

# Broward County Board of County Commissioners



## 2012 ENVIRONMENTAL BENCHMARKS REPORT



**March 2013**

ENVIRONMENTAL PROTECTION AND GROWTH MANAGEMENT DEPARTMENT

  
Broward County Board of County Commissioners

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# EXECUTIVE SUMMARY

In 1999, Broward County, Florida began to annually review its efforts to protect the environment by creating the Environmental Benchmarks Report. Today, monitoring relevant environmental benchmarks is one way Broward County is addressing its commitment to the Sterling Performance Excellence Challenge known within the County as "Our Best. Nothing Less." The Broward County Environmental Protection and Growth Management Department is using benchmarks to demonstrate environmental improvements and impacts. This document presents benchmarks which represent the state of the resource (Climate, Air, Water, Land, and Marine), the pressures on those resources and the responses that reflect how changes in natural resource management initiatives translate into improvements in the environment. Today and into the future, the Broward County Board of County Commissioners continues to recognize the importance of environmental quality as part of the Commission's Goal to have and maintain a pristine and healthy environment. The general trends in the benchmarks are shown in Table E1. A narrative is provided below.

## **General Trends in the Environmental Benchmarks**

While the sections below focus on each of the environmental resources the County protects, general trends are present across all the benchmarks. Since 2009, monitoring data for many of the benchmarks was unavailable, reflecting economic pressures on government to reduce staff and cut costs. The economic impacts on residents and the construction industry have resulted in the easing of some pressures on the environment. As a community we are building less, driving less, using less energy and generating less waste. Environmental protection and management efforts support these changes.

## **Climate**

Globally, the level of greenhouse gas, a major contributor to climate change, continues to increase. Locally, we are experiencing both warmer and colder weather. While the average tide height in Key West has decreased over the last three years, the long term trend shows rising sea levels. In response to well substantiated and compelling scientific evidence supporting the validity and urgency of climate change and the public's desire for action, the Broward County Board of County Commissioners is working at the internal, community-wide and regional level to mitigate the causes and adapt to the consequences of climate change. The Government Operations Workgroup has progressively reduced the County's carbon footprint. Implementation of the Broward County Climate Change Action Plan is addressing climate issues across the County. Finally, development of the Regional Climate Action Plan will focus efforts on larger scale issues across a four-County area.

## **Air**

Outdoor air quality steadily improved over the last few years during a period of compliance with ozone and particulate matter standards. The number of "good" air quality days in 2011 increased to 95% as compared to 90% in 2010. In addition, in 2011

Broward County had 4 days in which the air quality was affected by "an unusual event" (i.e. wild fire or Saharan dust). Pressures on the air quality from mobile source emissions have decreased since 2007 due to a reduction in vehicle miles traveled and on-going federal regulations for cleaner vehicles and fuels, and the promotion of alternative modes of transportation such as carpooling, transit, etc. For further local improvements, county government and municipal fleets are using alternative fuel vehicles in response to high fuel prices and to support environmental and climate protection goals. Additionally, the turnover on the local fleet characterization with newer vehicles replacing older models, generate lower emissions. This is a result of a combination of the phase-in of cleaner fuels, computerized onboard emissions diagnostic systems, and cleaner burning engines.

The percentage of over capacity roadway segments remained the same (20%) as compared to 2010. Mass transit ridership continued to decrease as well by 1% compared to 2010. The use of control equipment by power plants (i.e., electrostatic precipitators (ESPs) and low NOx burners) continues to contribute to reductions in emissions in 2011 by over 58% as compared to 2010. Broward County values public education as a vital link in building local community support and advocacy for efforts that enhance the quality of life for its residents. Broward County continues to develop public outreach events such as Air Awareness Month and Car Care Month which increase community awareness and empower citizens to take personal action to protect air quality. Broward County partners with the Broward County School Board in coordinating educational programs for all public schools. The U.S. Environmental Protection Agency (EPA) awarded Broward County the 2012 Clean Air Excellence Award for Education/Outreach for the 2011-2012 Conservation and Climate Change (C3) Challenge for Schools program. The Clean Air Excellence Awards recognize innovative programs that protect Americans' health and the environment, educate the public, serve their communities and stimulate the economy. Due to events such as the C3 Challenge, the number of people reached through outreach events increased by 40% from 14,544 in 2010 to 20,430 in 2011.

## **Water**

Water is a critical part of our natural resources. Water quality in our canals, offshore and in the groundwater affects our quality of life. The amount of water impacts flood protection and water supplies. The water quality status of our surface water resources in Broward County is generally good. In the last year, phosphorus levels at the S-9 Pump Station increased along with a decrease in urban water quality in the C-13 Canal. Pressures on water quality such as building permits and locations without surface management regulation have a decreasing trend. Efforts to improve water quality such as street sweeping, certification of NatureScape Sites and education on environmentally-friendly landscaping continue to increase. Groundwater wells for public water supply continue to meet standards. A trend toward increasing groundwater levels reversed in 2011. However, a growing number of wells are showing saltwater intrusion. Pressures on groundwater quality such as septic systems, solid waste, number of contaminated sites and reported hazardous material discharges are decreasing. Many water conservation efforts such as the NatureScape Irrigation Service, Conservation Pays toilet rebates, and NatureScape educational programs, coupled with the County-wide 2-day per week

limit on landscape irrigation, have resulted in a decrease in potable water well withdrawals and per capita consumption. Broward County continues to work closely with local water managers and utilities to achieve improvements and offer public education, such as the annual Water Matters Day event, to encourage understanding and wise use of our water resources. The County's water conservation efforts are furthered under an Environmental Partnership Agreement with the Broward School District with services including educational programming, staff training and landscape improvements. This collaboration led to recognition of the Broward School District in 2012 as the first and only District-wide Community Wildlife Habitat certified by the National Wildlife Federation.

## **Land**

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 that preserve habitat for indigenous plants and animals. In recognition of the need to preserve Broward County's remaining natural lands and their biological functions, County residents passed the Safe Parks and Land Preservation Bond referendum in November 2000 which provided for renovation of our park system and acquisition of natural lands and open spaces. As the land acquisition portion of the Bond program concludes, over 121 sites have been acquired comprised of over 1,000 acres. Through the funding of the Land Stewardship Program, a five-year capital improvement program, the ecological restoration and site-appropriate park development of these lands continues. By providing limited access to our natural lands, visitors can gain appreciation for the resources that have been preserved.

The other significant land resource is in our urban landscape. These resources are under significant pressure from physical development, hydrologic stress, exotic plants and animals, fire suppression, littering, dumping and contamination and even weather events. Tropical storms and hurricanes have altered Broward County natural and urban landscapes in the past. Fortunately, no major storms have impacted the county over the past five years allowing our natural lands and urban tree canopy to recover. In response to continued pressures on our urban landscape, the County has provided several programs to improve the urban areas for wildlife habitat and neighborhood aesthetics. Through the NatureScape Broward program, residents and communities have created nearly 3,000 Florida-friendly landscapes that conserve water, protect water quality, and create wildlife habitat. Tree related enforcement actions are decreasing while the number of trees funded for planting through the Tree Trust Fund has increased over the last three years. The County, as well as many other organizations, has taken a variety of steps to respond to these pressures and maintain the value of our land resources as high as possible.

