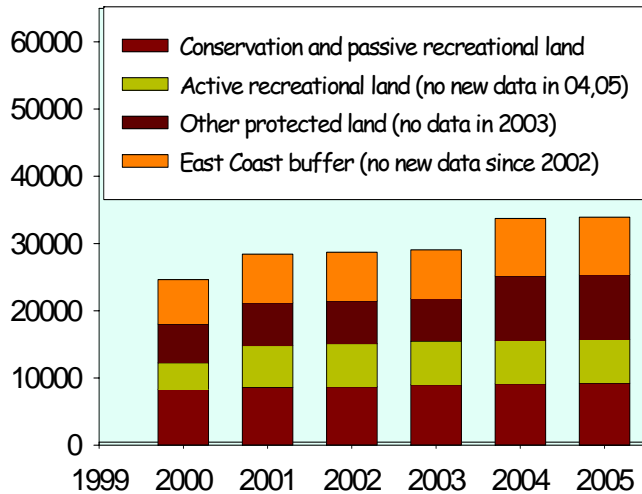
**Land Resources** - Our critical land resources include natural areas which preserve habitat (Quantity), the extent to which those lands reflect indigenous Florida plants and animals (Quality) and the urban landscape. This last resource encompasses how public and private entities create human and natural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



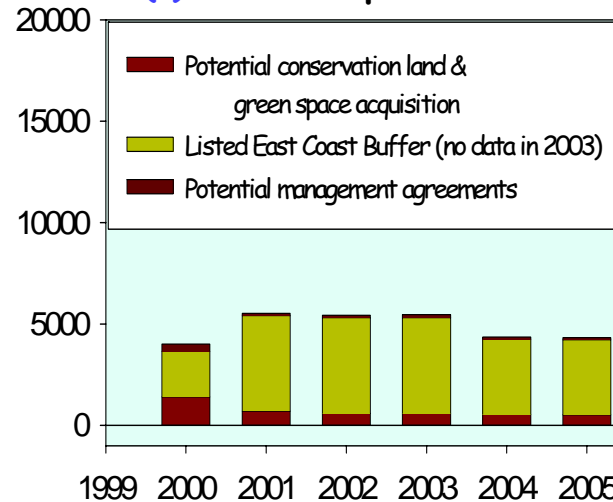
# LAND RESOURCES - Natural Land *Quantity*



**(A) Acres of Protection Lands**



**(B) Acres of Unprotected Land**



**(C) Everglades Water Conservation Area -**

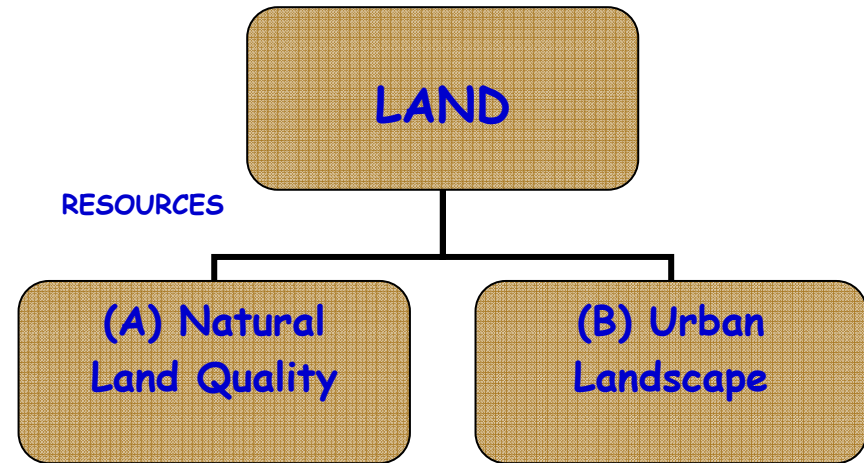
Approximately two-thirds of Broward County lands exist as Water Conservation Areas (WCA's) in the Everglades. Four WCA's serve as a buffer between developed regions and the Everglades while providing wetland habitat. To learn more about WCAs, see the endnotes on page 76.

Endnotes for the Land Quantity Resource benchmarks are on pages 76-77.



# LAND RESOURCES - Natural Quality and Urban Landscape

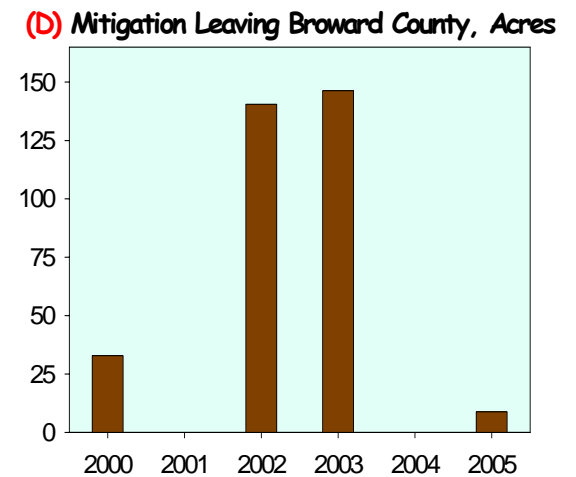
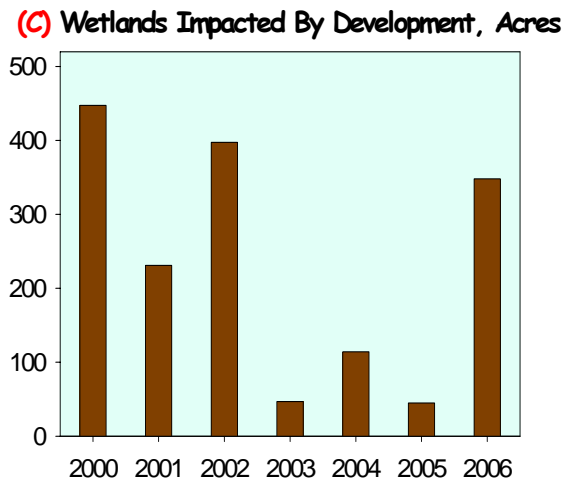
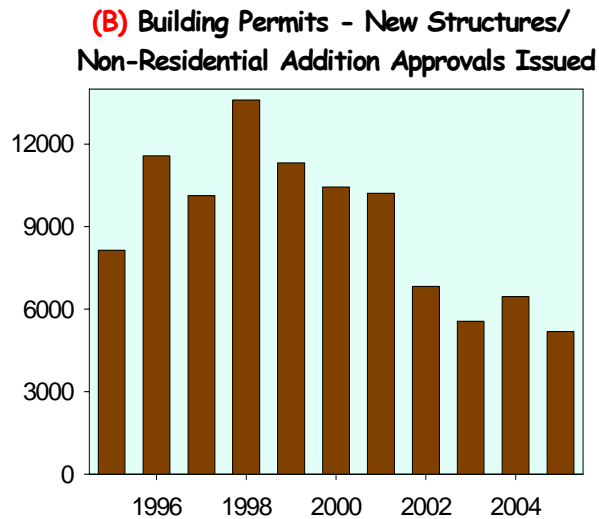
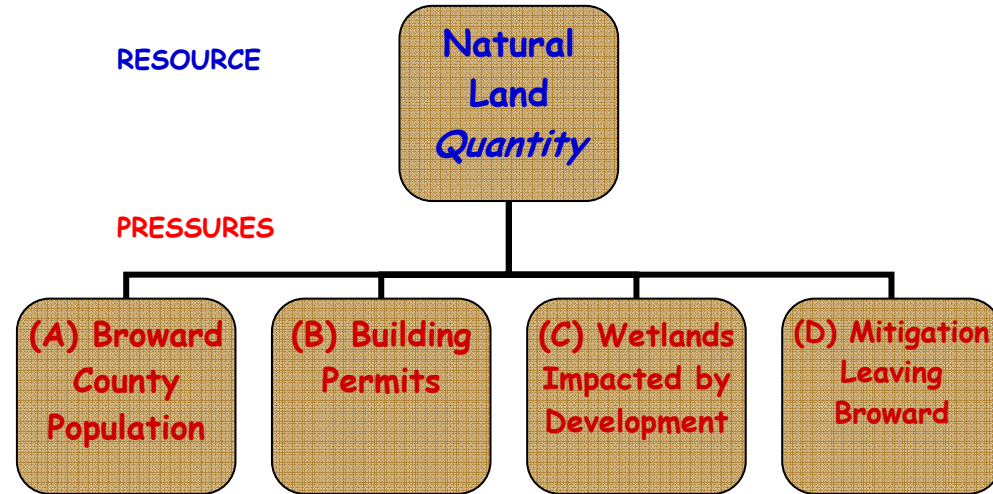
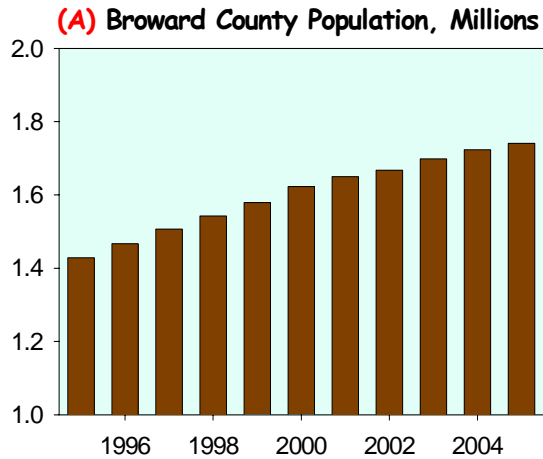
**(A) Natural Lands Quality** - Broward County Parks and Recreation Division manages over 3,200 acres of lands preserved for their natural flora and fauna. Assessment of the "ecological health" of these natural areas is difficult. Many issues related to exotic species, hydrology and urban pressures influence the quality of these lands. To learn more about these issues, see the endnotes on page 77.



**(B) Urban Landscape** - The trees in the median, the sod in the swales, and the flowers in your garden all contribute to the urban landscape. Trees and plants bring both an aesthetic and ecological value to our living space if they are chosen and located properly. To learn more, see the endnotes on page 77.

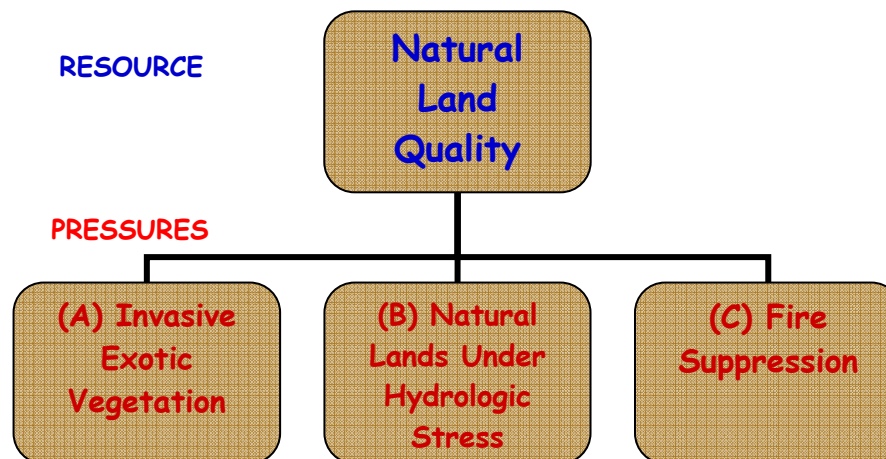


# PRESSURES ON LAND QUANTITY



Endnotes for the Land Quantity Pressures benchmarks are on pages 78-79.

# PRESSURES ON 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 79.

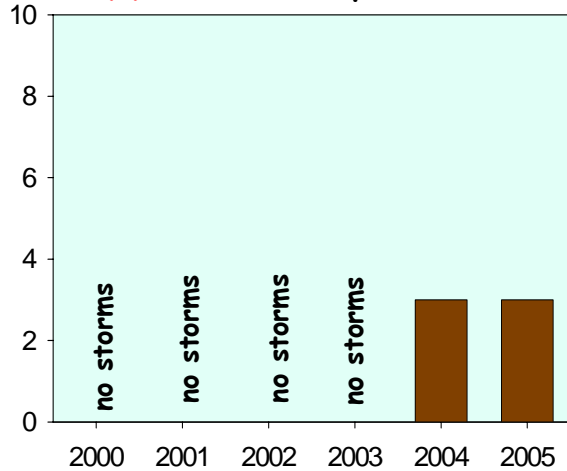
**(B) Natural Lands Under Hydrologic Stress** - Many natural wetland areas in Broward County have been altered by historical development and drainage practices. The construction of the canal systems altered the groundwater level. While this provided flood protection for residents, it also impacted wetlands by depressing water levels necessary for maintaining wetland plant species. To learn more, see the endnotes on page 80.

**(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 80.



# PRESSURES ON URBAN LANDSCAPE

**(A) Number of Tropical Storms**



RESOURCE

Urban Landscape

PRESSURES

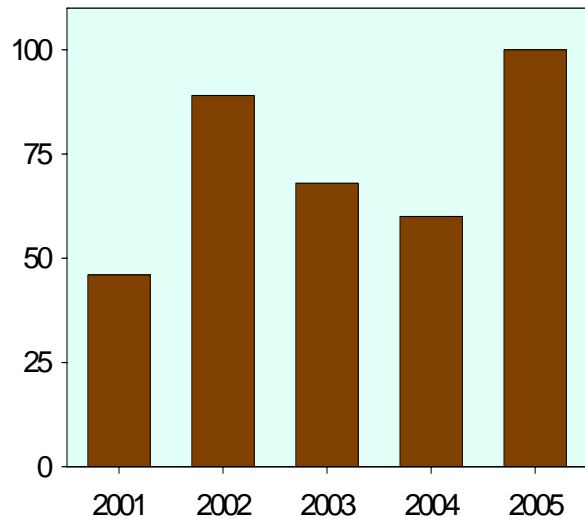
(A) Tropical Storms

(B) Tree Related Complaints

(C) Reduction Of Wildlife Habitat

(D) Trees Removed for Development

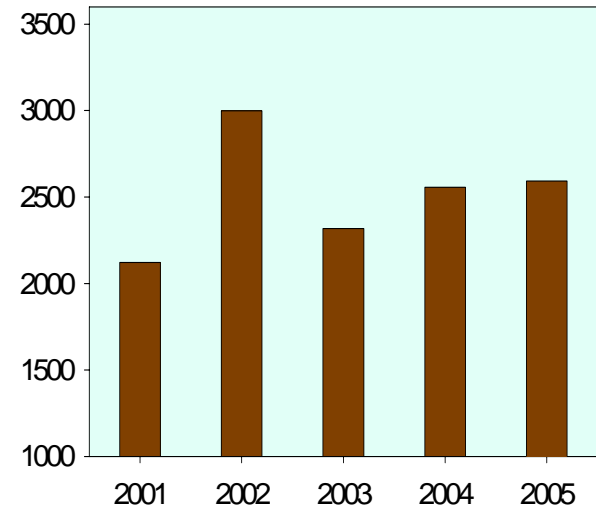
**(B) Number of Tree Related Complaints**



**(C) 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 81.

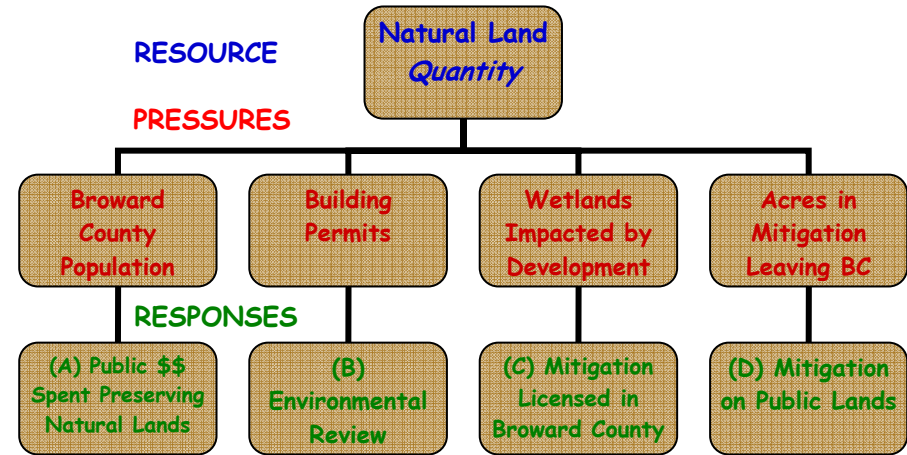
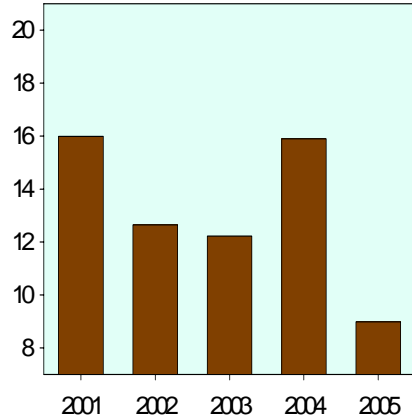
**(D) Number of Trees Licensed for Removal**



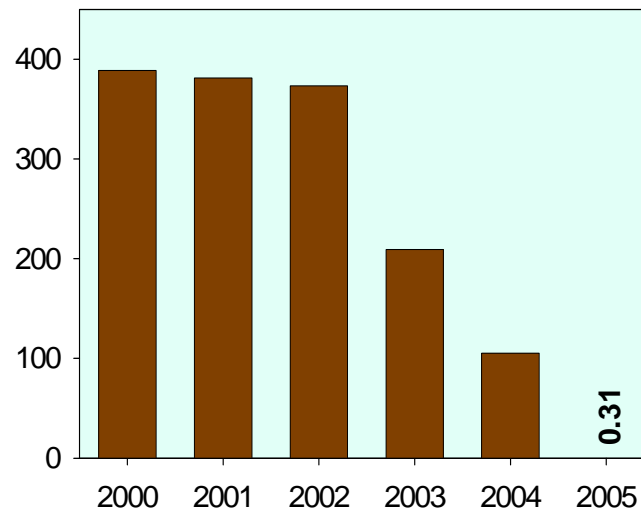
Endnotes for the Urban Landscape Pressure benchmarks are on pages 80-82.

# RESPONSES TO THE PRESSURES ON LAND QUANTITY

(A) Public Dollars Spent to Preserve Natural Lands, Millions



(C) Acres of Mitigation Licensed



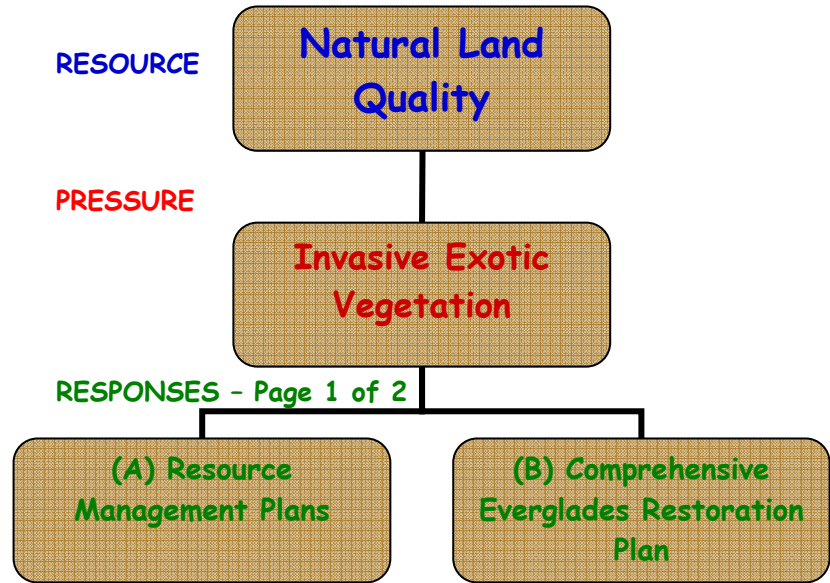
**(B) Environmental Review**  
 - All large scale developments are reviewed to ensure proper land use and to protect natural land resources from impacts. Wetland permitting ensures that mitigation for impacts is kept within Broward. For more information, see the endnotes on page 82.

**(D) Acres of 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 83.

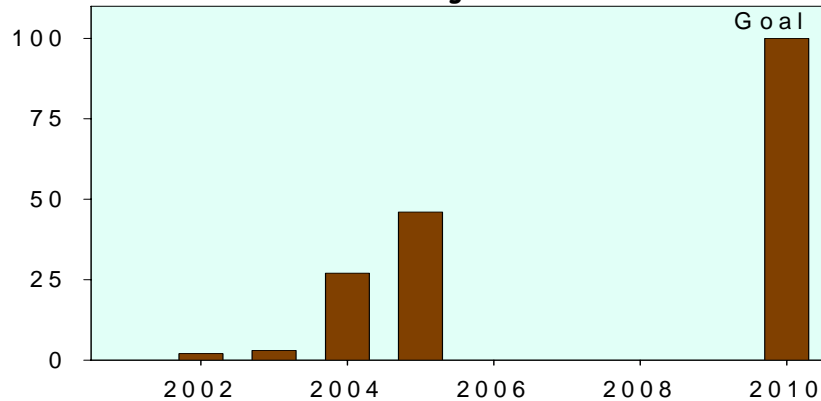
Endnotes for the Land Quantity Response benchmarks are on pages 82-83.

# RESPONSES TO THE PRESSURES ON LAND QUALITY

**(A) 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 83.



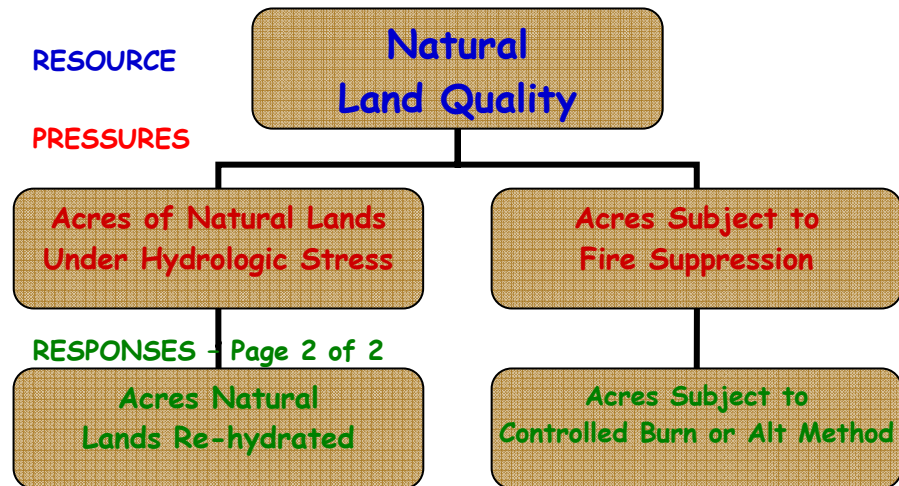
**(A) Percent of Municipal Natural Land Sites with Management Plans**



**(B) 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 84.

Endnotes for the Land Quality Response benchmarks are on page 84-85.

# RESPONSES TO THE PRESSURES ON 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 some of the damaged wetlands. Pumps are been installed to increase water flow to the wetlands and raise groundwater levels to support native wetland plants. To learn more, read the endnote on page 84.

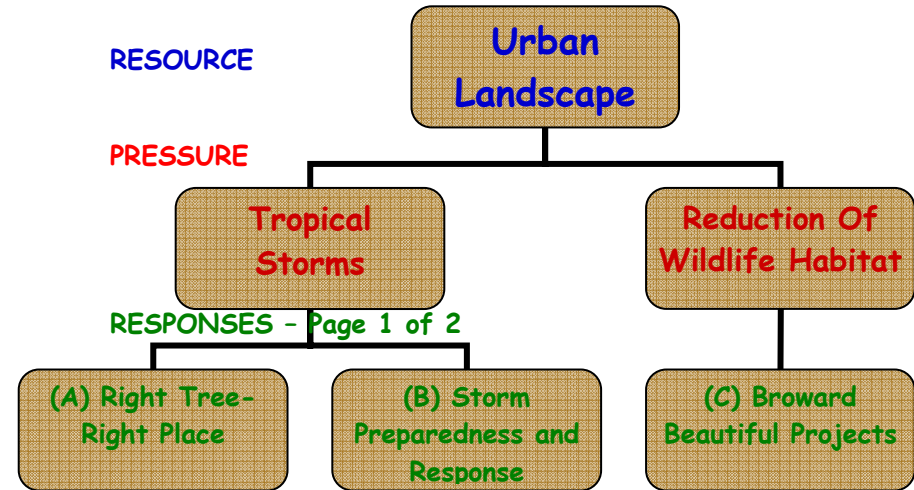


**Acres Subject to Controlled Burn or Alternative Management Method** - Prescribed burning accomplishes many land management objectives including reducing the risk of wildfires while recycling nutrients into the soil. Native fire-tolerant species, including wildflowers and grasses, become established in open areas created by fires thus increasing the overall diversity of the plant community. To learn more, read the endnote on page 85.

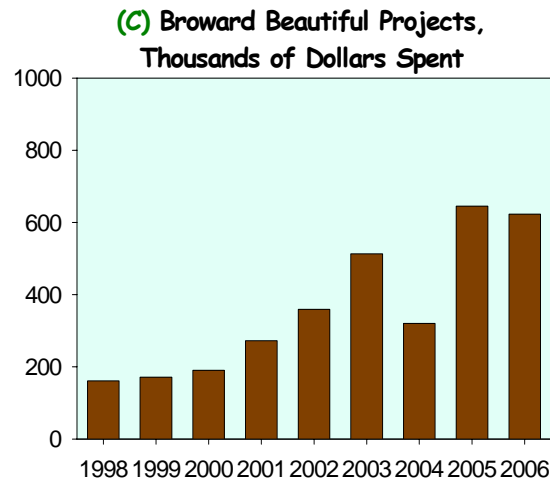


# RESPONSES TO THE PRESSURES ON URBAN LANDSCAPE

**(A) Public Education - Right Tree Right Place** - In response to urban forestry issues following Hurricane Wilma, the Broward County Environmental Protection 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 85.



**(B) 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 86.



Endnotes for the Urban Landscape Response benchmarks are on pages 85-89.

# RESPONSES TO THE PRESSURES ON URBAN LANDSCAPE

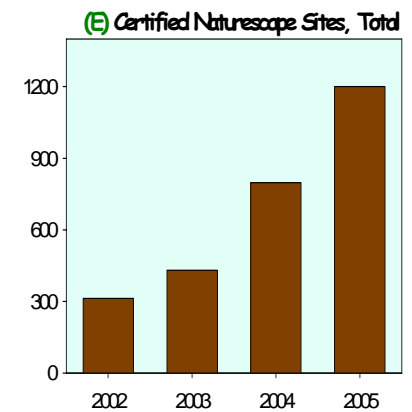
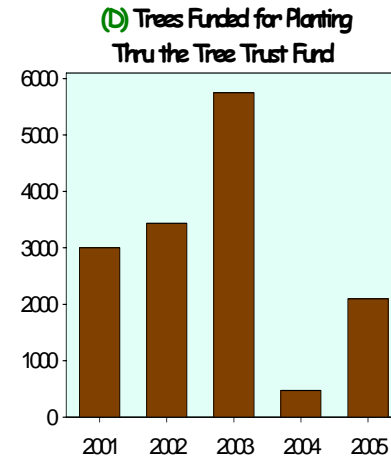
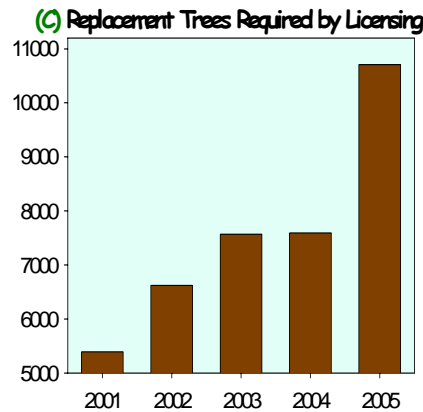
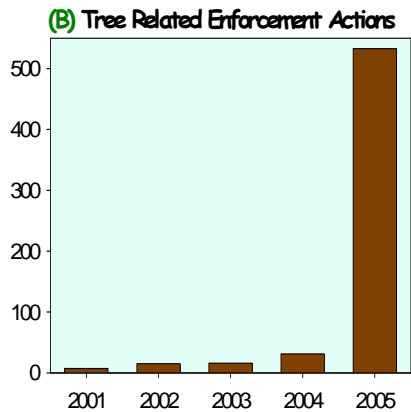
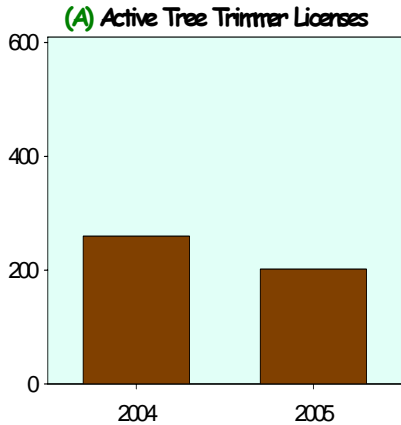
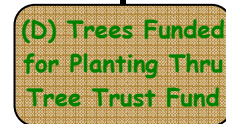
RESOURCE



PRESSURES

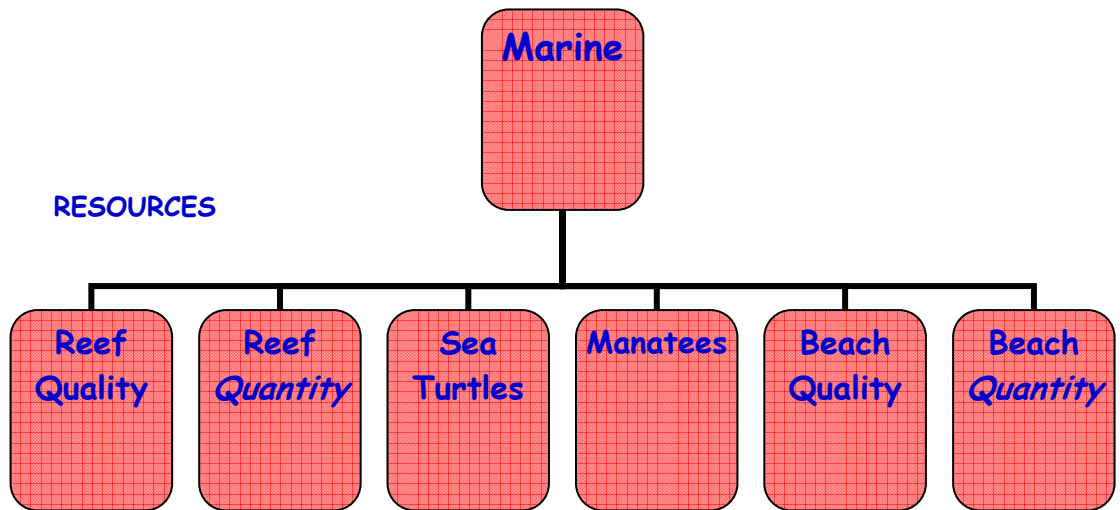


RESPONSES - Page 2 of 2



Endnotes for the Urban Landscape Response benchmarks are on pages 85-89.

# MARINE RESOURCES

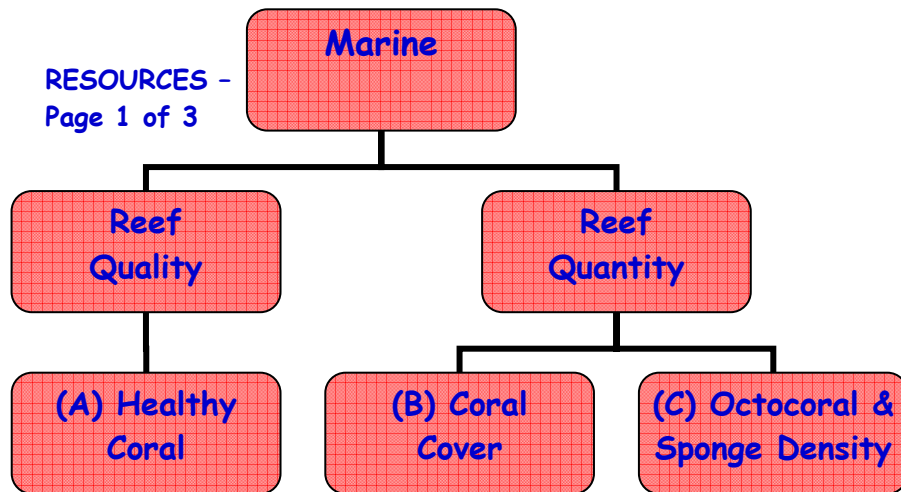


**Marine Resources** - The coastal environmental of Broward County is a major contributor to our quality of life and our economy. The beach and coral reefs provide natural habitat, tourism destinations and protection from storms. These marine resources include the endangered sea turtles and manatees.



# MARINE RESOURCES - Reefs

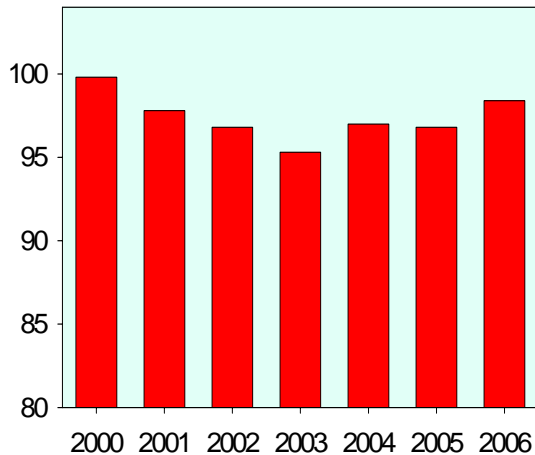
RESOURCES -  
Page 1 of 3



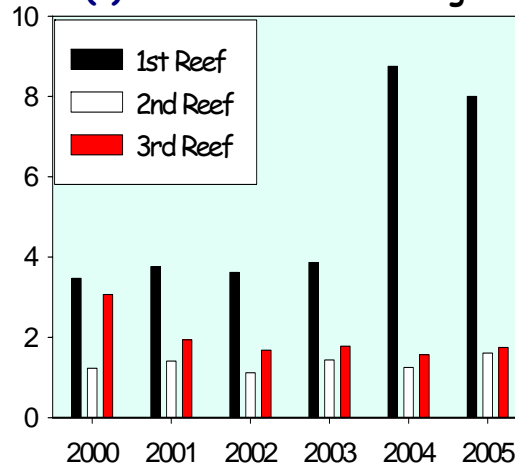
**Coral Reefs** - Coral reefs and their associated sea life are important natural resources for recreational fishing and diving industries in Broward County. The sound ecological condition of the reef community is a key indicator of the general condition of all marine resources of the Broward coastline.



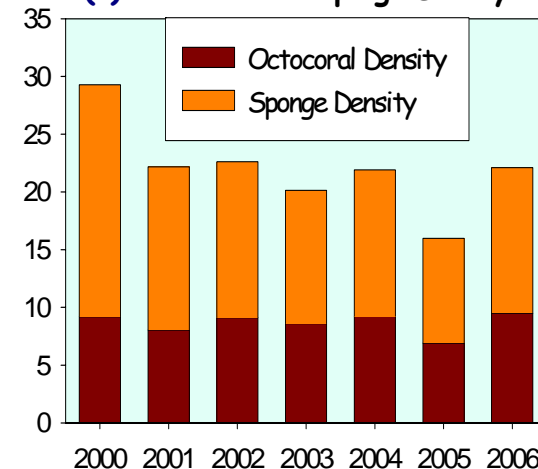
(A) Percent Healthy Coral



(B) Percent Live Coral Coverage



(C) Octocoral and Sponge Density

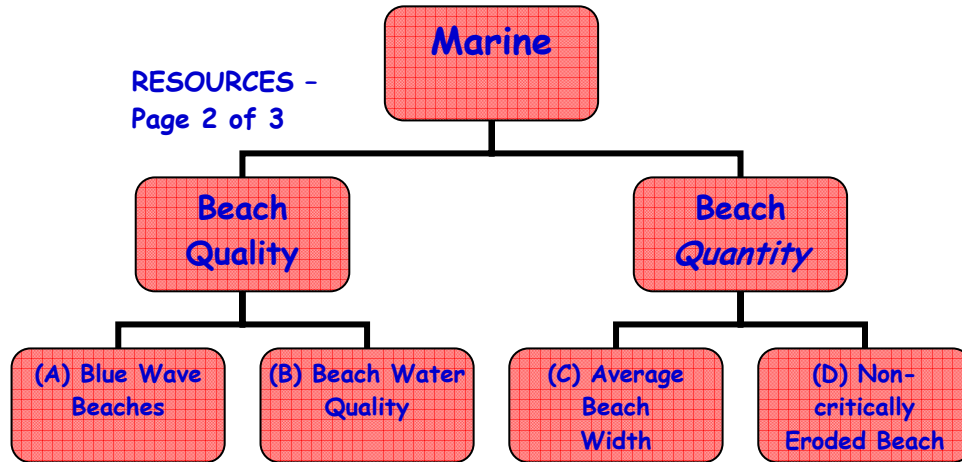


Endnotes for the Reef Resource benchmarks are on pages 89-90.