## **Marine**

Broward County's marine resources are fundamental to the area's economy, environment, and quality of life. For the purposes of these benchmarks, our marine resources include a variety of nearshore hardbottom 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 enable actions in support of protection, restoration, and enhancement of the resources, the County monitors and actively manages the reefs, beaches, and listed wildlife. While the relative percentage of corals are healthy (99% on the first reef) and we maintain a diverse fish population (>70 species on the first reef), coral and reef fish populations especially in the near shore environment are generally declining over the last few years. In 2012, Broward had a substantial increase in turtle nests with a total of 3539 nests. Florida manatee population has been greater the last three years than the recent past.

High human population density, resource use, and coastal build-out result in a number of pressures on the marine resources. Pressures such as fishing licenses and boater registrations are down from a decade ago. Commercial maritime traffic; inlet-caused beach erosion; beachfront and waterfront development and redevelopment; nutrient-laden runoff and treated wastewater; and increasing numbers of residents and visitors (>11M visitors in 2011) all have effects on ecosystems in coastal waters. Add to these anthropogenic impacts, naturally occurring cycles of storms, temperature extremes, water quality fluctuations, and harmful algal blooms, and it is clear that these fragile marine resources are at risk. Quantitative trends with respect to these impacts are sometimes difficult to discern due to natural variability and the confounding effects of large-scale events such as hurricanes, nutrient-laden deepwater upwellings, or synoptic-level temperature events, and in some cases, it may also be difficult to clearly define a single cause of damage to a particular resource. In response to these real and potential risks and damages, the County undertakes a multitude of actions intended to ascertain trends and causes; to mitigate existing impacts to reefs, beaches, and listed wildlife; to prevent future impacts; and to restore resources which have been damaged. Beach nourishment, beach and reef clean-up programs and resource monitoring are activities which are continuously used to protect marine resources.

These benchmarks are used to identify areas of concern and to determine the effectiveness of environmental protection programs and regulations. For other aspects of the quality of life in Broward County and public perceptions of the environment, please see the Coordination Council of Broward's survey (<http://www.sfrpc.com/ccb/PRC2011Report.pdf>).

**TABLE E1. BENCHMARK TRENDS**

<p><b>TABLE E1.a. CLIMATE BENCHMARKS.</b> This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.</p>	<p><b>RESOURCES</b>                      Declining □                      No trend □                      Improving □</p>	<p><b>PRESSURES</b>                      Increasing □                      No trend □                      Decreasing □</p>	<p><b>RESPONSES</b>                      Decreasing □                      No trend □                      Increasing □</p>
<b>Climate</b>			
Deviation of the annual average temperature in Fort Lauderdale from the 1950-1970 baseline	▲		
Change of annual average sea level in Key West from the 1920 baseline	▼		
<b>Pressures on Climate</b>			
Global average carbon dioxide (ppm)		■	
Broward Countywide Greenhouse Gas Emissions (Million tonnes eCO2)		■	
Broward County Government Operations GHG Emissions Reductions FY2011		■	
<b>Responses to Climate</b>			
Broward County Government Operations Greenhouse Gas Emissions Reductions (Million tonnes eCO2)		■	
Broward County Climate Change Task Force		Narrative	
Southeast Florida Regional Climate Change Compact		Narrative	

<b>TABLE E1.b. AIR RESOURCES BENCHMARKS.</b> This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<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 outdoor air quality was good			
Annual ozone compliance value, ppm	In compliance		
Annual particulate compliance value, ug/m <sup>3</sup>	In compliance		
<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>Mobile Sources Responses</b>			
Number of air quality outreach events			Above established annual goal
Number of people reached through air quality outreach events			▲
Number of mass transit passenger trips, millions of trips/year			▼
Community shuttle ridership, thousands of trips/year			▲
<b>Regulated Stationary Sources Pressures</b>			
Number of regulated stationary sources		▼	
Emissions from power plants, tons/year			
Total electricity consumption, billions of kilowatt hours/year		▼	

<b>TABLE E1.b. AIR RESOURCES BENCHMARKS.</b> This summary table shows trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining <input type="checkbox"/> No trend <input type="checkbox"/> Improving <input type="checkbox"/>	<b>PRESSURES</b> Increasing <input type="checkbox"/> No trend <input type="checkbox"/> Decreasing <input type="checkbox"/>	<b>RESPONSES</b> Decreasing <input type="checkbox"/> No trend <input type="checkbox"/> Increasing <input type="checkbox"/>
Per capita power consumption, kilowatt hours/year		▼	
<b>Regulated Stationary Sources Responses</b>			
Number of compliance inspections of regulated stationary sources			▲
Changes in stationary source regulations			Narrative
Percent regulated stationary sources inspected and found to be in compliance			
<b>Other Sources Pressures</b>			
Days air quality was impacted by an unusual event		▲	
<b>Other Sources Responses</b>			
Open burning regulations			Narrative



<b>TABLE E1.c. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<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 at the S-9 pump station, ppb	▼		
Urban freshwater quality in the C-13 Canal - percent improvement over 1995 baseline	■		
Estuarine water quality: C-13 & C-14 Canals - percent improvement over 1995 baseline	▲		
<b>Surface Water Quality Pressures</b>			
Urban stormwater runoff		Narrative	
Building permits - new structure/non-residential addition approvals issued		▲	
Percentage of developed land not subject to surface water management regulation		■	
<b>Surface Water Quality Responses</b>			
Miles of streets swept		■	
Total number of certified NatureScape sites		■	
Number of educational programs delivered		■	
C-11 Canal Basin / Broward Everglades Working Group Activities		Narrative	
Clean Water Act - Total Maximum Daily Loads		Narrative	
Active construction sites within BC jurisdiction with surface water management licenses		■ Less construction sites = less licenses	
Total surface water management construction licenses issued since 1989		■	
<b>Ground Water Quality</b>			
Percent of potable water wells meeting drinking water standards	100%		

<b>TABLE E1.c. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Ground Water Quality Pressures</b>			
Percent saltwater monitoring wells with changing chloride concentrations, 2000 baseline		7-year downward trend	
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 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			
Percent licensed hazardous material sites inspected and found to be in compliance			
<b>Ground Water Quantity</b>			
Percentage of monitoring wells with changing ground water levels	▲		

<b>TABLE E1.c. WATER RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Ground Water Quantity Pressures</b>			
Inches of annual rainfall		2011 below avg 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>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			
NatureScope irrigation service, million gallons saved/year		▲	
Water Matters Day attendance		Above goal	

<b>TABLE E1.d. LAND RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<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, thousands	unchanged		
Acres of unprotected (developable) land	unchanged		
Everglades Water Conservation Areas	Narrative		
<b>Natural Land Quantity Pressure</b>			
Broward County population, millions			
Building permits - new structure/non-residential addition approvals issued		▲	
Wetlands licensed for development, acres		▲	
Mitigation leaving Broward County, acres			
<b>Natural Land Quantity Responses</b>			
Public dollars spent to preserve natural land, millions			
Environmental review		Narrative	
Acres of mitigation licensed			
Acres of mitigation on public land			
<b>Natural Land Quality</b>			
Natural land quality	Narrative		

<b>TABLE E1.d. LAND RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Natural Land Quality Pressure</b>			
Invasive exotic vegetation		Narrative	
Natural lands under hydrologic stress		Narrative	
Fire suppression on natural land		Narrative	
<b>Natural Land Quality Responses</b>			
Percent of municipal natural land sites with management plans			
Land Stewardship			Narrative
Comprehensive Everglades Restoration Plan			Narrative
Restoring hydrologic function to natural land			Narrative
Controlled burn or alternative management methods			Narrative
<b>Urban Landscape</b>			
Urban landscape	Narrative		
<b>Urban Landscape Pressure</b>			
Number of tropical storms		No storms	
Reduction of wildlife habitat		Narrative	
Emerging Pest Problems		Narrative	
Number of tree related complaints			
Number of trees licensed for removal			

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

<b>TABLE E1.e. MARINE RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<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>			
Percent healthy corals	No 2009 data ▼		
Number of fish species observed on reef	No 2009 data ▲		
<b>Reef Quantity</b>			
Percent live coral coverage	No 2009 data ▲		
Octocoral and sponge density	No 2009 data		
Number of fish surveyed on the reef	No 2009 data ▲		
<b>Reef Resources Pressures</b>			
Saltwater fishing licenses issued in Broward County, thousands		▼	
Number of days when water temperature was not optimal for corals		▼	
Percent of reef monitoring sites impacted by algae		No 2010 data	
Number of times ship damage impacted Broward's reefs		No 2012 data	
Cumulative acres of reef impacted by destructive activities			



<b>TABLE E1.e. MARINE RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Reef Resources Responses</b>			
Marine protected areas			Narrative
Coastal water quality, total nitrogen, ug/l			
Coastal water quality, total chlorophyll, mg/l			▲
Algal bloom monitoring efforts			Narrative
Acres of constructed habitat			unchanged
Number of shipwreck reefs			unchanged
Acres of reef mitigation for coastal construction activities			No recent mitigation
Marine debris clean-up campaigns, pounds of litter collected/participant/event			
Number of mooring buoys			unchanged
Number of tires removed from the reef zone			No removal
<b>Beach Quality</b>			
Percent of beach water quality results rated "Good"	No recent data		
<b>Beach Quantity</b>			
Average beach width at high tide, feet	▲		
Percent of non-critically eroded beaches			

<b>TABLE E1.e. MARINE RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Beach Resources Pressures</b>			
Presence of inlets		Narrative	
Days of small craft advisories		▼	
Number of visitors to Broward County, millions			
Overdevelopment		Narrative	
Trash on the beach		Narrative	
<b>Beach Resources Responses</b>			
Sand bypass		Narrative	
Beach nourishment		Narrative	
Monitoring the condition of the beach		Narrative	
Regulatory comment on beach resources		Narrative	
Beach clean-up campaigns, pounds of litter collected/participant/event		▲	
<b>Marine Wildlife - Sea Turtles</b>			
Number of sea turtle nests	▲		
Percent of sea turtle nesting success			
<b>Marine Wildlife - Manatees</b>			
Florida West Indian manatee population	▼		

<b>TABLE E1.e. MARINE RESOURCES BENCHMARKS.</b> Summary table showing trends in the quantitative benchmarks over the last three data points. Green represents improvements or three-year stable reading. Yellow designates no trend with triangles noting direction of the last data point. Red represents negative trends. Information on "narrative" benchmarks may be found in the body of the report and in the Endnotes section.	<b>RESOURCES</b> Declining □ No trend □ Improving □	<b>PRESSURES</b> Increasing □ No trend □ Decreasing □	<b>RESPONSES</b> Declining □ No trend □ Improving □
<b>Marine Wildlife - Pressures on Sea Turtles</b>			
Beaches without turtle-friendly lighting		Narrative	
Number of sea turtle nests destroyed by predators			
Obstructed nesting attempts		▲	
Number of sea turtle hatchling disorientation events		▲	
Number of juvenile and adult sea turtles found injured or dead			
<b>Marine Wildlife - Sea Turtle Responses</b>			
Percent of sea turtle nests relocated			No relocation since 2006
Percent of surveyed nests left in place			
Beach nourishment			Narrative
Regulatory comment on beach resources			Narrative
<b>Marine Wildlife - Pressures on Manatees</b>			
Number of vessels registered in Broward County			
Manatee mortality in Broward County		▲	
Number of boat slips in Broward County		▲	
<b>Marine Wildlife - Manatee Responses</b>			
Manatee protection			Narrative

# INTRODUCTION

## PROGRAM PURPOSE

In 1999, one of the County Commission's *New Vision* goals was to review efforts to protect the environment and develop a comprehensive environmental strategy. The Broward County Environmental Protection and Growth Management Department initiated the Benchmarks Program to demonstrate environmental trends. Today, monitoring relevant environmental benchmarks is one way Broward County is addressing its commitment to "Our Best. Nothing Less".

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 with time. These benchmarks measure how changes in natural resource management initiatives translate into changes in the environment. These benchmarks reflect the Broward County Board of County Commissioners' commitment to a pristine and healthy environment.

## INDICATORS AND PERFORMANCE MEASURES

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

## RESOURCE-PRESSURE-RESPONSE CONCEPT

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

## NATURAL RESOURCE CATEGORIES

The Benchmarks Program concentrates on four primary natural resource categories: *climate, air, water, land* and *marine*. For each of these resources, we have identified one or more resource, pressure and response benchmark measures. If historical data is available, we chart it to show trends. For newly-formulated performance measures, historical data may not be available. In these

cases, we plot first year baseline data and trends will become evident in future reports. Narratives explain trends in policies, regulation or issues that cannot currently be quantified to give a broader perspective on the status of the resources. The flow charts at the top of each benchmark's page and shown here, provide a visual representation of how the responses and pressures are connected to a specific resource.

### DATA COLLECTION INTERVALS

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

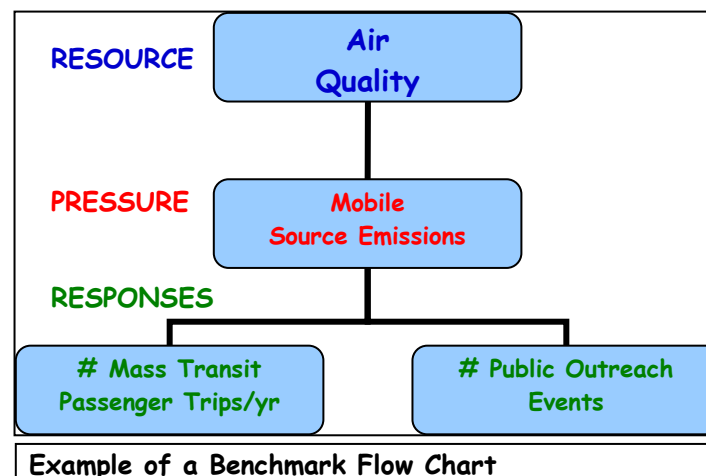
### INDICATOR OVERLAP

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

### ENDNOTES

The last section of the report is *Endnotes*. Each benchmark has an associated set of endnotes which 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 contact information for readers wanting additional information on the performance measure. You may contact the Natural Resources Administrator at (954) 519-1295 to obtain the data for any of the charts in this document.