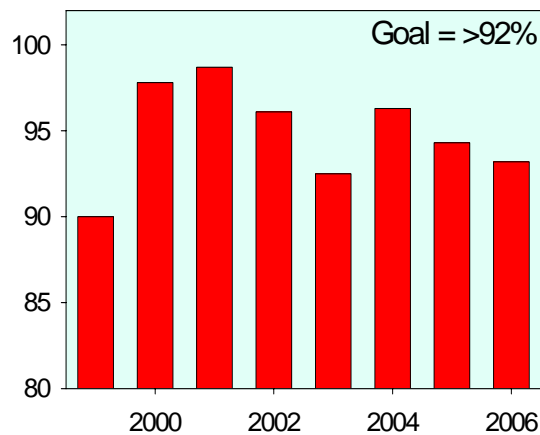
# MARINE RESOURCES- Beach

RESOURCES -  
Page 2 of 3

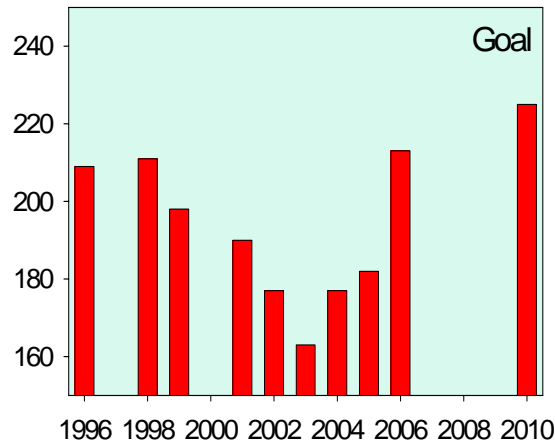


**(A) Blue Wave Beaches** - To encourage the preservation of America's beaches, the Clean Beaches Council developed the "Blue Wave" certification. Five of Broward's beaches have met the Blue Wave Beach criteria for water quality, cleanliness, safety, services and maintenance, conservation efforts, warning and information systems and management of erosion. To learn more, read the endnote on page 90.

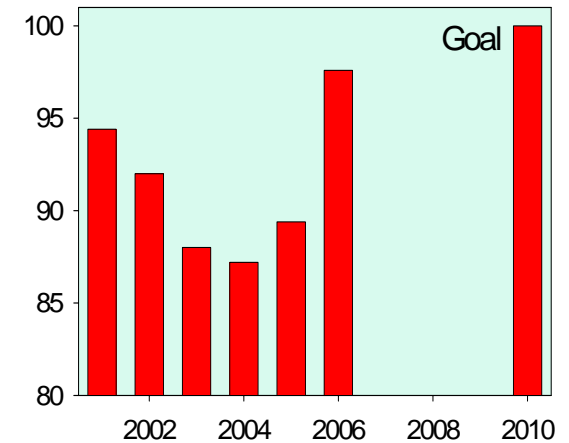
**(B) Percent of Beach Water Quality Results Rated "Good"**



**(C) Average Beach Width at High Tide, Feet**



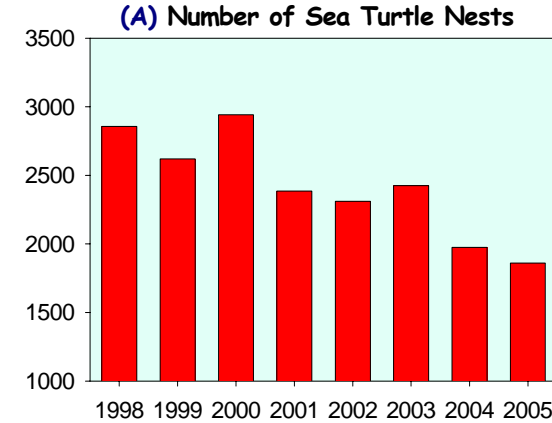
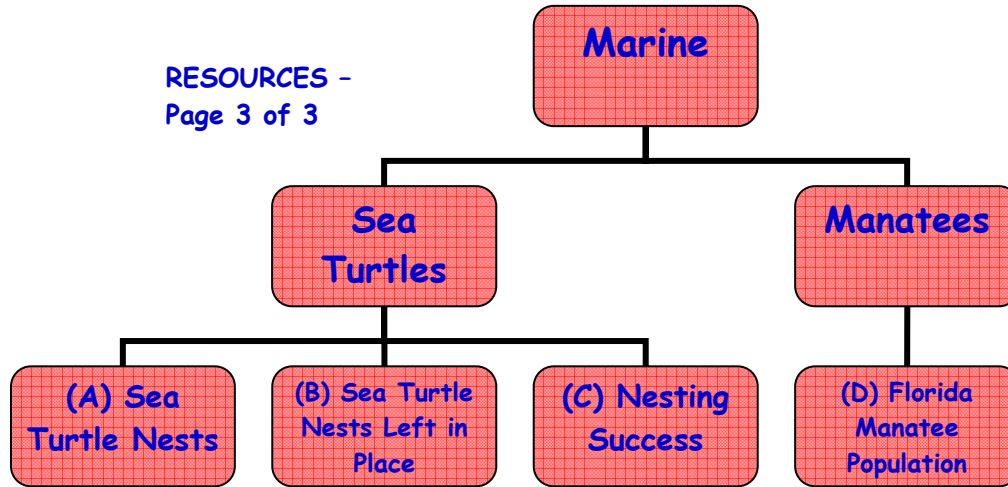
**(D) Percent of Non-critically Eroded Beaches**



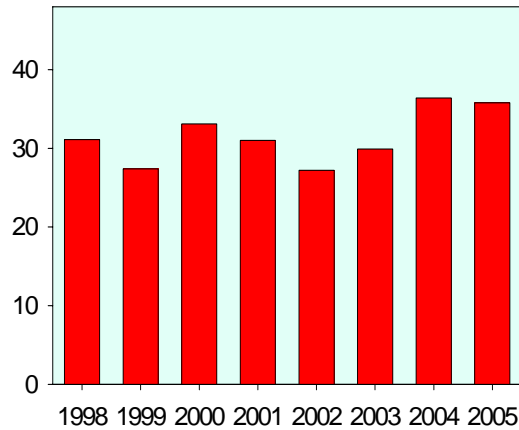
Endnotes for the Beach Resource benchmarks are on pages 90-92.

# MARINE RESOURCES- Wildlife

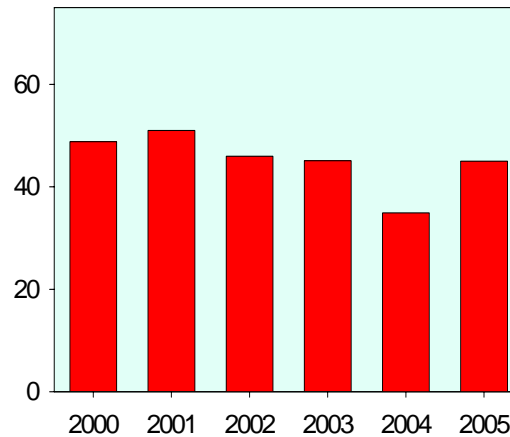
RESOURCES -  
Page 3 of 3



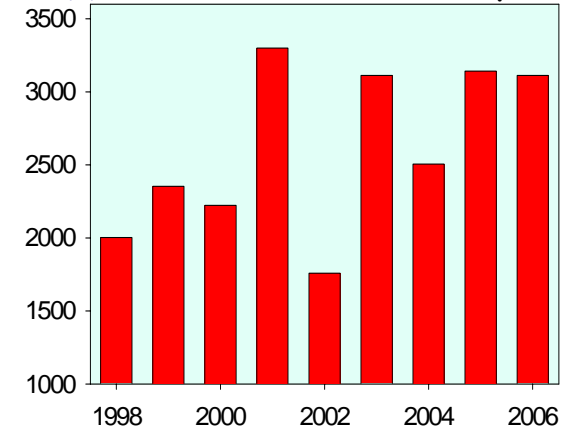
**(B) Percent of Surveyed Nests Left in Place**



**(C) Percent Nesting Success**

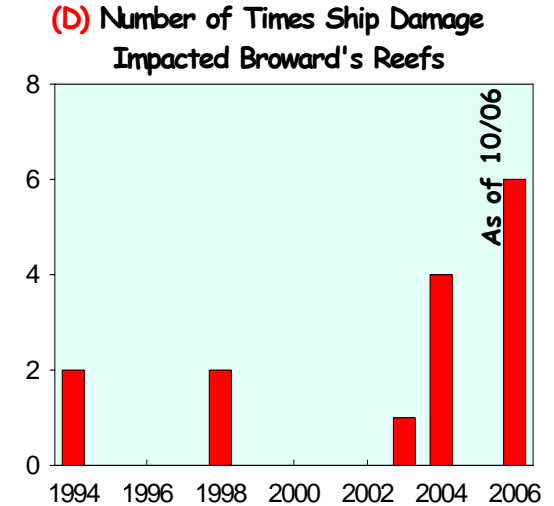
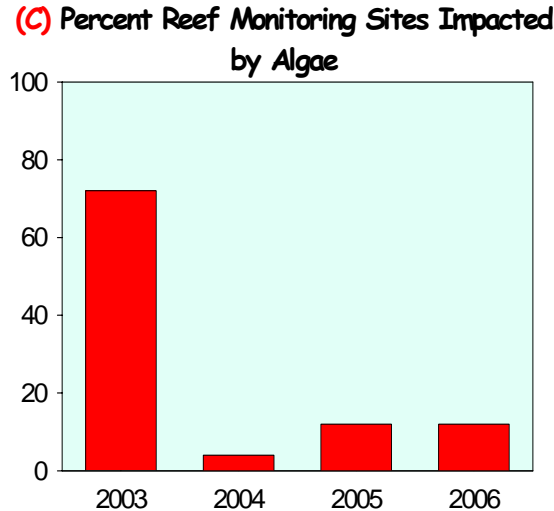
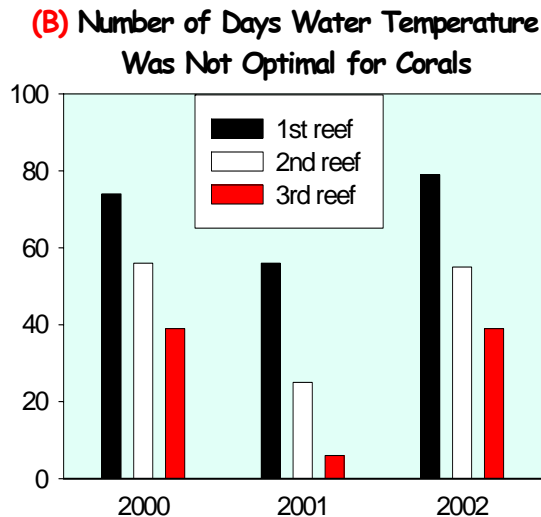
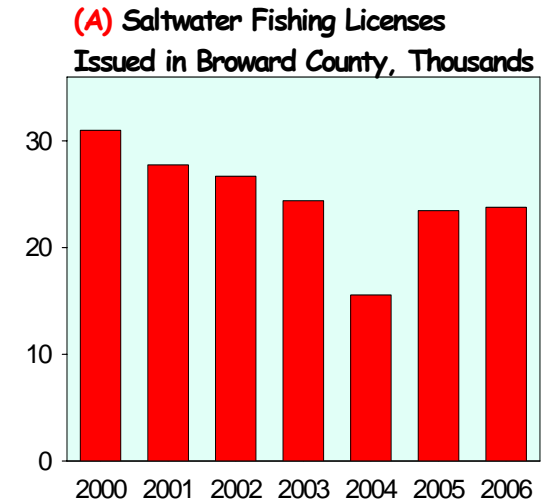
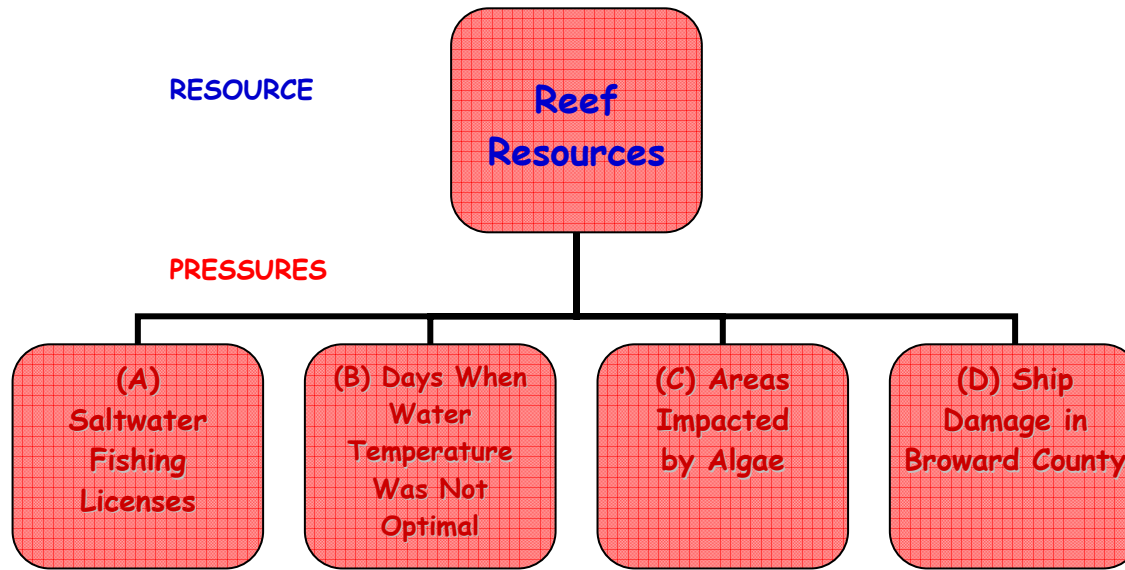


**(D) Florida West Indian Manatee Population**



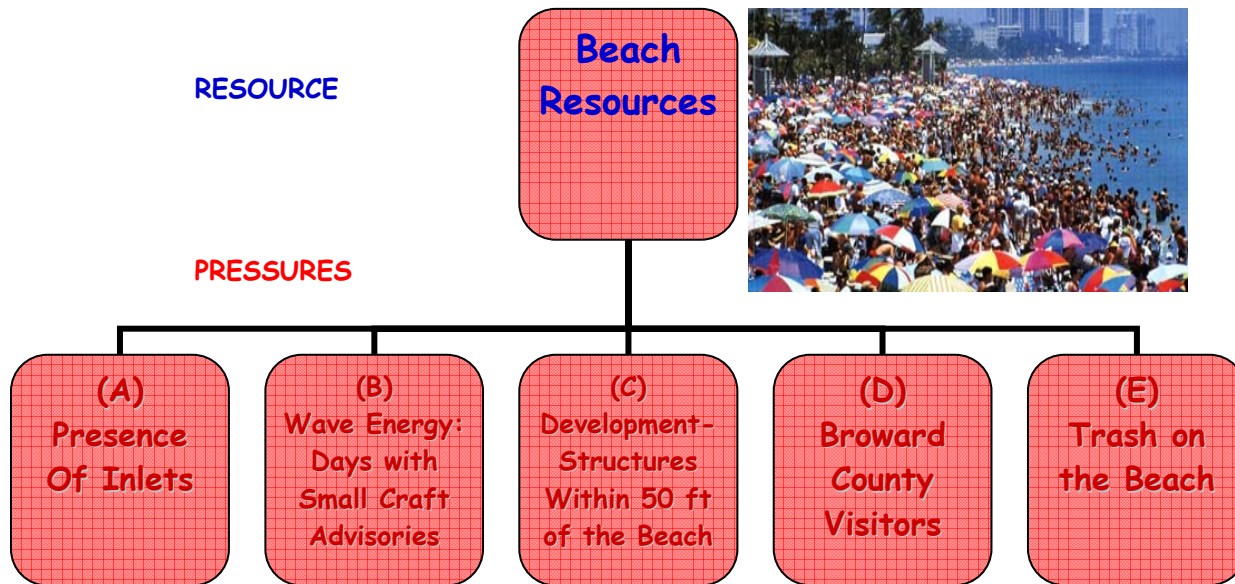
Endnotes for the Marine Wildlife Resource benchmarks are on pages 92-93.

# PRESSURES ON REEF RESOURCES



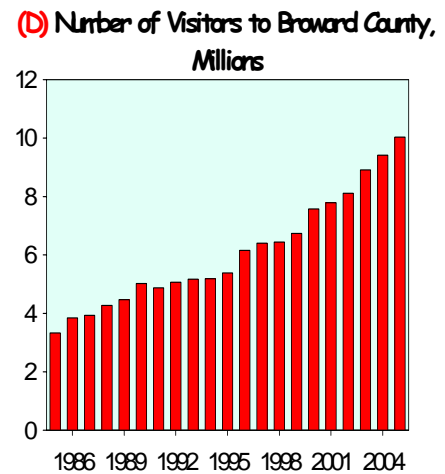
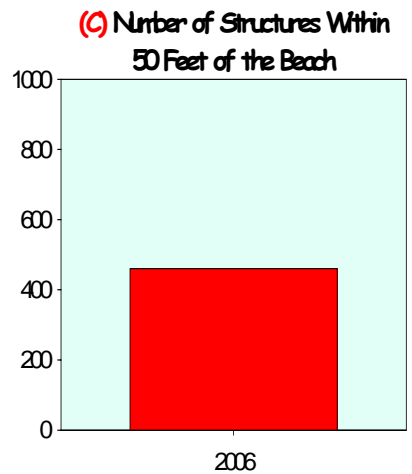
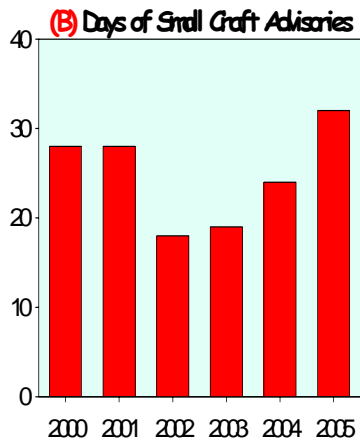
Endnotes for the Reef Resource Pressure benchmarks are on pages 94-97.