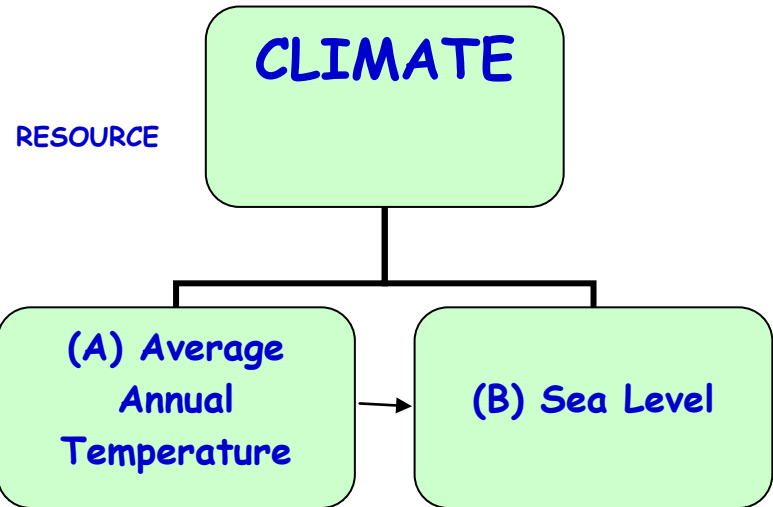
We hope you find the report interesting and informative. This document may also be found on the Broward County web page under Environmental Protection and Growth Management Department (<http://www.broward.org/EnvironmentAndGrowth/EnvironmentalProgramsResources/Publications/Pages/Publications.aspx>).



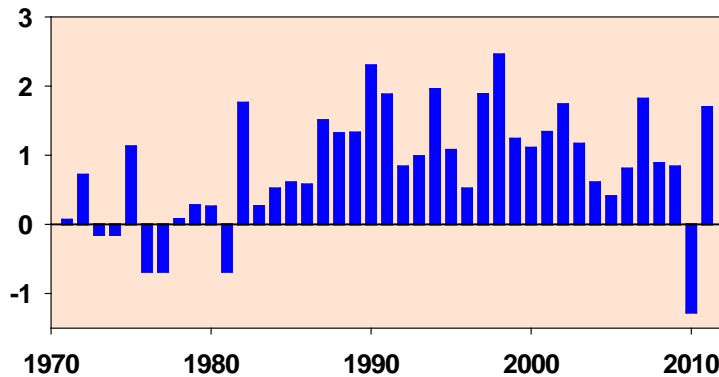
# CLIMATE

**Climate.** Global climate change has emerged as a phenomenon of critical concern worldwide. Global concentrations of greenhouse gases (GHG) have increased markedly as a result of human activities; global air and ocean temperatures are increasing; and average sea level is rising. Climate change is very much a part of any current discussion regarding the environment.

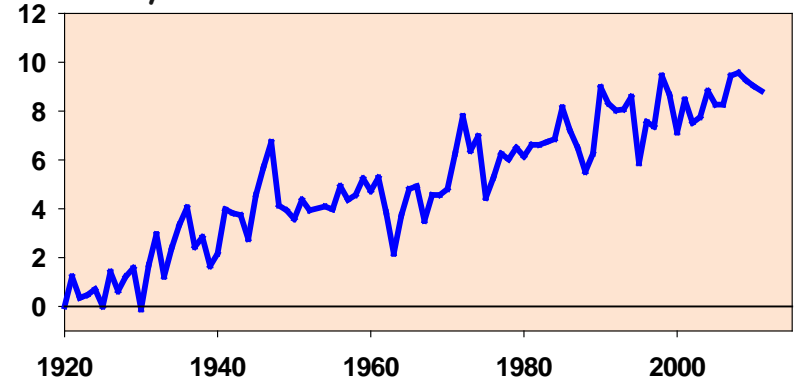
Climate change is a global phenomenon with significant regional impacts. Our low topography makes Broward County especially vulnerable to sea level rise. This section describes local indicators of the climate change, local contributors of greenhouse gases and ways that Broward County Government is responding to this growing environmental concern.



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



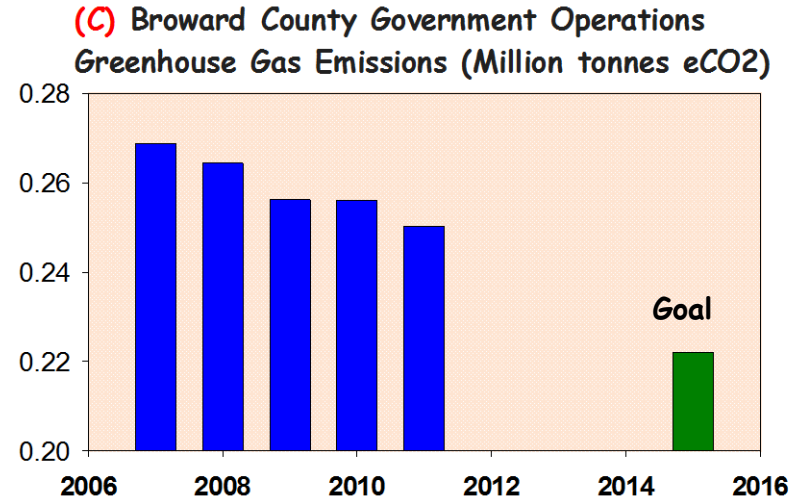
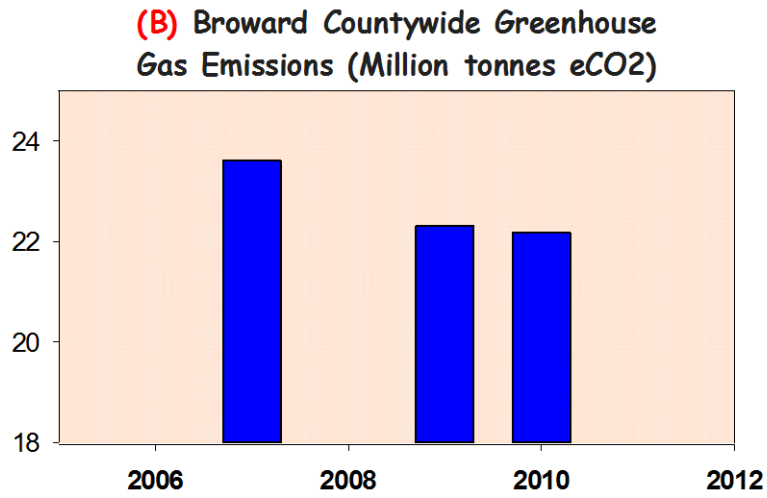
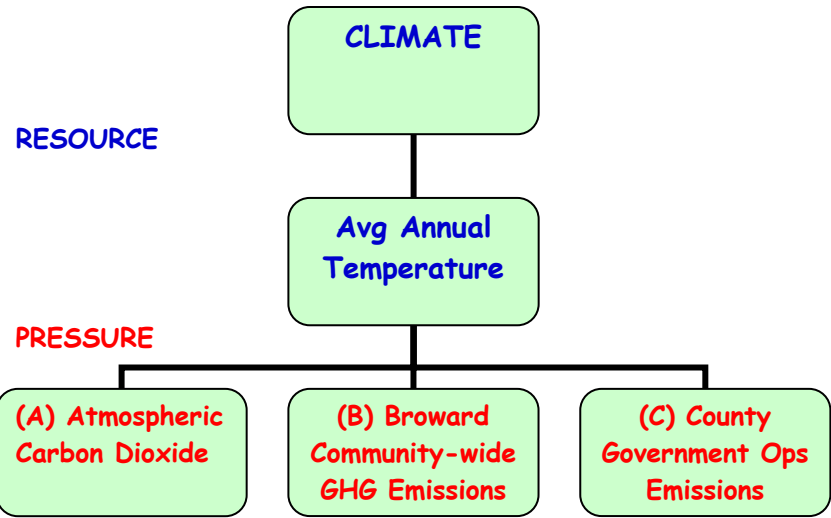
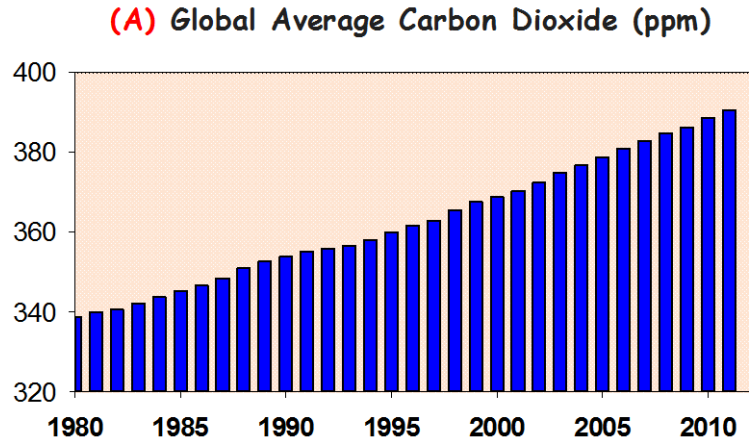
**(B) Change of Annual Average Sea Level (inches) in Key West from the 1920 Baseline**



Endnotes for the Climate Benchmarks are on pages 59-63.

# PRESSURES ON CLIMATE

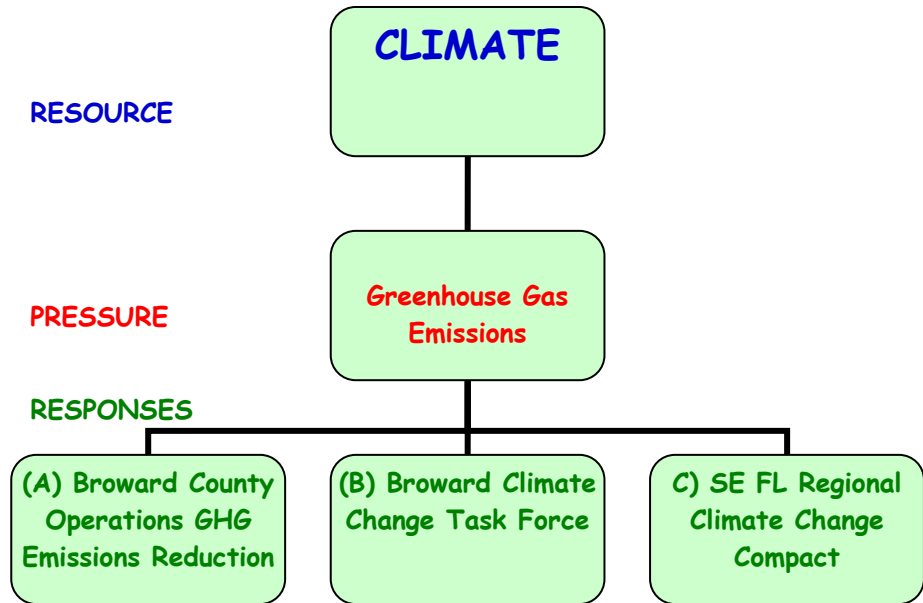
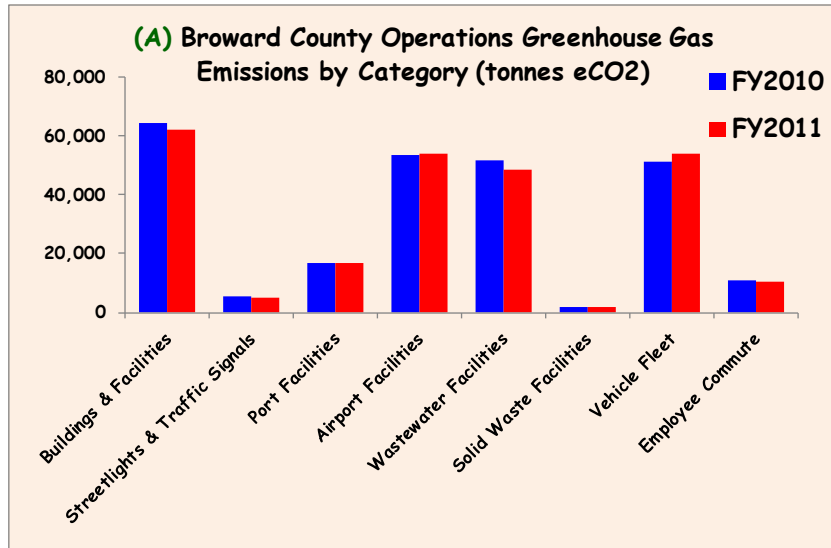
**Greenhouse Gas Emissions** Vehicles, energy consumption, and other sources emit carbon dioxide and other so called "greenhouse" gases (GHG). Increasing concentrations of these gases in the atmosphere is contributing to global warming and other climate impacts.



Endnotes for the Climate Benchmarks are on pages 59-63.