# PRESSURES ON BEACH RESOURCES



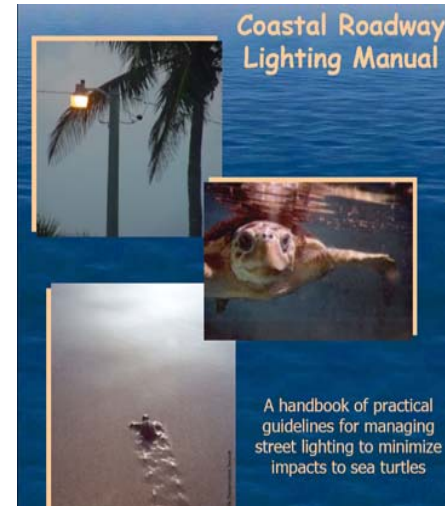
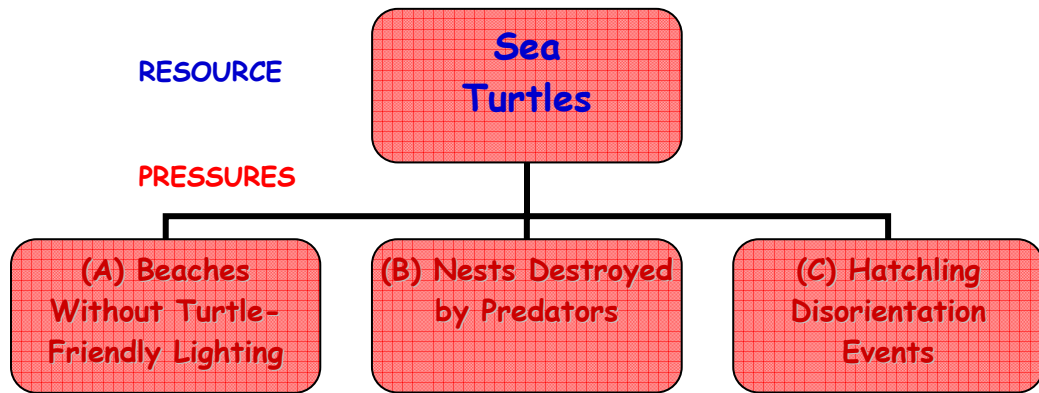
**(A) Presence of Inlets**  
 - Inlets, composed of jetties and dredged channels, interrupt the movement of sand, causing buildup to the north and erosion to the south of the channel. To learn more, read the endnote on page 97.

**(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 99.

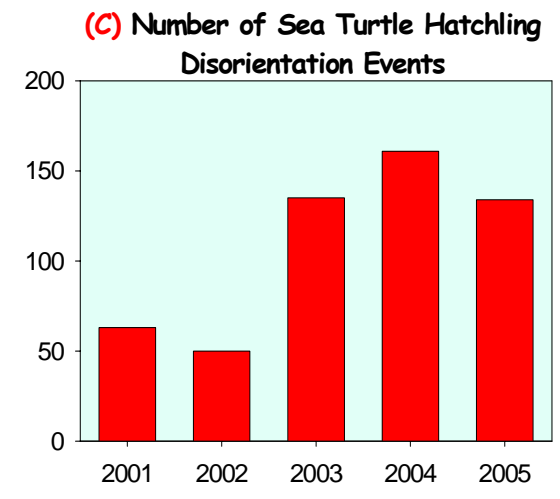
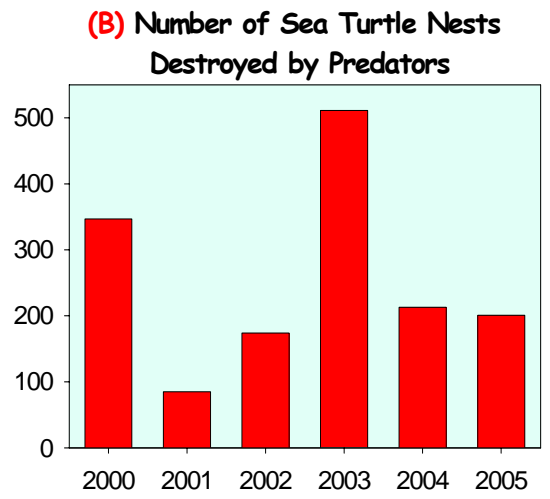


Endnotes for the Beach Resource Pressure benchmarks are on pages 97-99.

# PRESSURES ON MARINE WILDLIFE

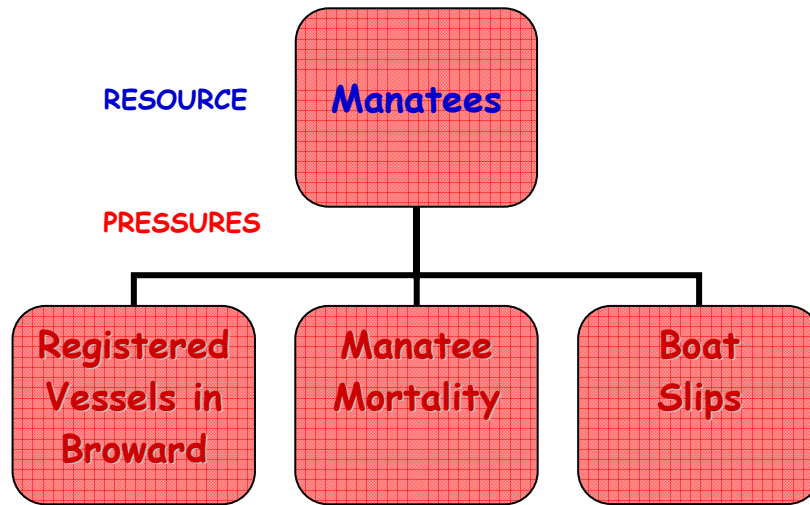


**(A) Beaches Without Turtle-Friendly Lighting** - Even active enforcement of lighting ordinance enacted in 5 of the 8 coastal municipalities in Broward County has not resulted in enough light reduction to have areas of the beach considered "turtle friendly". To learn more, read the endnote on page 99.

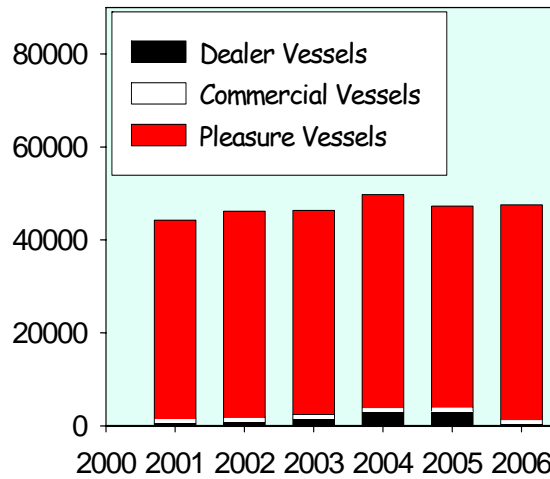


Endnotes for the Marine Wildlife Pressure benchmarks are on pages 99-102.

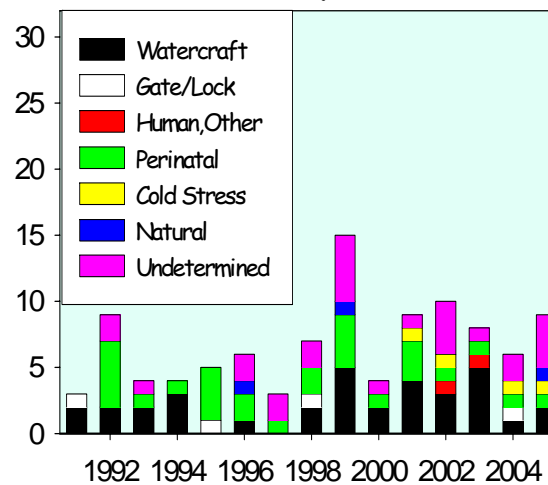
# PRESSURES ON MARINE WILDLIFE



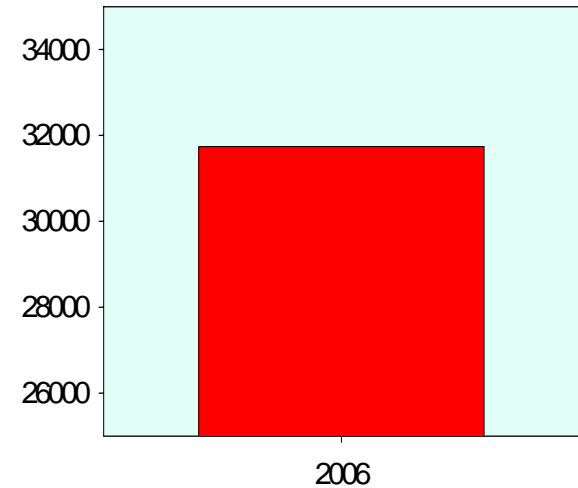
**(A) Numbers of Vessels Registered in Broward County**



**(B) Manatee Mortality in Broward County**



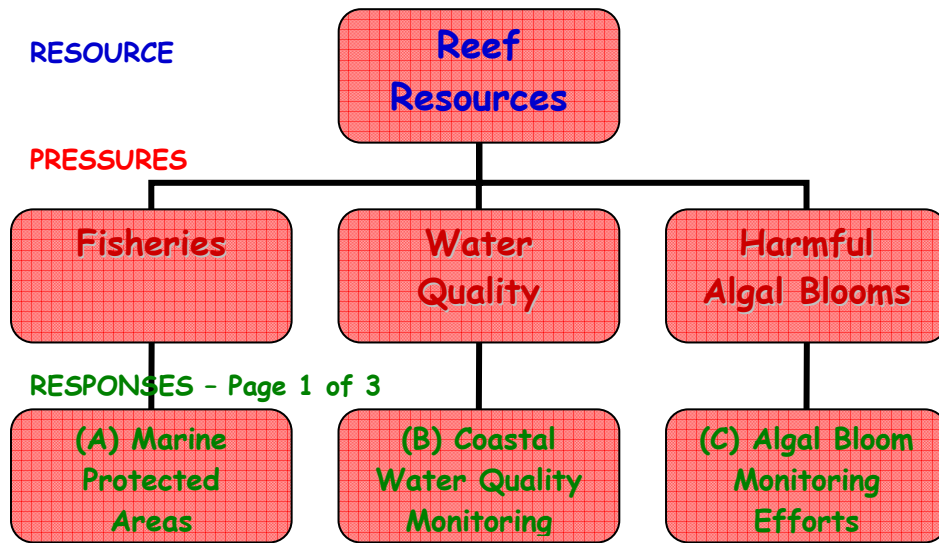
**(C) Number of Boat Slips in Broward County**



Endnotes for the Marine Wildlife Pressure benchmarks are on pages 99-102.



# RESPONSES TO THE 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. MPAs are a tool that could be used to preserve Broward's reefs. To learn more, read the endnotes on page 102.

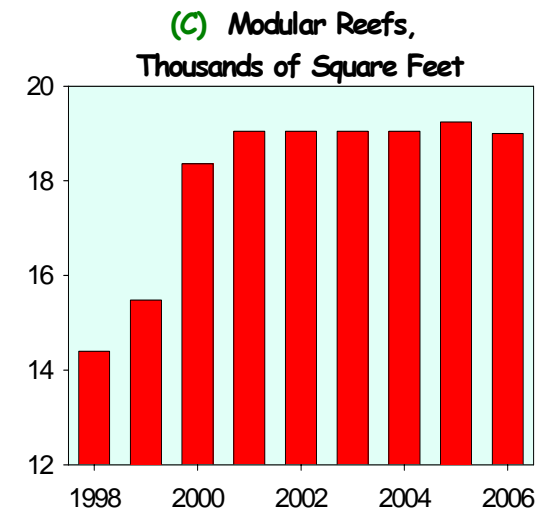
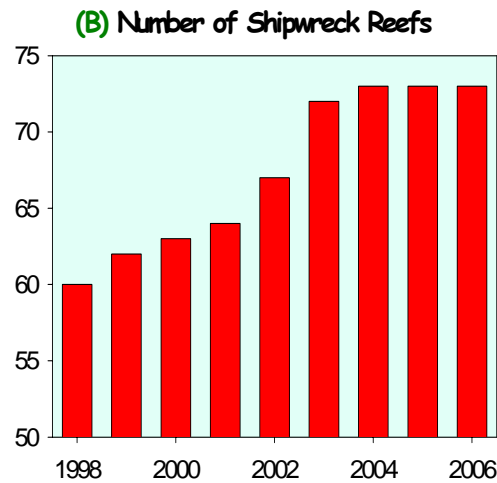
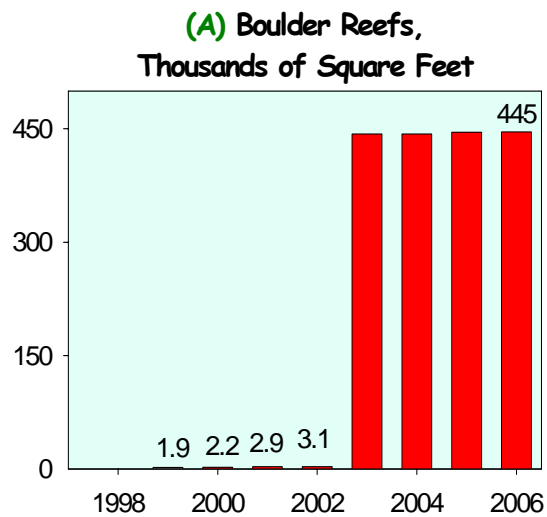
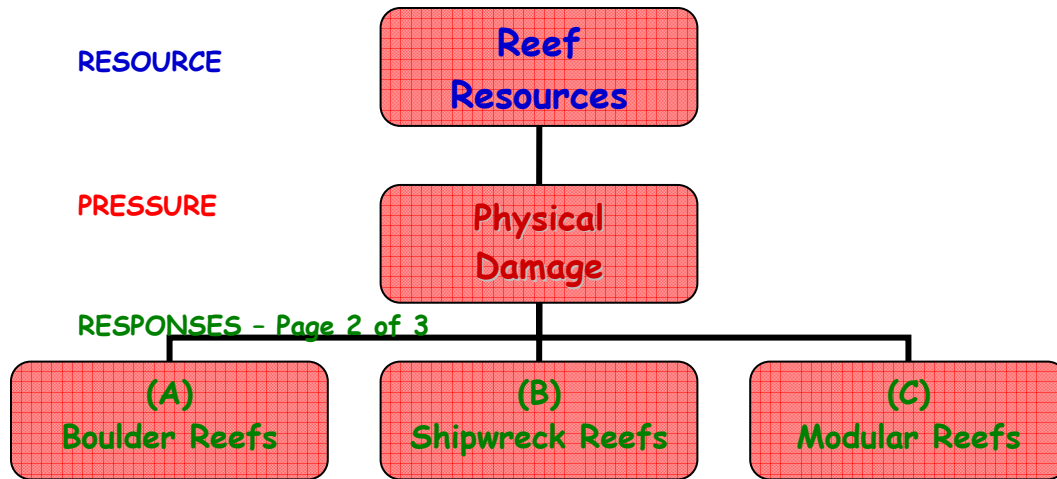
**(B) Coastal Water Quality Monitoring** - Broward County has initiated a Coastal Water Quality Monitoring Program to generate baseline data to better understand how stormwater flows from inlets and other discharges influence the water quality reaching our reefs. Currently four sites are monitored including one at the mouth of Port Everglades. To learn more, read the endnotes on page 102.

**(C) Algal Bloom Monitoring Efforts** - Twenty five sites of Broward County are monitored regularly for the presence of algal blooms. To learn more, read the endnotes on page 103.



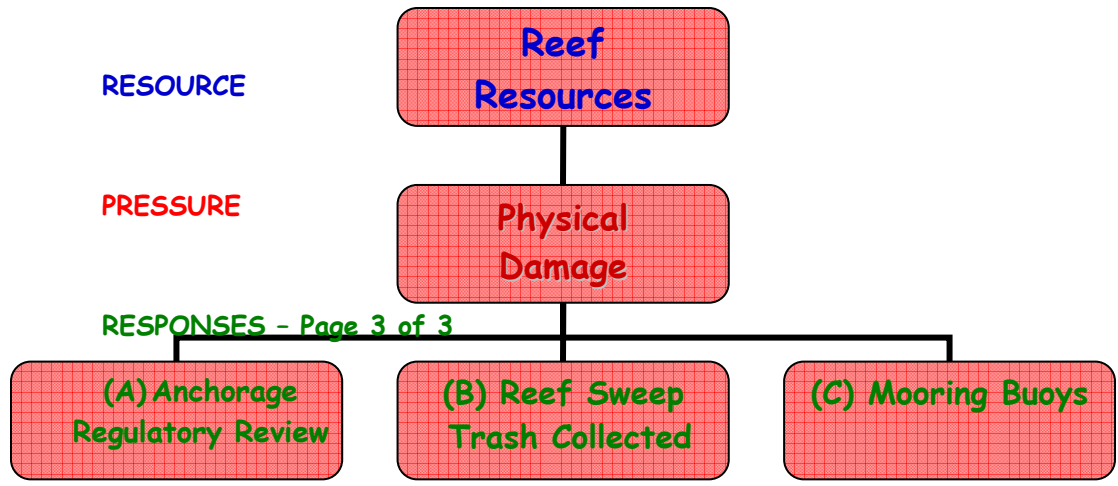


# RESPONSES TO THE PRESSURES ON REEF RESOURCES



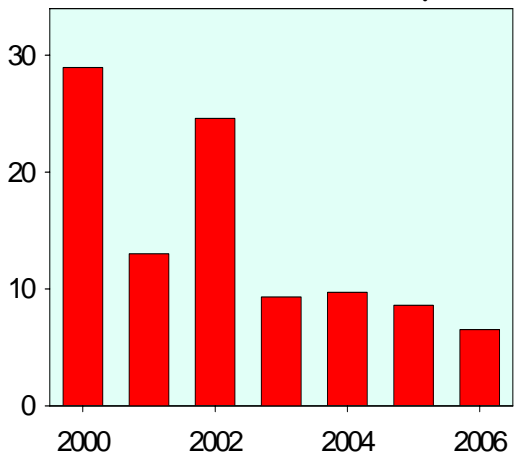
Endnotes for the Reef Resource Response benchmarks are on pages 103-104.

# RESPONSES TO THE PRESSURES ON REEF RESOURCES

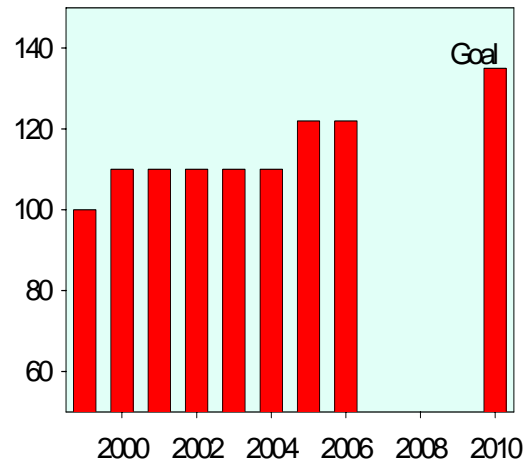


**(A) Anchorage Regulatory Review** - Following numerous ship groundings on the reefs, Broward County staff requested that the Coast Guard review the current location and extent of the ship anchorage outside of Port Everglades. A change in the boundaries could provide greater protection of Broward's reef resources. To learn more, read the endnote on page 104.