# RESPONSES TO THE PRESSURES ON CLIMATE



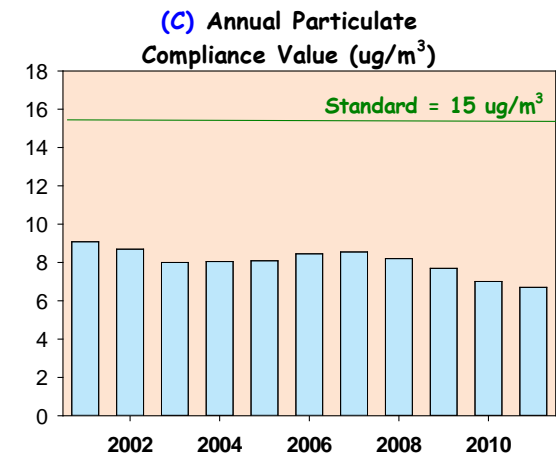
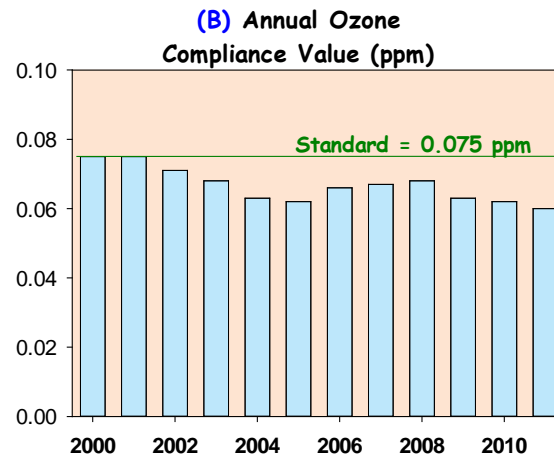
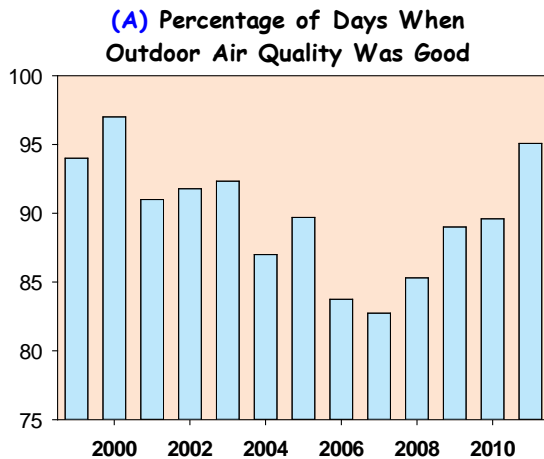
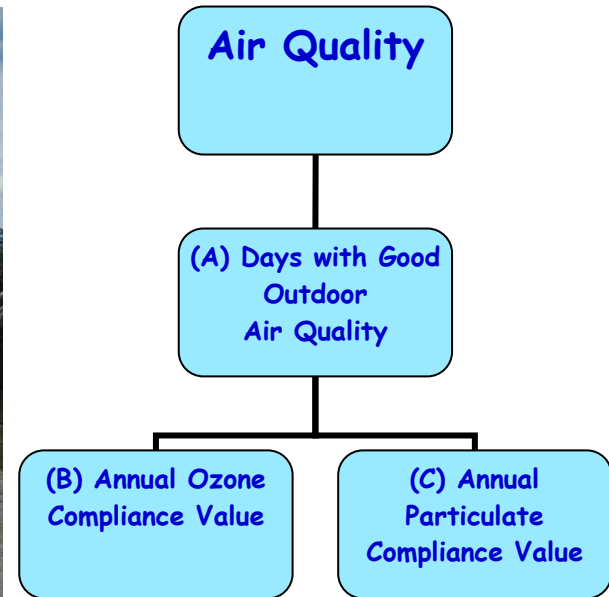
**(B) Broward County Climate Change Task Force** - On June 24, 2008, the Broward County Board of County Commissioners approved Resolution 2008-442 to create a Broward County Climate Change Task Force. Over the course of the next 18 months, they developed a countywide Climate Change Action Plan, a coordinated countywide strategy for mitigating the causes, and addressing the local implications, of global climate change. The Plan is in its third year of implementation. To learn more, see the endnotes on pages 59-63.

**(C) Southeast Florida Regional Climate Change Compact** - Recognizing the vulnerability of the SE Florida region to climate change, Palm Beach, Broward, Miami-Dade and Monroe County Commissioners entered into a cooperative agreement. To date the Compact Counties have coordinated positions on State and Federal legislation, sought adaptation funding, developed a SE FL Regional Climate Action Plan with regional mitigation and adaptation strategies and held the SE FL Regional Climate Leadership Summit annually. To learn more, see the endnotes on pages 59-63.

Endnotes for the Climate Benchmarks are on pages 59-63.

# AIR RESOURCES

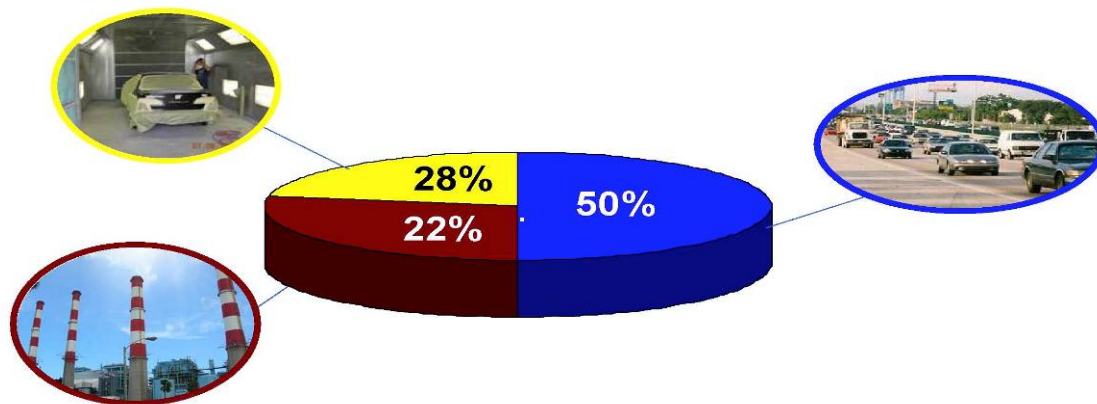
**Air is essential for life.** In South Florida, we depend on clean air to allow residents and visitors to enjoy the warm weather and many natural resources the area has to offer. The Air Quality Program determines the air quality by measuring parameters which have the potential to impact human health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



Endnotes for the Air Quality Benchmarks are on pages 63-72.

# PRESSURES ON AIR QUALITY

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



## ■ Mobile Sources

A moving source of pollution

### On-road

Examples: cars, trucks, motorcycles

### Non-road

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

## Stationary Sources

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

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

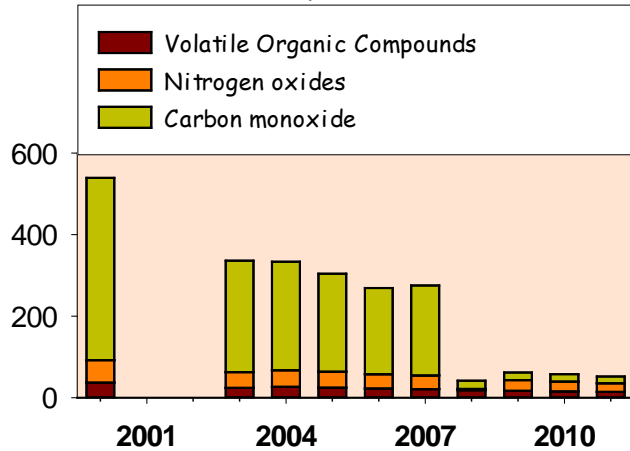
Examples: power plants, petroleum terminals

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

Examples: dry cleaners, paint spray booths

# PRESSURES ON AIR QUALITY - Mobile Sources

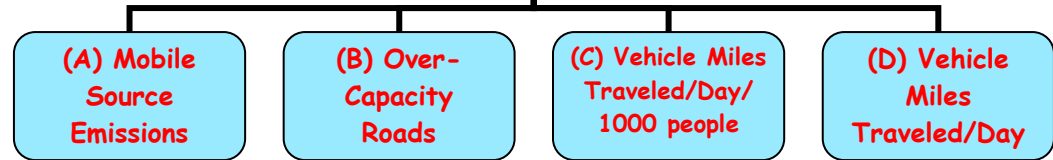
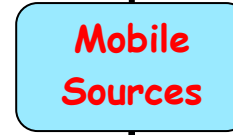
**(A) Mobile Source Emissions**  
Thousands of Tons/Year



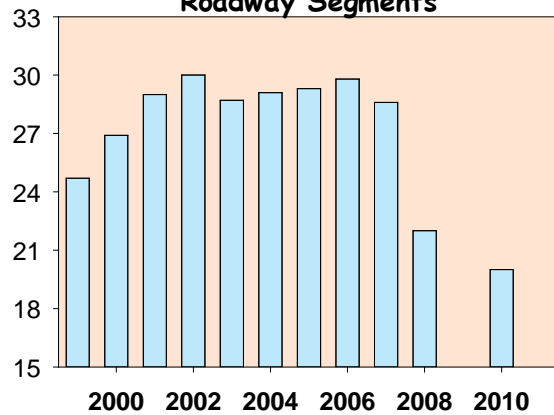
RESOURCE



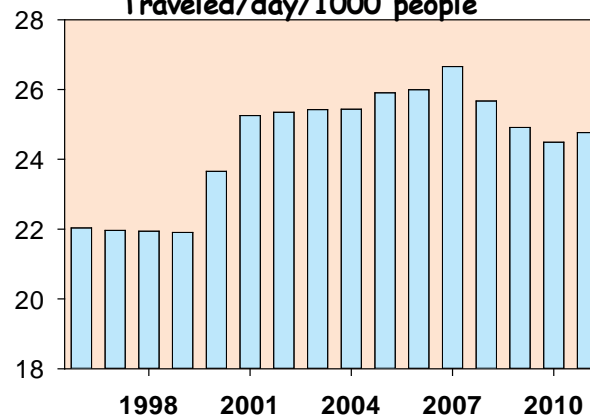
PRESSURES



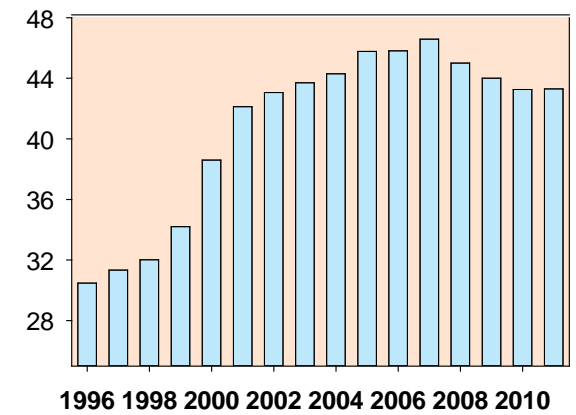
**(B) Percentage of Over-Capacity Roadway Segments**



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



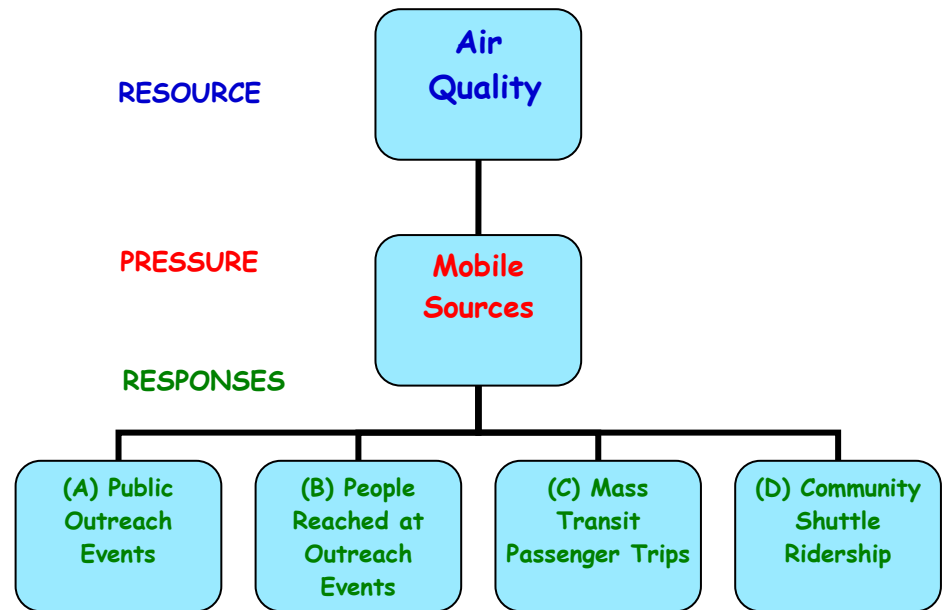
**(D) Vehicle Miles Traveled per Day, Millions**



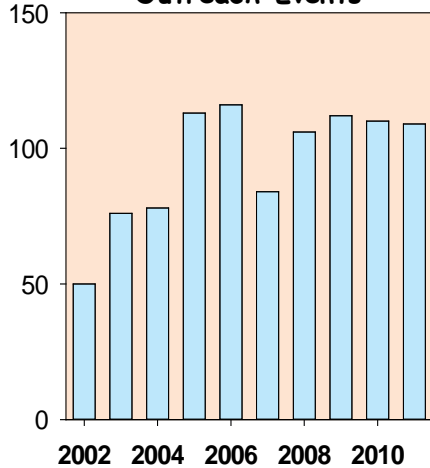
Endnotes for the Air Quality Benchmarks are on pages 63-72.

# RESPONSES TO PRESSURES ON AIR QUALITY - Mobile Sources

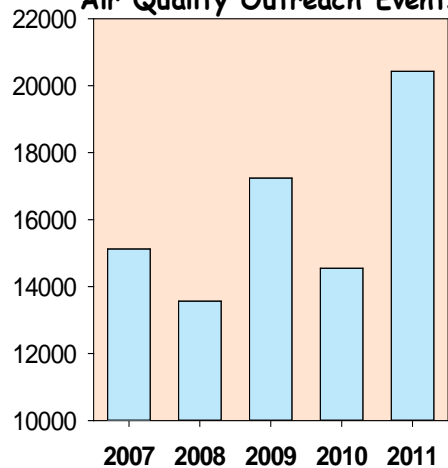
**Mobile Sources** - To reduce the impacts of mobile sources on air quality, development and implementation of strategies to reduce the number of vehicles on the road and their associated emissions are important. Responses that support reductions in mobile source emissions include educating the public about air quality issues and promoting the use of mass transit (i.e. buses and Tri-Rail), carpooling, vanpooling, ridesharing and the use of alternative fueled vehicles.



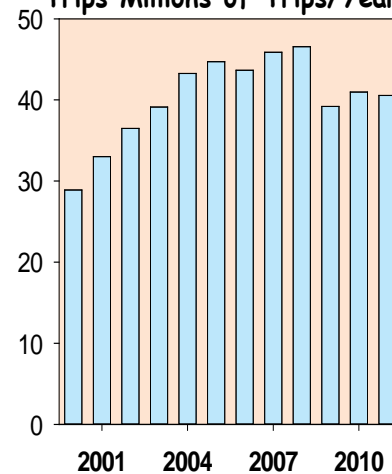
**(A) Number of Air Quality Outreach Events**



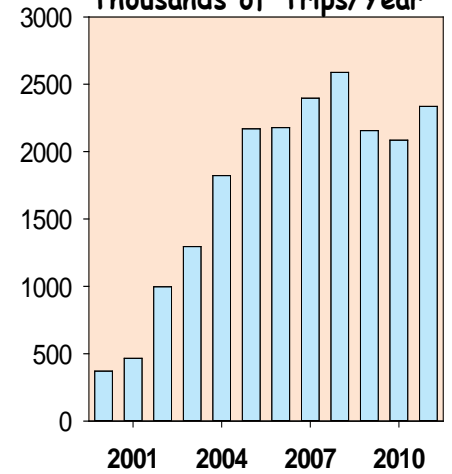
**(B) Number of People Reached thru Air Quality Outreach Events**