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

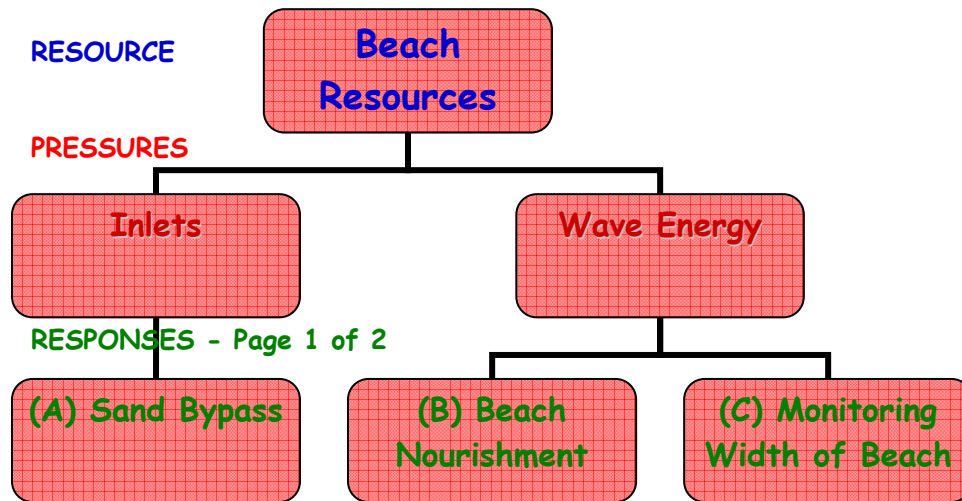


**(C) Number of Mooring Buoys**



Endnotes for the Reef Resource Response benchmarks are on pages 102-105.

# RESPONSES TO THE PRESSURES ON BEACH RESOURCES

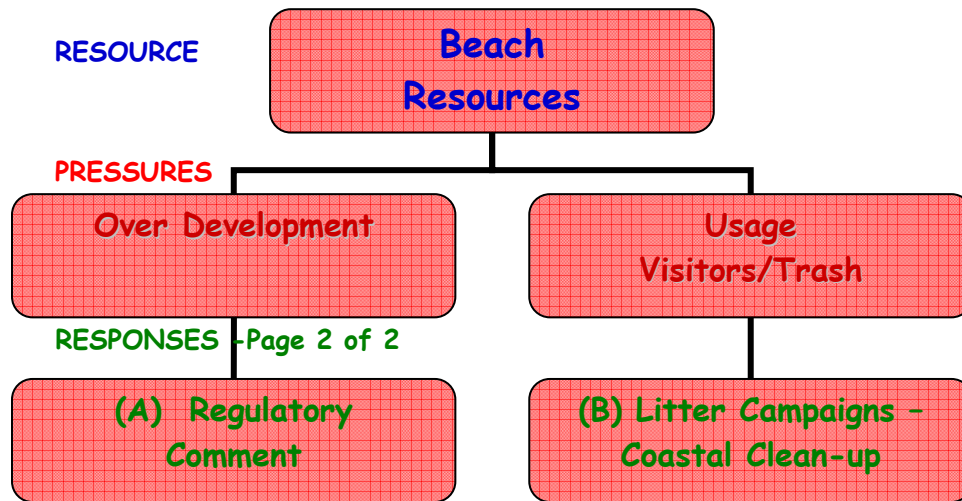


**(A) Sand Bypass** - Sand bypassing is conducted to reduce erosion of beaches which are impacted by stabilized inlets like Port Everglades. Sand bypassing captures sand which accumulates on the updrift side of a stabilized inlet or might be lost into the channel and mechanically move the sand to the downdrift side. To learn more, read the endnotes on page 105.

**(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 105.

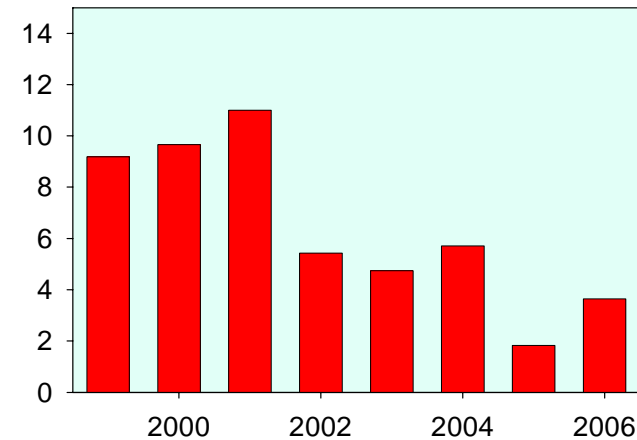
**(C) Monitoring the Condition of the Beach** - Monitoring the condition of the beach is essential to understanding how the beach behaves. Monitoring includes regular surveys of the extent and elevation of the sand. Aerial photos are often used for this purpose. To learn more, read the endnotes on page 106.

# RESPONSES TO THE 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 106.

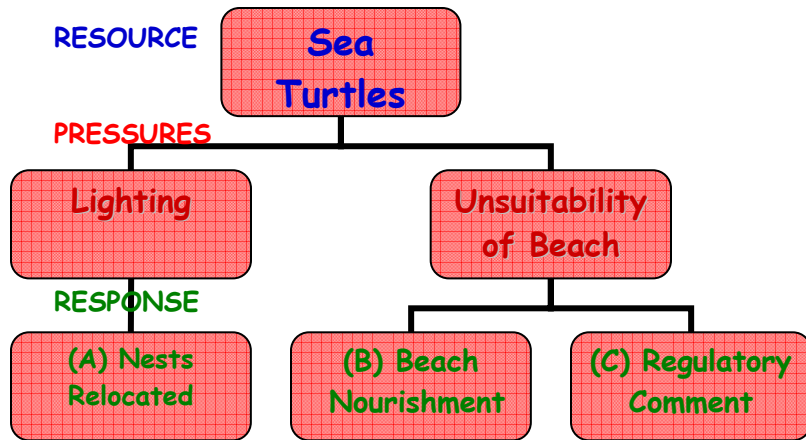
**(B) Litter Clean-up Campaigns, Pounds of Litter Collected/Participant/Event**



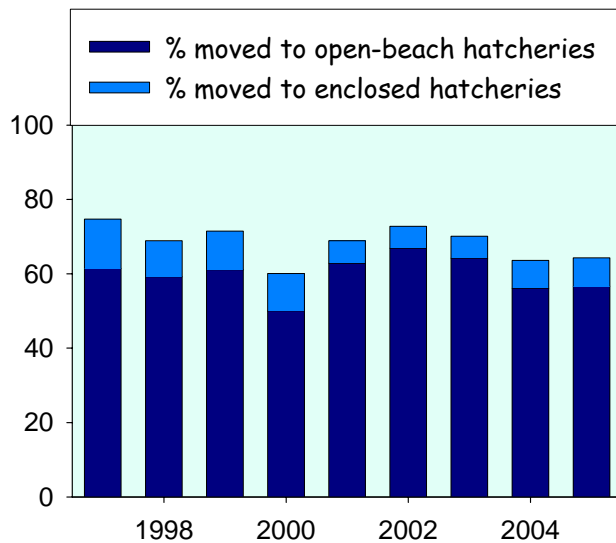
Endnotes for the Beach Resource Response benchmarks are on pages 105-107.



# RESPONSES TO THE PRESSURES ON MARINE WILDLIFE



**(A) Percent of Sea Turtle Nests Relocated**

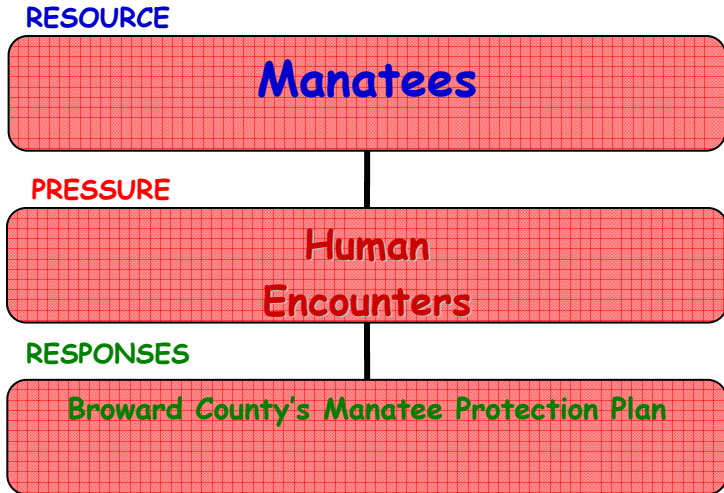


**(B) Beach Nourishment -** Adding sand to restore the historical width and slope of the beaches also serves to preserve critical nesting habitat for sea turtles. Grain size and composition of the replacement sand is important. To learn more, read the endnotes on page 105.

**(C) 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 106.

Endnotes for the Marine Wildlife Response benchmarks are on pages 107-108.

# RESPONSES TO THE PRESSURES ON MARINE WILDLIFE



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

**Manatee Protection** - The Broward County Biological Resources Division has 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 elements of the Plan were approved by the Broward County Commission in 1992 and were adopted into the Broward County Comprehensive Plan in 2001. 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 Biological Resources Division website. For more information, see the endnotes on page 108.

# ENDNOTES

## OUR 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 of that day. The Air Quality Division monitors sites through Broward County (site map at [www.broward.org/air/monitoring.htm](http://www.broward.org/air/monitoring.htm)) for a variety of different pollutants used to determine daily air quality.

**Explanation:** Poor air quality affects public health, especially children and the elderly. The United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for ozone, particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide and lead to ensure adequate public health and environmental protection. The EPA developed a national Air Quality Index (AQI) to reflect air quality on any given day. In April, 2005, Broward County with Miami-Dade and Palm Beach Counties commemorated the achievement of 10 years of formal designation as an Ozone Attainment area by the EPA. 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/](http://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 EPA's Clean Air Scientific Advisory Committee to ensure that the latest medical and health related research are considered when the NAAQS are set. As such, what may have been accepted as good air quality in previous years may no longer be considered good air quality. 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 on the AQI. Recent trends show a period of improvement in yearly ambient air quality (2001-2003) followed by a slight decrease (2004). The decrease may seem misleading but can be explained by the implementation of new air quality standards that have more stringent categories for particulate matter. Therefore, ambient air quality is not necessarily worsening; rather the new standards make it more challenging for any given day to achieve a rating of "good" on the AQI. The AQI was in the Moderate range for 37 days in 2005, the good range 321 days and 7 days were unaccounted for due to hurricane Wilma.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, Monica Pognon (954) 519 - 1476

### AVERAGE ANNUAL OZONE CONCENTRATIONS, ppm

**Measurement:** Ozone (O<sub>3</sub>) is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground level is created by a chemical reaction between oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC) in the presence of sunlight. It is measured as parts per million (ppm) and daily recorded averages were recorded.

**Explanation:** Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO<sub>x</sub> and VOC's that contribute to 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 damages the leaves of trees and other plants, reduces crop and forest yields and increases plant vulnerability to disease.

**Trends:** Over the past five years the average annual concentrations have remained relatively uniform for all years. Average annual Ozone



concentrations for the 2005 calendar year were 0.023 ppm. The 2005 average is consistent with annual averages from the last 5 years.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, Monica Pognon (954) 519 - 1476

#### **AVERAGE ANNUAL PARTICULATE CONCENTRATION ( $\mu\text{g}/\text{m}^3$ )**

**Measurement:** Particulate Matter ( $\text{PM}_{2.5}$ ) is a complex mixture of extremely small particles and liquid droplets. The size of particles is directly linked to their potential for causing health problems.  $\text{PM}_{2.5}$  refers to particles 2.5 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) in size or smaller. Daily and annual averages were recorded for this measure.

**Explanation:** Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The smaller the particles, the easier those particles pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air to form fine solid particulates.

**Trends:** Average annual concentrations have fluctuated over the past 5 years with the highest annual average of  $12.1 \mu\text{g}/\text{m}^3$  occurring in 2001. The last few years have reflected a relatively consistent annual average ranging between  $8.3 \mu\text{g}/\text{m}^3$  -  $8.7 \mu\text{g}/\text{m}^3$ . The annual average concentration for the 2005 calendar year was  $8.7 \mu\text{g}/\text{m}^3$  which is within the range experienced during the past few years.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, Monica Pognon (954) 519 - 1476

## **PRESSURES ON OUR AIR RESOURCES**

### **Mobile Sources**

#### **MOBILE SOURCE EMISSIONS, THOUSANDS OF TONS/YEAR**

**Measurement:** This performance measure tracks the amount of volatile organic compounds, oxides of nitrogen, and carbon monoxide emissions from mobile sources (automobiles and trucks). The Air Quality Division staff used the 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 2005 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. Volatile organic compounds and oxides of nitrogen emissions from mobile sources are precursors for ozone, the pollutant of concern in Broward. 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. Through more stringent fleet performance and fuel quality standards, transportation conformity and voluntary initiatives, the EPA is implementing additional programs to offset the increase of mobile source emissions due to population and vehicle miles traveled (VMTs) growth. In addition, the average vehicles on the roadway have lower emissions compared to the generations of cars before them.

**Trends:** The total level of pollution from mobile sources emissions in Broward County, measured in tons-per-year, has decreased between the years 2000 - 2005. This is likely the result of a combination of the mandatory phase-in of cleaner fuels, computerized onboard emissions diagnostic systems, and cleaner burning engines. Although the total amount of mobile source emissions decreased in 2005 as compared with previous years, levels of VOC and  $\text{NO}_x$  emissions increased over that of the previous year. VOC and  $\text{NO}_x$  are important emission categories

because they are the primary contributors to the formation of ground-level ozone. Ground-level ozone is the primary air pollutant of concern in Broward County. Broward recently celebrated 10 years of consecutive compliance for the EPA's air quality standards for ozone.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, John Oltman, (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 defines "overcapacity" segments as those operating at levels of service worse than Level of Service "D." The roadway level of service (LOS) standard is a qualitative assessment of the road user's perception of the quality of flow of traffic. The LOS standard is represented by letters "A" through "F," with "A" representing the most favorable conditions and "F" representing the least favorable. This benchmark supplements the information provided by the two "Vehicle miles traveled" benchmark. 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.

**Trends:** The 2005 figure is 0.69% higher than the 2004 levels, which is directly attributed to the annual growth in population, employment, school enrollment and other socioeconomic variables leading to higher travel demand.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Transportation Planning Division, Lina Kulikowksi (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 2005 figure is slightly lower than the 2004 level of 21,349 miles traveled/day/1000 people. The reduction in travel per capita is likely the result of increase in gas prices, traffic congestion and using other modes of travel than auto.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Transportation Planning Division, Lina Kulikowksi (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 will implement additional programs to offset the increasing VMT, due to population increase.

**Trends:** The 2005 figure is 0.78% higher than the 2004 levels, which is directly attributed to the annual growth in population, employment, school enrollment and other socioeconomic variables leading to higher travel demand.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Transportation Planning Division, Lina Kulikowski (954) 357-6610

### Regulated Stationary Sources

#### REGULATED STATIONARY SOURCES

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

**Explanation:** The types of regulated air pollution sources include, but are not limited to, operations such as power generators, waste incinerators, dry cleaners, printers, machine shops, service stations, wastewater-treatment plants, concrete manufacturing, chemical production and storage, as well as painting and repair shops. This category included both point-sources and area-sources. Point-source emissions can be defined as emissions that enter the environment from an identifiable, and often concentrated, outfall. Area sources are small, stationary sources that usually do not emit large amounts of criteria pollutants or toxics as individual sites. However, area sources are more numerous than point sources and therefore they can also contribute a significant amount of emissions when taken collectively.

**Trends:** The Broward County Air Quality Division will begin tracking such occurrences starting with the 2006 calendar year and aims to begin reporting on this measure in the next edition of the Environmental Benchmarks Report.

**Data:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, Clifton Bittle (954) 519-1208

#### EMISSIONS FROM POWER PLANTS (TONS PER YEAR)

**Measurement:** The amount of criteria pollutants (carbon monoxide, sulfur dioxide, nitrogen oxides, particulate matter and volatile organic compounds) 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 contributes to poor air and water quality. VOC and NO<sub>x</sub> are important emission categories because they are the primary contributors to the formation of ground-level ozone.

**Trends:** Total power plant emissions have fluctuated over the past few years. Emissions decreased as a result of a change in fuel supply available for generating electricity. For a short period, natural gas was more economical for the plants to use than other fuel stocks such as petroleum based fuels. Since natural gas is typically a cleaner-burning fuel than petroleum-based fuels, the power plants experienced a reduction in total air emissions for the period when natural gas was the primary fuel stock. However, petroleum-based fuels have again become more economical for the power plants to use and as a result, such fuels constitute the majority of the stock used to generate electricity. As a result, emissions are being elevated to levels similar to those observed during calendar year 2003.

**Data source:** Calendar year data. Broward County Environmental Protection Department, 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 electric power consumed in Broward County annually. 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<sub>x</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>). VOCs and NO<sub>x</sub> are precursors for ozone, whereas CO<sub>2</sub> is a greenhouse gas that contributes to climate change. NO<sub>x</sub> and SO<sub>2</sub> 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:** Power outages associated with active hurricane seasons in 2004 and 2005 contributed to the reduction in usage.

**Data source:** Calendar year data. Florida Power & Light Co., Lynn Shatas, (954) 321-2215

### Other Sources

#### AIR QUALITY IMPACTED BY UNUSUAL EVENTS

**Narrative:** This measure represents the number of calendar days that the Air Quality Index was potentially 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 Division will begin tracking such occurrences starting with the 2006 calendar year and aims to begin reporting on this measure in the next edition of the Environmental Benchmarks Report.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Air Quality Division, Monica Pognon (954) 519 - 1476

## RESPONSES TO AIR RESOURCE PRESSURES

### Mobile Sources

#### NUMBER OF AIR QUALITY OUTREACH EVENTS

**Measurement:** The Outreach, Planning, and Mobile Sources Section (OPAMSS) of the Air Quality Division organizes and participates in numerous educational outreach programs and events throughout the year.

**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 2005, the number of outreach/educational activities increased over that of previous years. The response has increased due to new outreach initiatives and programs. This FY Clean Air Month activities increased to include the participation of additional local partners and new activities such as magazine ads, radio Public Service Announcements, new websites, to name a few. New initiatives also included the Alternative Fuel Airport Airawareness Forum, Ultra Low Sulfur Diesel Presentation, State Energy Program Workshop, Environment Tile Contest and an increased number of requests for educational presentations from schools, libraries, civic groups, radio shows and summer camps.

**Data source:** County fiscal year data. Broward County Environmental Protection Department, Air Quality Division, John Oltman, (954) 519-1220

## **NUMBER OF MASS TRANSIT PASSENGER TRIPS - MILLIONS OF TRIPS PER 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:** Without disrupting existing service, the Broward County Mass Transit Division's new service approach has shifted to realign east/west and north/south routes along major corridors. Other improvements include the new swipe boarding pass cards, increased headways in the weekday peak hours and extended service hours for those routes with heavy ridership. These changes help improve the boarding speed and keep the buses on schedule. Significant route straightening took place in the north part of the county along with establishing of the new Route 42, which travels from east to west along Atlantic Blvd from east of A1A to Coral Square Mall at University Dr. Additionally similar route straightening took place in the south part of the county with the new route 4 which travels from the Airport Tri-Rail Station along Dania Beach Blvd to A1A, south on A1A to Aventura Mall in Dade County, these two routes increased the fix bus routes total to 41. These efforts have contributed to an increase of about 3.5 per cent in ridership system wide. Continued rising fuel cost and increases in population will further increase ridership in the future.

**Data source:** County fiscal year data. Broward County Mass Transit Division, Tri-County Commuter Rail Authority, Marketing Department, Robert Fossa (954) 357-8336 and Ed Byers (954) 788-7948

## **NUMBER OF ALTERNATIVE FUEL VEHICLES IN GOVERNMENTAL FLEETS**

**Measurement:** This is the number of vehicles used by federal, municipal, and local governments that operate on alternative fuels including compressed and liquified natural gas, liquified petroleum gas (LPG), propane, ethanol, bio-diesel, and electricity.

**Explanation:** Vehicular traffic is a major source of air pollution. The incomplete combustion of gasoline in motor vehicles results in the emissions of hydrocarbons, oxides of nitrogen, and carbon monoxide. These pollutants react in the presence of sunlight to produce ozone, the pollutant of main concern in Broward County. Ozone can cause respiratory distress to individuals with impaired respiratory functions especially children and the elderly. The Energy Policy Act of 1992 established goals to reduce dependence on imported oil by requiring federal and state fleets to increase the percentage of their vehicles operating on alternative fuels. Energy diversification protects our energy security, enhances environmental protection, and promotes economic development. By June 2005, Broward County employees had driven over 5 million miles in alternative fuel vehicles since the program began tracking mileage in 1997.

**Trends:** The slight increase in the number of alternative fuel vehicles in government fleets during 2005 is largely due to the continued success of Hybrid Electric Vehicles. Because they operate on gasoline and electricity, they are categorized as an advanced technology vehicles. The range and ease of refueling have contributed to their success. This increase can also be attributed to the fuel conversion of the Fort Lauderdale-Hollywood International Airport shuttle fleet to a 20% Biodiesel Blend (B20).

**Data source:** Calendar year data. Broward County Public Works Department, Energy Management Section, Anthony Rosa, (954) 357-6506 and the South Florida Regional Planning Council, Carlos Gonzales, (954) 985-4416

## **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 Sept. 30th.

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

**Trends:** As the community bus program has grown over the years from seven (7) to twenty (21) 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 is also the result of providing passengers with access to schedules for BCT and the Community Buses. Schedules are being posted in many public locations including neighborhood shops, parks, churches and libraries. This year the community Bus fleet increased to 88 with Mass Transit providing 74 and the other 14 provided by the contractors. For the last two years a 10% increase was provided in the Mass Transit budget to support the Community Bus Service Program because of the amount of funding that was available at that time. To access the website, go to [www.broward.org/bct/welcome.htm](http://www.broward.org/bct/welcome.htm).

**Data source:** County fiscal year data. Broward County Division of Mass Transit, Service Development Team, Robert Fossa (954) 357-8336 and the Broward County Urban Planning and Redevelopment Department, Transportation Planning Division, Enrique Zelaya (954) 357-6635

## **Regulated Stationary Sources**

### **AIR QUALITY COMPLIANCE INSPECTIONS**

**Narrative:** The compliance inspections is included as a benchmark in order to track one of the regulatory tools used by the Air Quality Division to ensure that operations at such facilities conform to local, state, and federal guidelines.

**Explanation:** Natural resource specialists periodically conduct site visits to the facilities that are in operation throughout Broward County to ensure that the daily operations are conducted within the regulatory parameters set forth. This measure includes both point and area-source facilities operating in the County.

**Trends:** The Broward County Air Quality Division will begin tracking such occurrences starting with the 2006 calendar year and aims to begin reporting on this measure in the next edition of the Environmental Benchmarks Report.

**Data source:** Calendar year data, Broward County Environmental Protection Department, 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 of Florida Power and Light (FPL) customers within Broward County that are enrolled in the utility company's Sunshine Energy® Program and track associated enrollment trends.

**Explanation:** FPL offers 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. By signing up for the Sunshine Energy® program, FPL reports that each customer in Broward can reduce over 8,000 pounds of carbon dioxide (CO<sub>2</sub>) emissions - as much as a car would produce in almost 9,000 miles of driving. By enrolling in FPL's Sunshine Energy® program, customers are also helping to spur the development of new green energy facilities. Spurring the development of new solar facilities is one of the missions of the program. For every 10,000 customers who sign up for Sunshine Energy, an additional 150kw of solar arrays will be built in Florida.



**Trends:** Over 23,000 participants are currently enrolled in the program. New solar arrays are scheduled to be announced this year.

**Data source:** Calendar year data. Florida Power & Light Co., Lynn Shatas, (954) 321-2215

## OPEN BURNING

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

**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 Division issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases.

**Trends:** Historically, the Air Quality Division has issued approximately 15 to 20 open burn licenses annually. The majority of these have been for recreational bonfires, training of firefighters and agricultural fires. In 2005 there was open burning conducted at 4 locations in Broward County to dispose of the massive amount of vegetative debris generated by Hurricane Wilma. The experience from dealing with environmental issues caused by burning of hurricane debris has prompted the Air Quality Division to initiate the process of amending Broward County's open burning code.

**Data source:** Broward County Environmental Protection Department; Air Quality Division Clifton Bittle (954) 519- 1220

## OUR 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 year ending April 30<sup>th</sup>.

**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 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 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. Phosphorus concentrations have averaged 16.6 ppb.

**Data source:** Water Year - May 1 to April 30. South Florida Water Management District, DB Hydro Database. Data summary, Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **FRESH WATER QUALITY, PERCENT IMPROVEMENT IN THE C-13 CANAL**

**Measurement:** This performance measure is calculated based on four quarterly sampling events per calendar year obtained from Environmental Protection 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 Department station numbers 12, 13 and 14. 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, nutrients and biological diversity with each category potentially having more than one parameter. 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 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 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.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Environmental Monitoring Division, Nancy Gassman, (954) 519-1241

#### **ESTUARINE WATER QUALITY, PERCENT IMPROVEMENT IN THE C-13/C-14 CANAL**

**Measurement:** This performance measure is calculated based on four quarterly sampling events per calendar year obtained from Environmental Protection 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 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. Four quarterly sample data points per calendar year are used.

**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 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.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Environmental Monitoring Division, Nancy Gassman, (954) 519-1241

## 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 Natural Resource Protection Code (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 the Natural Resource Protection Code.

**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 with 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:** Quarterly raw water sampling data. Broward County Environmental Protection Department, Pollution Prevention and Remediation Division, Harvey I. Schneider, (954) 519-1439

## Ground Water Quantity

### PERCENTAGE OF GROUND WATER MONITORING WELLS WITH CHANGING GROUNDWATER LEVELS

**Measurement:** This measure tracks the change in groundwater levels with respect to a long-term (16 year) average at 7 groundwater monitoring wells representing northern, central, and southern parts of the County and extending from west to east. The response is presented as the percent of total wells with changes in groundwater 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 groundwater levels decline. By measuring groundwater 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 groundwater levels have been measured at the sites monitored during the last 5 years. In general, groundwater levels in saltwater intruded areas located in northern, central, and southern parts of the County appear to have increased from 0.03 to 1.30 feet above sea level compared to long-term averages. Such increases may help abate saltwater intrusion. Groundwater levels in the western part of the County are slightly lower (as much as 0.32 feet) compared to average water levels measured during the baseline period of record.

**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 Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1450

## PRESSURES ON WATER RESOURCES

### 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 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 a lot more than sediments; other pollutants of concern are heavy metals, hydrocarbons, and certain trace elements. Most of the County's efforts to reduce urban stormwater runoff have been in the area of source controls. Development projects are required to provide more on-site retention and pretreatment systems help remove pollutants from runoff. A number of training programs have also been implemented, with courses in construction and landscape best management practices. Other efforts include street sweeping programs, 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 great improvement

to the site. Local governments and communities throughout the State have been growing increasingly concerned with nutrients due to improper landscape practices. The State legislature is expected to review legislation that will set minimum standards for the labeling, sale, and use of residential fertilizers with emphasis on the promotion of low and no-phosphorus formulations.

**Data source:** Information provided by Broward County EPD, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **BUILDING PERMITS -NUMBER OF ALL 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 Development Management Division (DMD). The approval process includes an evaluation of potential environmental impacts of the proposed construction. To find the number of approvals issued, we query the DMD Permit Monitoring System for the number of approvals issued during the calendar year.

**Explanation:** A measure of pressures on our land 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 DMD. 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. Following Hurricane Wilma in October 2005, applications for approvals were reduced through the end of the year.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Development Management 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 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 number of new projects and redevelopment projects permitted sustains the high levels that began in Fiscal Year 2000. The total number of projects permitted for Fiscal Year 2005 continues the trend started in Fiscal Year 2003 and is stable at an increase of 40% over the number of projects permitted in Fiscal Year 2000. The average size of each project continues to decrease 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



## 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 30<sup>th</sup>.

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

G-2149	G-2445	G-2694	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 0.50 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-2694 resulted in a change in the 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/index\\_qw.html](http://www.sflorida.er.usgs.gov/edl_data/index_qw.html) and [http://www.sflorida.er.usgs.gov/ddn\\_data/text/brw.html](http://www.sflorida.er.usgs.gov/ddn_data/text/brw.html).

**Trends:** For the first time, data collected in 2005 showed one well (G-2899) with a significant increase in chloride concentration (greater than 0.5 logarithm change), as compared to the 2000 baseline condition. Wells G-2697, G-2893, G-2897, G-2898, G-2899, G-2900, G-2903, G-2904, and G-2906 are showing increases in chloride concentration since the year 2000. Only well G-2899 has eclipsed the criteria for a 0.5 logarithm change. This suggests the saltwater intrusion front may be advancing in the areas monitored by these wells. Wells G-2445 and G-2785 are showing decreases in chloride concentration suggesting a receding salt water intrusion front in these locations.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Water Resources 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 Department GIS coverage and the average number and size of developments licensed by the Environmental Protection 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 groundwater 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. In addition, 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 Department, Water Resources Division, Leonard Vialpando, (954) 519-1264

#### **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 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](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:** The total waste produced in Broward County increased slightly (approximately 2%) during year 2003 due to the increase in population in the county.

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

#### **NUMBER OF CONTAMINATED SITES**

**Measurement:** This is the total count of sites 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 a continued decrease in the number of existing contaminated sites, although the decrease is not significant due to the occurrence of new discharges. For example, under State rules, many of underground fuel tanks need to be replaced by the end of 2009; as tanks are replaced, new contamination is discovered.

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

#### **NUMBER OF HAZARDOUS MATERIAL & STORAGE TANK LICENSES**

**Measurement:** This is the number of hazardous materials and storage tank licenses issued by Environmental Protection 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 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.

**Explanation:** Businesses that handle and store hazardous materials represent a potential threat to ground and surface water quality. The Environmental Protection 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 continues to increase due to resource efficiencies realized from technologies implemented and the conversion of some wellfield licenses. The number of wellfield licenses has decreased due to public outreach encouraging a reduction of regulated substances only inside of the wellfield zones 1 and 2.

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

#### **AMOUNT OF HAZARDOUS MATERIALS HAULED IN BROWARD COUNTY, 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 Department licensed waste transporters submit a report to Environmental Protection 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 increased approximately 5% during year 2005 due to the increase in population in the County.

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

#### **NUMBER OF NEW REPORTED DISCHARGES**

**Measurement:** This measure tracks the total number of confirmed discharges reported (mostly from petroleum storage tank facilities) during the County fiscal year.

**Explanation:** Discharge Reporting Forms (DRF) are required to be completed and submitted to the PPRD 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, groundwater 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 the old tank. 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 event is 2009.

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

#### **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 groundwater hydrology in Broward County. Annual rainfall in Broward County averages 57 inches per year, 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 groundwater 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, groundwater 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 7 of the last 10 years, suggesting a pattern of wetter than normal weather conditions during the last decade. However, rainfall in 2004 was particularly low, with a total of 45 inches of local rainfall, much less than the historical average.

**Data source:** Calendar year data. Data provided by the SFWMD and are considered provisional, summarized by Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **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 groundwater seepage and surface water deliveries from the Everglades. In recent years there has been growing concern about the carrying capacity of the Biscayne Aquifer, and urban reliance upon the Everglades as source water for aquifer recharge. With Broward County's urban population expected to reach 2.4 million by 2025, there has been increasing discussion 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 provides 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:** Potable wellfield pumpage has remained relatively constant during the last five years with an increase of just 4.15 million gallons per day (MGD) or 1.5% between 2000 and 2005. For the period of analysis, rates of wellfield pumpage were highest (270.4 MGD) in 2004 when annual rainfall measured 45 inches, or 12 inches less than the 30-year long-term average of 57 inches measured between 1971 and 2000. Rates of wellfield pumpage were lowest in 2001 when County-wide wellfield pumpage totaled 233.7 MGD. At this time, annual rainfall was 60 inches, 3 inches above the long-term average for Broward County.

**Data source:** Calendar year data. Data provided by the SFWMD and summarized by Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

### **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. The current graphic reflects the recently adopted methodology and population estimates derived from the 2000 census numbers.

**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 2001 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. BCWWS purchased the Broadview Park Water Utility on July 1, 2004. The equivalent population of the Broadview Park service area is 7300; the per capita consumption for 2004 was 86 gallons/day/per capita; this helped lower the total average per capita consumption for WWS customers.

2. Since 2001, the District 2A water treatment plant provided 75 psi water pressure to customers which saves energy and reduces per capita consumption.

3. The WWS Neighborhood Improvement Projects have replaced 25% of our underground infrastructure thereby reducing leaks and per capita consumption.

4. All new construction is required by Broward County Ordinance to use more efficient low-flow plumbing fixtures.

5. We believe our on-going Water Conservation Program has also helped reduce per capita consumption.

**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 water policy will result 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.

**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 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.

**Data source:** Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464



## RESPONSES TO WATER RESOURCE PRESSURES

### 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 Federal 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 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 Department, Water Resources Division, Ashok Raichoudhury, (954) 519-1490

#### TOTAL NUMBER OF NATURESCAPE CERTIFIED 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.

**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.

**Trends:** The total number of certified NatureScapes in Broward County has steadily increased since program inception, with annual increases of 38% in 2003, 85% in 2004, and 50% in 2005.

**Data source:** Calendar year data. Data maintained by Broward County Environmental Protection Department, Water Resources Division, Diana Guidry (954) 519-0317

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

**Narrative:** In 2005, the Broward Everglades Working Group met twice, after two meetings were cancelled due to hurricane activity. Participants representing drainage districts and municipalities presented proposed agency-specific pollution reduction plans. These presentations were then compiled as part of the broader C-11 West Basin Pollution Reduction Action Plan, to be adopted as part of the State's Long-term Plan.

**Explanation:** The Broward Everglades Working Group was convened in 2004 in response to recommendations outlined in the Long-term Plan for Achieving Water Quality Improvements in the Everglades Water Conservation Areas (2003). The Long-term plan 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. With three ESP Basins in Broward County (North Springs Improvement District, North New River Canal Basin, and C-11 West Basin), the County was eager to take a leadership role and requested that source controls on pollution be presented as a priority for Broward, and that a Working Group of affected parties be convened to participate in the generation of local pollution reduction plan.

Broward County staff and the South Florida Water Management District called upon stakeholder groups in the C-11 West Basin of Broward County, a major source of stormwater discharge and urban pollution to the Everglades, to participate in the creation of a 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 ESP basins and eventually to all of Broward County. Representatives from affected municipalities, drainage and water control districts, the agricultural industry and others, came together to assess the legislative, regulatory, and outreach initiatives that could be employed as part of the Pollution Reduction Action Plan ([http://www.broward.org/waterresources/c\\_11\\_pollution\\_actionplan.pdf](http://www.broward.org/waterresources/c_11_pollution_actionplan.pdf)). Since the first meeting was convened in May 2004, a total of 6 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 Working Group has operated is now serving as a model for similar local pollution reduction efforts relating to the State's Total Maximum Daily Loads on pollutants for waterbodies that have designated as impaired.

**Trends:** The Broward Everglades Working Group will continue to meet quarterly to report activities, assess progress, and modify approach as

needed.

**Data source:** Information provided by Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **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 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 construction authorizations has increased by 38% since 1999 (the beginning of the recent boom in construction) and is dependent on 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 Department, Water Resources 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 for each fiscal year ending September 30th.

**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. 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:** County fiscal year data. Surface Water Management licensing databases, FOXPRO and POSSE. Data summary, Broward County Environmental Protection Department, Water Resources Division, Leonard Vialpando, (954) 519-1473

## 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 groundwater levels. Aquifer recharge is an important means of combating saltwater intrusion.

**Explanation:** Broward County's Integrated Water Resources Plan (IWRP) recognizes the need for a coordinated approach among water managers to effectively meet the County's future water supply needs and water resource goals. The 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. However, water is a regional resource, with management implications that extend well beyond the jurisdictional boundaries of individual entities. Therefore, the County has sought to promote a regional approach to water management through the identification, pursuit, and promotion of projects that are multi-jurisdictional in nature and that have multiple water resource benefits. The pursuit of secondary canal improvement projects that allow for coordination in surface water management activities has been fundamental to this effort. Secondary canal interconnections are demonstrated to substantially increase surface water storage and improve aquifer recharge. Aquifer recharge is critical to local efforts to help abate saltwater intrusion and is of particular value where potable wellfield operations are constrained by saltwater intrusion.

**Trends:** Through the IWRP and cost share grant funding provided under this program, the County has provided interlocal partners with cost share funding in the feasibility analysis and design of numerous secondary canal improvement projects. The County recently approved 2 projects in cost share with local municipalities to improve surface water management and wellfield recharge, and enhance stormwater reuse, and has completed development of an advanced hydrologic model to assist local water managers in identifying and quantifying the benefits of various secondary canal improvement projects. Broward County and has also partnered with the United States Geological Survey to develop a saltwater intrusion model for the northern portion of the County. This model 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.

**Data source:** Information provided by Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

### 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 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 complements the information provided by the "Percentage of the county where central domestic sewer service is not available" performance measure. It is a measure of progress 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 installations or add to the total flows handled by sanitary sewer facilities.

**Trends:** Several of the County's Neighborhood Improvement Projects were finally completed and released for use resulting in a large influx of septic to sewer conversions. These Neighborhood Improvement Projects are on going 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 Urban Planning and redevelopment Department, Development Management 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 1.7% during year 2003. According to Waste and Recycling Services of Broward County, there are several factors that contributed to the decrease in recycling percentages over the ten past years: (1) Florida Department of Environmental Protection (FDEP) has revised the designation of materials that are accountable toward the recycling percentages. (2) Recycling is not as popular as 10 years ago. (3) Material packaging has improved technologically over the past 15 years. The trend in packaging has been away from heavy returnable glass bottles to lighter containers.

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

#### **NUMBER OF LICENSED HAZMAT SITES INSPECTED/YEAR**

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

**Measurement:** This is a measure of the activities of Environmental Protection Department to inspect the holders of hazardous material licenses in Broward County during the fiscal year indicated. The total number of inspections is calculated using Environmental Protection Department'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. Environmental Protection Department designed these measurements to track both the activity and outcome associated with the number of satisfactory hazardous material facility inspections.

**Trends:** Since 1999, the Pollution Prevention Section has undergone numerous changes, including the loss of inspector positions and the implementation of an e-inspection process, the full adoption of which has taken approximately two years. This variability has prevented the deduction of any clear trend.

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

## Ground Water Quantity

### MAINTENANCE OF URBAN GROUNDWATER 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 through alternative water supply development and coordinated surface water management operations which will serve to reduce urban demands on groundwater 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 groundwater levels.

**Explanation:** There is a direct connection between urban groundwater levels, the integrity of the Biscayne Aquifer, the health and function of urban wetlands, the operation of drainage infrastructure, and Everglades restoration. As groundwater levels decline, wetland systems can dry out, urban wellfields can become impacted by saltwater intrusion, the operation of drainage infrastructure can become compromised due to erosion, and induced rates of groundwater seepage from the Everglades can increase. Since none of these outcomes are desirable, the County has committed tremendous resources to the development of technical tools to help better manage surface water resources for aquifer, wetland, and wellfield recharge, and is 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 in coming years are expected to focus more on the identification and pursuit of sub-regional alternative water supply projects to replace and augment existing water resources.

**Data source:** Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

### ALTERNATIVE WATER SUPPLY DEVELOPMENT

**Narrative:** This benchmark will be measured in the future in terms of the total volume of water produced through the construction of new (post 2005) alternative water supply projects.

**Explanation:** Broward County is estimated to need an additional 100 million gallons of water each day 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, desalination. The State of Florida is supportive of this new direction and as an incentive has established a source of recurring funding to assist water utilities with the cost of construction, with preferred funding for those projects considered multi-jurisdictional in nature. As the State is also in the process of updating 20-year regional Water Supply Plans, these two efforts are being coordinated, with State funding for alternative water supply projects largely tied to projects being specifically identified in the relevant regional water supply plan. With the Lower East Coast Regional Water Supply Plan in the final phase of development, Broward County intends to monitor the amount of water produced through the proposed alternative water supply projects and will track this volume with respect to permitted wellfield operations and projected needs.

**Trends:** While many water utilities have invested in alternative water supply development on a small scale (e.g., reclaimed wastewater for wash down applications), there are very few larger-scale projects that are actually producing an offset to potable water supplies. Instead, utilities have focused in recent years on leak reduction programs and other water conservation activities.

**Data source:** Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

### **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, there are increasing constraints 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 85% in 2005. Eleven IWRP-related activities and programs were provided support in 2005.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **NATURESCAPE IRRIGATION SERVICE, MILLION GALLONS/YEAR SAVED**

**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 initiative being implemented by Broward County in partnership with 22 local water utilities. The goal of the NIS is 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.

NIS evaluations include a basic site assessment, overview of the existing irrigation system and operational schedule, a measure 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, if appropriate. The result is a savings in not only water, but energy, time and money.

**Trends:** In the first partial year of operation (July to December 2005), the Broward County NatureScape Irrigation Service completed 54 evaluations and achieved a total water savings of 43.1 million gallons.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

#### **WATER MATTERS DAY ATTENDANCE**

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

**Explanation:** A key component of Broward County's effort to educate residents about water conservation is Water Matters Day. This fun, activity-filled event focuses on teaching residents about the need to conserve and protect our water resources. Water Matters Day focuses in large part on outdoor activities and irrigation practices in particular, which is estimated to account for one-half of household water consumption. Landscape runoff is also identified as a major source of water pollution, so Water Matters Day is also designed to provide residents with information about the proper use of fertilizers and other landscape chemicals. The event is geared towards helping Broward residents make the connection between their daily activities and the impact on local water resources and adjacent natural systems. Participants learn about local water management, Everglades restoration, and how our canals connect 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.

The best part is that while Water Matters Day is about education, it's also about fun. Water Matters Day is packed with workshops, giveaways, children's activities, and entertainment. For instance, while parents are learning about choosing the right plants for their yards, their children can learn about the creation of backyard wildlife habitats as they participate in a birdhouse-building workshop. Giveaways have included rain gauges, automatic shut-off devices for irrigation systems, native trees and plants, and garden mulch. Not only are these freebies popular, but they help attendees apply what they've learned when they get home. That is the most important part of Water Matters Day, imparting the message that water conservation and environmental stewardship is about more than one event, but that it must be a conscience part of our day-to-day activities, as in the plants we select, our irrigation practices, and the other ways we go about maintaining our 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, an estimated 4000 people attended the event.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Water Resources Division, Jennifer Jurado, PhD, (954) 519-1464

## OUR LAND RESOURCES

### Natural Land Quantity

#### PROTECTED LAND AND UNPROTECTED LAND, ACRES

- o Conservation and passive recreational land

#### UNPROTECTED (DEVELOPABLE) LAND, ACRES

- o Potential Conservation Land and Green Space acquisitions

- o Potential Open Space acquisitions

- o Potential Management Agreements

**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 and/or management agreement. 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 but 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.

**East coast buffer:** 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 and/or management agreements.

*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 Safe Parks and Land Preservation Bond program. Additionally, over 550 acres of Open Space sites are protected.

**Data source:** Calendar year as of August. Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

## **Everglades Water Conservation Areas**

### **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 groundwater 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 groundwater 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, 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 Department, Biological Resources Division, Donald Burgess, (954) 519-0305

### Natural Land Quality

#### NATURAL LANDS QUALITY

**Narrative:** Broward County Parks and Recreation 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.

**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 recently formed Natural Lands Management Program will conduct an assessment of all protected natural lands in the County to determine the condition of the habitat and to determine a priority schedule for restoration efforts. This effort is quite extensive and will likely take several years to accomplish.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

### 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 Naturescape Broward can help mitigate some of the impacts.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

## PRESSURES ON LAND RESOURCES

### 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 ([www.bebr.ufl.edu](http://www.bebr.ufl.edu)) provides the annual projections.

**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.

**Trends:** We are seeing a continuation of population growth primarily through net migration. At least through the year 2016, the majority of Broward County's growth will be the result of 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 is changing as well as growing.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Planning Services 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 Development Management Division (DMD). The approval process includes an evaluation of potential environmental impacts of the proposed construction. To find the number of approvals issued, we query the DMD Permit Monitoring System for the number of approvals issued during the calendar year.

**Explanation:** A measure of pressures on our land 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 DMD. 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. Following Hurricane Wilma in October 2005, applications for approvals were reduced through the end of the year.

**Data source:** Calendar year data. Broward County Urban Planning and Redevelopment Department, Development Management Division, Monthly

### **NEW WETLAND ACREAGE 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.

**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. Note the trend should have been decreasing, however, we have had 2 large projects with high impact acreages i.e. 117.8 and 77.23 acres, that has led to this year's increase.

**Data source:** State fiscal year data. Broward County Environmental Protection Department, Biological Resources Division, Barbara Chow, (954) 519-1419

### **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 Department, Biological Resources Division, Linda Sunderland, (954) 519-1454

### **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. It is important to educate the public 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. This work includes efforts by the SFWMD within the Water Conservation Areas, Broward County's largest area of natural land, as well as 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.

**Data source:** Broward County Environmental Protection Department, Biological Resources 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 groundwater is replenished. In addition, wetlands have recreational, historical, scientific and cultural values.

**Trends:** The Broward County Environmental Protection 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 Department, Biological Resources 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 Department, Biological Resources Division, Donald Burgess, (954) 519-0305

## **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 during the period 2000-2005.

**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.

**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 2006, Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

#### **NUMBER OF TREE RELATED COMPLAINTS**

**Measurement:** This measure tracks the number of tree abuse, tree removal or tree trimming licensing complaints received during each of the past five years.

**Explanation:** The three complaints that the Upland Resources 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 database to determine the number of complaints received per year.

**Trends:** The number of complaints received rose significantly in 2005; a direct result of the transfer of the Tree Trimmer Licensing Program to the Biological Resources Division.

**Data source:** This is calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Peter Burke, (954) 519-1224

#### **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, if a paper company is discharging chemicals into a waterway and poisoning the water, then there has been a qualitative loss. Sometimes there is a combination of quantitative and qualitative, such 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 Department, Biological Resources Division, Donald Burgess, (954) 519-0305

#### **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 database to determine the number of trees licensed for removal per year.

**Trends:** The number of trees licensed for removal has stayed fairly consistent over the last five years.

**Data source:** This is calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Peter Burke, (954) 519-1224

## RESPONSES TO LAND RESOURCE PRESSURES

### Natural Land Quantity

#### PUBLIC DOLLARS SPENT TO PRESERVE NATURAL LANDS, MILLIONS

**Measurement:** The 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 was reallocated to Open Space sites. 44 Open Spaces comprising more than 573 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 2006. Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

### ENVIRONMENTAL REVIEW

**Narrative:** All projects which are proposed on undeveloped parcels are reviewed by the Environmental Protection Department's Biological Resources 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 aspects 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 Department, Biological Resources 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 decreased over the past year as several large projects have been initiated. 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 Department, Biological Resources Division, Linda Sunderland, (954) 519-1454

#### **ACRES OF 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 Department, Biological Resources Division, Linda Sunderland, (954) 519-1454

## 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 Department, Biological Resources 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\\_april\\_2006\\_high.pdf](http://www.evergladesplan.org/docs/fs_bcwpa_april_2006_high.pdf), Broward County Environmental Protection Department, Biological Resources 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 Resource Plan, the 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 County Parks and Recreation staff, some sites such as Forman ESL, Tradewinds ESL, and Tradewinds Park 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. 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, the County will apply for funds in the next round of grants from the Integrated Water Resource Plan to install the pump while still under their management. Coconut Creek will take over this site in the future. The Woodmont Cypress Strand design is under contract. 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  $\frac{1}{2}$  acre, using 0.3 mgd.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Donald Burgess, (954) 519-0305

#### **ACRES SUBJECT TO CONTROLLED BURN OR ALTERNATIVE MANAGEMENT METHOD**

**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 Department, Biological Resources Division, Donald Burgess, (954) 519-0305

#### **Urban Landscape**

##### **PUBLIC EDUCATION - RIGHT TREE-RIGHT PLACE**

**Narrative:** In response to urban forestry issues following Hurricane Wilma, the Broward County Environmental Protection Department (EPD) 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."

**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 EPD 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 right tree right place.

**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.

**Data source:** County fiscal year. Broward County Environmental Protection Department, Biological Resources Division, Sean McSweeney, (954) 519-0327

### **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 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 Department, Biological Resources Division, Peter Burke, (954) 519-1224

### **DOLLARS SPENT ON BROWARD BEAUTIFUL PROJECTS**

**Measurement:** The Broward Beautiful program provides matching grants to non-profit organizations for environmentally friendly landscape projects through various grant programs. Broward Beautiful 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 defunct 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 FY2006. 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 FY2006 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 Waterway Cleanup, Ocean Watch Foundation Reef Sweep).

**Explanation:** The figures reported represents County dollars approved for grant projects in the indicated calendar year. Because all the grant

programs require an applicant match these figures represent approximately half of the actual impact of these grant projects.

**Trends:** A significant reduction in the dollars spent on Broward Beautiful projects is expected beginning FY2007 due to proposed budget reductions and exhaustion of the Tree Preservation Trust Fund. The Broward Beautiful GreenSHADE program and Greening Gateways program will see a shortfall of approximately \$250,000 in FY07 due to the unavailability of Tree Preservation Trust Fund dollars. This will effectively discontinue both these programs. The fund balance in the Tree Preservation Trust Fund is no longer sufficient to provide funds for these programs as nearly all of the available fund balance has already been committed to specific projects by the Tree Preservation Trust Committee. GreenSHADE increases Broward's greatly damaged tree canopy by providing matching grants to cities for shade tree planting projects; this program has been entirely funded by the Tree Preservation Trust Fund at approximately \$100,000 per year. The Greening Gateways program partners with Cities and FDOT to improve the appearance of I-95 interchange gateways within Broward County; this program uses Tree Trust dollars to leverage State grants. This year \$225,000 county dollars (including \$150,000 from the Tree Trust) leveraged \$900,000 in State grants for the I-95/Oakland Park Greening Gateways project. Revenues in Tree Preservation Trust Fund are derived from contributions made by tree removal permit applicants when onsite or offsite required tree replacement is not feasible. As of the end of the 2<sup>nd</sup> quarter for FY06, the fund has received less than \$32,000 in new contributions for the year. Annexation could result in a continued decrease in contributions to the Trust fund in the long term.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Sean McSweeney, (954) 519-0327

#### **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:** There was an increase in the number of Tree Trimmer Licenses in 2005 over 2004. It should be noted that the program was transferred to the Biological Resources Division in 2004, so there is no available data prior to that year.

**Data source:** This is calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Peter Burke, (954) 519-1224

#### **TREE RELATED ENFORCEMENT ACTIONS**

**Measurement:** This measurement tracks the number of enforcement actions issued from 2001 to 2005. 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 significantly in 2005. This was due to the fact that the Biological Resources Division began enforcing the Tree Trimmer Licensing Program. This program relies on warning notices and citations for enforcement. It should be noted that there was incomplete data for 2001, as the Department was switching to a new database.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources 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 has been slowly increasing per year. The primary reason for the increase was an ordinance amendment in 2003 which required 50% additional replacement for trees removed due to development. It should be noted that the program was transferred to the Biological Resources Division in 2004, so there is no available data prior to that year.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Peter Burke, (954) 519-1224

## NUMBER OF TREES FUNDED FOR PLANTING THRU 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 the number of trees funded for planting is the amount of funds available in the trust fund and the number of projects proposed. It should be noted that the program was transferred to the Biological Resources Division in 2004, so there is no available data prior to that year.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Peter Burke, (954) 519-1224

## NATURSCAPE CERTIFIED 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.

**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 NatureScope 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. More information is available at [www.broward.org/naturescape](http://www.broward.org/naturescape).

**Trends:** The total number of certified NatureScapes in Broward County has steadily increased since program inception, with annual increases of 38% in 2003, 85% in 2004, and 50% in 2005.

**Data source:** Calendar year data. Data maintained by Broward County Environmental Protection Department, Water Resources Division, Diana Guidry (954) 519-0317

## OUR MARINE RESOURCES

### Reef Quality

#### PERCENTAGE OF HEALTHY CORAL; 1<sup>ST</sup>, 2<sup>ND</sup>, & 3<sup>RD</sup> REEFS

**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 0.75m<sup>2</sup> 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 a slight decrease in 2003. This is the year when cyanobacterial cover reached a recent maximum. This correlation does not represent a cause/effect relationship.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

### Reef Quantity

#### PERCENTAGE OF LIVE CORAL COVER; 1<sup>ST</sup>, 2<sup>ND</sup>, & 3<sup>RD</sup> REEFS

**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 0.75m<sup>2</sup> quadrat. This measurement is used to characterize the relative health of the coral reef communities. Twenty five sites were monitored 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 bares watching to determine if recent concerns over land based sources of pollution and harmful algae blooms are impacting the reef communities.

**Trends:** The average percent live coral cover on the first reef decreased between 2004 and 2005 from 8.75 to 8.00. Although not statistically significant the decrease may be the result of significant impact from several tropical storms and hurricanes that had influence on the reef resource habitat in 2005. Percent coral cover showed a slight average increase at examined second and third reef sites.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources 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 decreased significantly between 2004 and 2005 due in part to the high number of tropical storms and hurricane events that occurred during the summer of 2005. High wave energy environments can have a negative impact on the stable attachment of these types of reef colonies.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

### **Beach Quality**

#### **BLUE WAVE BEACHES**

**Narrative:** In 1998, the Clean Beaches Council of Washington, DC initiated the Blue Wave Campaign, seeking to encourage prudent management of beaches and to provide a special designation to those beach jurisdictions which meet its stringent management criteria.

**Explanation:** The Blue Wave Campaign is America's first environmental certification for beaches. The goal of Blue Wave is to promote public awareness and voluntary participation in beach sustainability.

Blue Wave beaches voluntarily pledge to uphold the following responsible beach management practices:

- water quality
- beach and intertidal conditions
- hazards
- services
- habitat conservation
- public information/education
- erosion management

Participating beaches proudly fly the distinctive Blue Wave flag - the symbol of responsible beach management. Broward County's Environmental Protection Department (Environmental Protection Department) and the Greater Fort Lauderdale Convention and Visitor's Bureau (GFLCVB) recognized the value of the Blue Wave designation both in terms of marketing for tourism and in helping beach jurisdictions to improve beach resource management. In 1999, five of Broward County's eight beachfront municipalities were judged to have met the criteria and were

designated Blue Wave Beaches, the first to be so honored in the State of Florida. Included were the cities of Deerfield Beach, Pompano Beach, Fort Lauderdale, Dania Beach, and Hollywood. The Blue Wave designation is an annual program, and these municipalities have received the Blue Wave Flag in each of the succeeding years.

**Trends:** Each year the County, through Environmental Protection Department and GFLCVB, renew the application for the cities that wish to participate in the program, and the two County agencies split the cities' fees to do so. To date, the Towns of Hillsboro Beach and Lauderdale-By-The-Sea and the City of Hallandale Beach have declined to pursue the Blue Wave Designation.

**Data source:** Clean Beaches Council (<http://www.cleanbeaches.org/>), GFLCVB, Environmental Protection Department, Stephen Higgins, (954) 519-1265

#### **PERCENT OF BEACH WATER QUALITY TEST RESULTS RATED AS SATISFACTORY**

**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 is the year ending 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 species and fecal coliform bacteria levels at fifteen locations along Broward's Atlantic coast. The density of enterococci species and fecal coliform bacteria as indicator groups in seawater show the 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://apps3.doh.state.fl.us/env/beach/webout/default.cfm>.

**Trends:** Over the past six years the percentage of satisfactory/good beach water samples is averaging 95.2% with a range from 92.5% to 98.7%. This year's result, 93.2%, is 2% below the six year average.

**Data source:** State fiscal year data. Broward County Health Department and Florida Department of Health, Howard Rosen, (954) 467-4854

#### **Beach Quantity**

##### **AVERAGE BEACH WIDTH AT HIGH TIDE, FEET**

##### **PERCENTAGE OF NON-CRITICALLY-ERODED BEACH**

**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, it is assumed that 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 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 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 mildly erosive. These beaches are scheduled for restoration in 2008-09. The beaches from the Broward/Palm Beach County line to Hillsboro Inlet likewise are stable to mildly erosive, but these beaches also benefit occasionally from infusions of sand from offshore, by sand bypassing at Boca Raton Inlet, and by sand drifting southward from beach restoration projects at south Boca Raton. Because of the nourishment project in 2005/2006 along the southern County shoreline, average 2006 beach widths are increased and the percentage of non-critically eroded beach is also higher.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Stephen Higgins, (954) 519-1265

### **Marine Wildlife**

#### **NUMBER OF SEA TURTLE NESTS**

#### **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 GPS location of each. Those nests found at sites not amenable to successful hatchling entry into the surf are relocated to either enclosed or open-beach hatcheries thereby facilitating successful hatchling entry into the ocean.

**Explanation:** The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to Environmental Protection Department for beach re-nourishment 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-re-nourishment 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 2005 will be less due to the enactment of sea turtle lighting ordinances in the Cities of Pompano Beach, Deerfield Beach, Lauderdale-By-The-Sea, Fort Lauderdale, and Hallandale 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 2004 to 2005 (1975 to 1861). The percent of nests left in-situ did not significantly change from 2004 to 2005. (36.4% to 35.8 %).

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

## PERCENT 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%, and 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.

**Data source:** Calendar year data. Broward County Sea Turtle Conservation Program, Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

## 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 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. It is the goal of the state and federal government 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.

**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.

**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 [www.floridamarine.org/manatees](http://www.floridamarine.org/manatees) under synoptic surveys.



## PRESSURES ON OUR MARINE RESOURCES

### Reef Resources

#### SALTWATER FISHING LICENSES ISSUED IN BROWARD COUNTY, THOUSANDS

**Measurement:** The total number of saltwater fishing licenses issued (July 1 to June 30) includes 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 County marine resources. More information about saltwater fishing licenses may be found at <http://marinefisheries.org/license.htm>.

**Trends:** Since the Florida saltwater fishing license was adopted in 1989, significant changes in licensing procedures have evolved. The creation of the 5-year license 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. Since 1999, total numbers of licenses had steadily declined, but because of the aforementioned issues, it is difficult to interpret the causes of annual fluctuations in the number of licenses. In 2006, the number of licenses increased due to the issuance of more fresh/salt combination licenses and an increase in the number of 5 yr licenses issued.

**Data source:** State fiscal year data. Florida Fish and Wildlife Conservation Commission, Tallahassee, Sandra Gilliam, (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. 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 13<sup>th</sup>, 2000. In the accompanying plot, we report the number of days when the mean daily water temperature for each reef tract was equal to or greater than 29°C. The mean daily water temperature was never below the thermal minimum of 16°C through 2002. 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, and 12/23/02-12/31/02, 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.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Ken Banks, (954) 519-1207



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

Site Name	Description	Depth (ft)	Latitude (dd.mm)	Longitude (dd.mm)
HW1	Hollywood 1st reef	-15	26.021117	-80.112007
HW2	Hollywood 2nd reef	-40	26.021170	-80.095290
HW3	Hollywood 3rd reef	-50	26.020458	-80.088225
JUL8	John U Lloyd 3rd reef	-50	26.083262	-80.084983
JUL7	John U Lloyd 2nd reef	-40	26.082725	-80.095535
JUL6	John U Lloyd 1st reef	-15	26.081867	-80.103710
FL1	Fort Lauderdale 1st reef	-15	26.102167	-80.101817
FL2	Fort Lauderdale 2nd reef	-25	26.102235	-80.093598
FL3	Fort Lauderdale 3rd reef	-70	26.102598	-80.082492
FTL1	Fort Lauderdale 1st reef	-15	26.158905	-80.095792
FTL2	Fort Lauderdale 2nd reef	-40	26.159952	-80.082537
FTL3	Fort Lauderdale 3rd reef	-50	26.158638	-80.077343

#### 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. Bethic 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. It is unknown if these cycles are caused by water quality or population dynamics of the grazing sea hare, *Stylocheilus* spp.

**Data source:** Nova Southeastern University Oceanographic Center *Lyngbya* presence/absence survey at Broward County Environmental Protection Department biological monitoring sites:

SITE NAME	DEPTH (ft)	LAT (DM)	LONG (DM)
JUL2	50	26.002593	-80.053010
JUL1	35	26.003014	-80.058134

HH2	15	26.006946	-80.067572
JUL8	50	26.049957	-80.050990
JUL7	25	26.049635	-80.057321
JUL6	12	26.049120	-80.062226
FTL6	18	26.089850	-80.058070
FTL5	18	26.088710	-80.057580
FTL4	18	26.082080	-80.058440
FTL3	55	26.095183	-80.046406
FTL2	40	26.095971	-80.049522
FTL1	18	26.095343	-80.057475
POMP6	52	26.145660	-80.043980
POMP5	31	26.145660	-80.047310
POMP4	19	26.127320	-80.052010
POMP3	50	26.112141	-80.043650
POMP2	40	26.113289	-80.048039
POMP1	14	26.114356	-80.052256
HB3	47	26.164255	-80.038189
HB2	35	26.165350	-80.042620
HB1	18	26.168357	-80.045390
DB3	57	26.186828	-80.035764
DB2	42	26.186280	-80.040262
DB1	15	26.185869	-80.043928
BOCA	30	26.208030	-80.038830

**NUMBER OF SHIP DAMAGE INCIDENTS TO REEFS**

**Measurement:** The number of groundings or ships anchored outside of the officially designated commercial ship anchorages that have been reported to EPD by State of 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 has resulted in numerous ship groundings ships disregarding the anchorage and anchoring outside of its bounds, thus damaging reef resources. Many groundings require intervention by USCG for removal and are, therefore, reported to the Florida Fish and Wildlife Conservation Commission (FWCC) or the Department of Environmental Protection (FDEP). Many anchor incidents are reported to USCG, and a responsible party can be identified, resulting in the assessment of penalties by the State. This results in the identification of a responsible party (RP) so reef restoration activities are initiated. Often ships ground briefly and free themselves or anchor on resources and it is not reported so the incident is unreported and no restoration occurs. Increased enforcement by USCG could result in a decrease in anchor damage.

**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. It is unknown if this increasing trend is the result of increased ship traffic or better reporting of incidents. Many more incidents likely occur that aren't reported.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Ken Banks, (954) 519-1207

## 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 are composed of jetties and dredged channels, interrupt the net southward movement of sand, causing a buildup on the updrift (north) side of the channel and erosion and recession on the downdrift (south) side of the channel.

**Explanation:** It is estimated that stabilized inlets are the cause of 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 target 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, the 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 slowing of erosion of those beaches. A renourishment of certain areas of Pompano Beach, Lauderdale-By-The Sea, and Fort Lauderdale is planned for 2008-09. 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 2 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 stages of developing a sand bypassing operation at Port Everglades. Construction is scheduled for early 2009.

**Data source:** Broward County Environmental Protection Department, 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 22 to 38 miles per hour (20 to 33 knots) as the standard, thus neatly encompassing the combined ranges of forces 6 and 7 on the Beaufort scale. Monthly wind records were reviewed for Fort Lauderdale-Hollywood International Airport. Days which experienced wind velocities of 20 knots 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 and sand also 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 20 knots or greater was chosen.

**Trends:** There is no discernable trend to the data.

**Data source:** Calendar year data. National Weather Service (<http://www.nws.noaa.gov/climate/>) Broward County Environmental Protection Department, Stephen Higgins, (954) 519-1265

#### **NUMBER OF STRUCTURES WITHIN 50 FEET OF THE BEACH**

**Measurement:** The measurement of 50 feet was chosen based upon a once-common setback requirement in Florida and other states. While coastal regulatory criteria have evolved beyond this simple metric, it is useful as a tool to gauge the *proximity of the structure to the sandy beach and the general vulnerability of structures and infrastructure to damage from storm waves*. Current aerial photography is used to measure the distance of a structure (defined as a permanent building, road, or parking lot) from the landward edge of the active sandy beach. For the purposes of this *measurement*, vegetated dunes are not considered to be part of the active sandy beach.

**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:** This is a new metric, so no trends are mapped. Intuitively, however, it can be inferred that the Broward County shoreline has been virtually fully developed for two or more decades, and that little new development occurs. Redevelopment of older structures is common, however, which sustains the developed nature of the beachfront in the County. Therefore, it is assumed that the actual number of structures within 50 feet of the beach has remained fairly stable over the analysis period.

**Data source:** Aerial photos taken in February 2006. Broward County Environmental Protection Department, Stephen Higgins, (954) 519-1265

#### **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. Top performances at the Broward Center for the Performing Arts and Bank Atlantic Center also attract residents and visitors to Broward's diverse attractions.

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

## 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, there remains a sizable amount of trash 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 International Coastal Cleanup, sponsored and coordinated 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 is 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 (3<sup>rd</sup> Saturday in September) during each year. Weight of debris collected in 2004 was increased due to collection of fishing lead around Anglin's Pier in Lauderdale-by-the-Sea. 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. 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.

**Data source:** Calendar year data. Broward County EPD, Biological Resources Division, Don Behringer, (954) 519-1218

## Marine Wildlife

### BEACHES WITHOUT SEA TURTLE FRIENDLY LIGHTING

**Narrative:** Although 5 of the 8 coastal municipalities in Broward County have passed sea turtle friendly lighting ordinances, most of the beach within those cities (Deerfield Beach, Pompano Beach, Lauderdale-BY-The-Sea, Fort Lauderdale, and Hallandale) has not yet complied enough to allow successful, ocean orientated, emergence of hatchlings turtles. The Town of Hillsboro Beach, composed mostly of private homes and containing substantial dune and dune vegetation, is considered turtle friendly despite the lack of a lighting ordinance, but the beaches in the rest of the County are without turtle friendly lighting conditions as of the nesting and hatching season in 2005.

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

**Trends:** The lighting on the beach continues to be inadequate to protect sea turtles.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources 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*) includes 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 the 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*), ghosts crabs (*Ocyrode quadrata*), foxes (*Vulpes vulpes*), feril dogs and cats, fire ants, and people.

**Trends:** The average number of nests taken by predators in Broward County is 237 each season.

**Data source:** 2005 Broward County Sea Turtle Conservation Program, Broward County Environmental Protection Department, Biological Resources 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. The 2005 survey resulted in 134 hatchling disorientation reports being filed while the 2004 survey produced 161 filed reports.

**Explanation:** The Sea Turtle Conservation program (prior to 2006) is 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 (FFWCC and USFWS) 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.

**Data source:** Calendar year data. Broward County Sea Turtle Conservation Program, Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

#### **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.hsmv.state.fl.us/html/revrpts.html>. 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, 2005 through June 30, 2006).

**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.

**Data source:** State fiscal year data. Florida Department of Highway Safety and Motor Vehicles (850) 922-9000

#### **WEST INDIAN MANATEE MORTALITY IN BROWARD COUNTY**

**Measurement:** 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. The total mortality for Broward is very low.

**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 [www.floridamarine.org/manatees](http://www.floridamarine.org/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 follows:

**Slip** - 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 rezoned 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.

**Trends:** Broward County has been under a marine facility permitting moratorium since 2004, awaiting approval of a BFSP. A few facilities and

single-family slips have been permitted, but required comprehensive review by the Florida Fish and Wildlife Conservation Commission. The table below shows the existing slips and the proposed increase listed in the September 2006 draft BFSP. A complete breakdown of slips of each type in each zone is presented in the draft BFSP. The main focus for new marina facilities is located in the South zone of the County (all waterways south of Sunrise Blvd., and including the Middle River).

BFSP Zone	Existing slips	Proposed slips Increase
North	5,620	1,353
Center	6,312	619
South	19,089	5,000
Port Everglades	718	0
Total slips	31,739	6,972

**Data source:** Broward County Boat Facility Siting Plan September 2006 draft. Broward County EPD, Biological Resources Division, Don Behringer, (954) 519-1218

## RESPONSES TO MARINE RESOURCE PRESSURES

### Reef Resources

#### MARINE PROTECTED AREAS

**Measurement:** Number of acres of Broward offshore area 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. 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.

**Trends:** No MPA's have ever been designated offshore Broward County.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Ken Banks, (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 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. Eventually this monitoring will be conducted on a monthly basis at up to eight coastal sites.

**Data source:** Broward County Environmental Protection Department, Environmental Monitoring Division, Dr. Nancy Craig, (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. 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. It is unknown if these cycles are caused by water quality or population dynamics of the grazing sea hare, *Stylocheilus* spp.

**Data source:** Nova Southeastern University Oceanographic Center *Lyngbya* presence/absence survey at Broward County Environmental Protection Department's 25 biological monitoring sites. Biological Resources Division, Ken Banks, (954) 519-1207

### **BOULDER REEFS, THOUSANDS OF SQUARE FEET**

#### **NUMBER OF SHIPWRECK REEFS**

#### **MODULAR REEFS, THOUSANDS OF SQUARE FEET**

**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 available grant funding or donations of materials. However, over the past three years, the planning for and construction of the Broward County Shoreline Protection Project has re-directed staff resources away from the artificial reef program. As a result, no artificial reefs have been constructed since the 10 acres boulder reefs in 2003. Re-permitting of artificial reef sites will be completed in 2006. Because of anticipated, yet undefined, changes in the Florida Department of Environmental Protection and US Army Corps of Engineers guidelines for artificial reef construction, the type of reef construction will probably change. It is very likely that the deployment of ships will be de-emphasized in favor of limestone based materials.

**Data source:** County fiscal year data. Broward County Environmental Protection Department, Biological Resources Division, Ken Banks, (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 USCG has resulted in several groundings and numerous cases of anchoring outside the anchorage on reef, respectively. Recently, USCG has increased enforcement and efforts are underway to modify the anchorages' configurations to minimize risk of grounding. In addition, an anchorage alternative feasibility study is underway which may propose strategies to further minimize risks of resource damage.

**Trends:** An emergency measure to modify the anchorages' configurations is in process to reduce risks of groundings. If successful, this will be incorporated on a permanent basis.

**Data source:** Broward County Environmental Protection Department, Biological Resources Division, Ken Banks, (954) 519-1207

## **MARINE DEBRIS CLEAN-UP CAMPAIGNS, POUNDS OF LITTER COLLECTED/PARTICIPANT/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. 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 31 tons of harmful marine debris, collected by over 8,000 volunteers, from the reefs offshore of Broward County. Each year this day long cleanup event includes removal of trash and debris from the ocean environment by scuba divers and from the shoreline by beach walkers. The Ocean Watch Foundation of Greater Fort Lauderdale is a non-profit, local volunteer organization involved in conservation and educational projects to help raise awareness and 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 fluctuates each year. Although one would like to see a trend of an increasing number of participants and a decreasing amount of trash removed from the reef each year, this is not the case. The increasing number of volunteers participating in reef sweep reflects the incorporation of additional clean up sites at fishing piers and along the beach, as well as better event promotion. In some years, such as in 2005, inclement weather affected volunteer turnout; at other times large and heavy debris items have been removed from the reef by a few enthusiastic volunteers which dramatically affected the weight total.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources 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 ones in place and add more in the future. The count for the indicated year is as of September 30th.

**Explanation:** Coral reef communities and the 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. The Biological Resources Division has obtained a Coastal Impact Assistance Program Grant from The Florida Department of Environmental Protection (FDEP) and the National Oceanic and Atmospheric Administration (NOAA) to expand, maintain, and monitor the Broward County Mooring Buoy System. For information on the use and location of the buoy network, please go to <http://www.broward.org/bio/mooringbuoy.htm>.

**Trends:** In 2005, twelve (12) new buoys were installed in the nearshore waters of Hollywood Beach and Hallandale Beach. The buoys are placed adjacent to the limestone boulder artificial reefs. The funding for the installations and maintenance of these buoys came from the Coastal Impact Assistance Program Grant. We hope to install an additional 25 mooring buoy anchors through 2005 - 2006. This work will be completed as time and funding allows.

**Data source:** County fiscal year data. Broward County Environmental Protection Department, Biological Resources Division, David Stout, (954) 519-1452

## **Beach Resources**

### **SAND BYPASS**

**Narrative:** Sand bypassing is conducted to reduce erosion of beaches which 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 and design stages of development of a sand bypassing operation at Port Everglades. Such an operation could move that 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 amounts 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 annual average quantities of material bypassed will not change appreciably.

**Data source:** Broward County Environmental Protection Department, 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 the number of unsuccessful emergences of nesting females (false crawls) and an overall reduction in the number of nests deposited. Renourishment 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, there have been ten beach nourishment projects 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 to line and grade 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. The recent renourishment at Hollywood and Hallandale Beaches is a good illustration of marine turtle nesting habitat replacement. The beach was 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 a significant reversal due in part to replacement of available nesting habitat.

**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. It is anticipated that traditional beach nourishment will become less frequent in Broward County.

**Data source:** Broward County Environmental Protection Department, Stephen Higgins, (954) 519-1265

### **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 GPS 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 FDEP range monuments, located approximately every 1000 feet along the shore. The County has conducted on 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 Department, 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, their associated wildlife, while assuring reasonable use of private property. The Coastal Construction Control Line Program protects the coastal system from improperly sited and designed structures which can destabilize or destroy the beach and dune system. Once destabilized, the valuable natural resources are lost, as are its 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 Department, Stephen Higgins, (954) 519-1265

#### **LITTER CLEANUP CAMPAIGNS, POUNDS OF LITTER COLLECTED/PARTICIPANT/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 and one underwater site 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 2000, 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. In 2001, an approaching tropical storm did not 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.

**Trends:** Weight of debris collected in 2004 was increased due to collection of fishing lead around Anglin's Pier in Lauderdale-by-the-Sea. Ocean conditions prior to the event can also have a great influence. Rough wave conditions in 2004 can deliver more debris to the beach. 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.

**Data source:** Calendar year data. Broward County EPD, Biological Resources Division, Don Behringer, (954) 519-1218

#### **Marine Wildlife**

##### **PERCENT OF SEA TURTLE NEST RELOCATIONS**

**Measurement:** Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March through October. 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 Department for beach re-nourishment 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-re-nourishment 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.

**Data source:** Calendar year data. Broward County Environmental Protection Department, Biological Resources Division, Louis Fisher, (954) 519-1255

## MANATEE PROTECTION

**Narrative:** The Broward County Biological Resources Division has 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 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 Biological Resources Division 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 Plan 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 mitigation measures. Mitigation measures, as established in the Plan, provide for:

- Two full-time marine law enforcement officers will be 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 (December-March) and quarterly surveys during the remainder of the year (biweekly surveys will be conducted until the BFSP is approved by FWC)
- 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 deeming Broward of the 13 key counties in need of an MPP. This situation has not changed and mortality levels have remained relatively consistent (2003 = 5, 2004 = 1, 2005 = 2), until 2006. From January-March 2006 there were six (6) water-craft related mortalities 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 Department, Biological Resources Division, Don Behringer, (954) 519-1218 and Mote Marine Laboratory Boating Traffic and Safety Study 2005, Jay Gorzelany