**(C) Number of Mass Transit Passenger Trips Millions of Trips/Year**



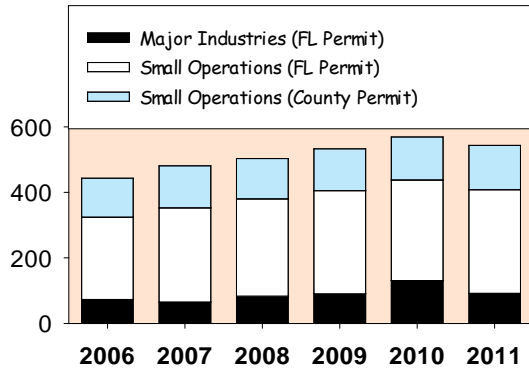
**(D) Community Shuttle Ridership Thousands of Trips/Year**



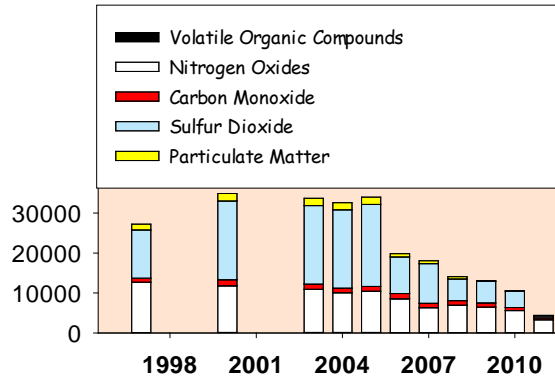
Endnotes for the Air Quality Benchmarks are on pages 63-72.

# PRESSURES ON AIR QUALITY - Regulated Stationary Sources

**(A) Number of Regulated Stationary Sources**



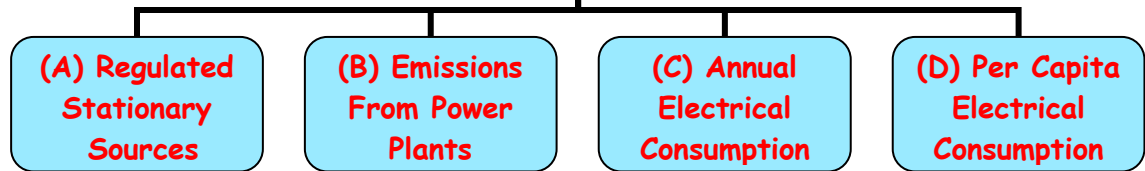
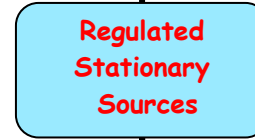
**(B) Emissions From Power Plants (Tons/Year)**



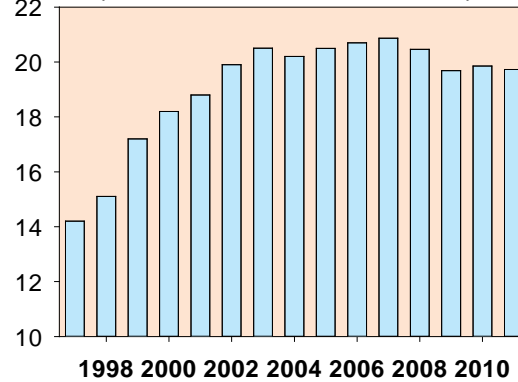
RESOURCE



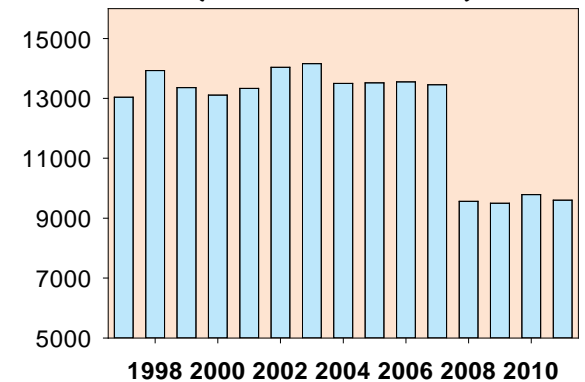
PRESSURES



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



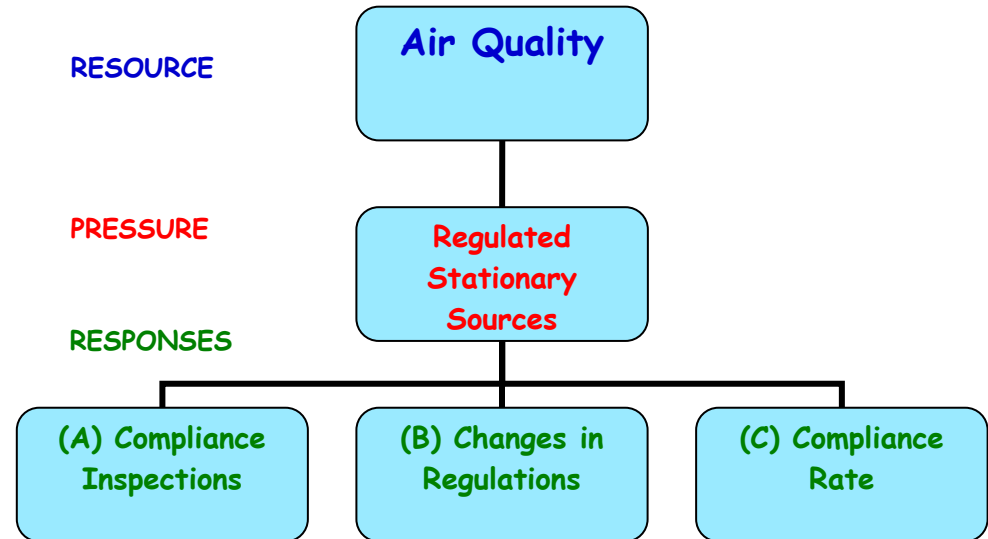
**(D) Per Capita Power Consumption (Kilowatt-Hours/Year)**



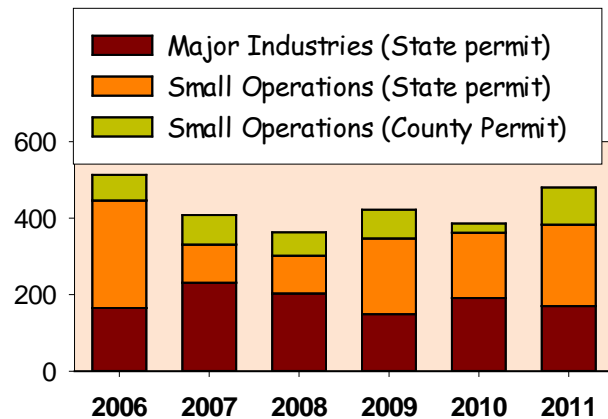
Endnotes for the Air Quality Benchmarks are on pages 63-72.



# RESPONSES TO PRESSURES ON AIR QUALITY - Regulated Stationary Sources

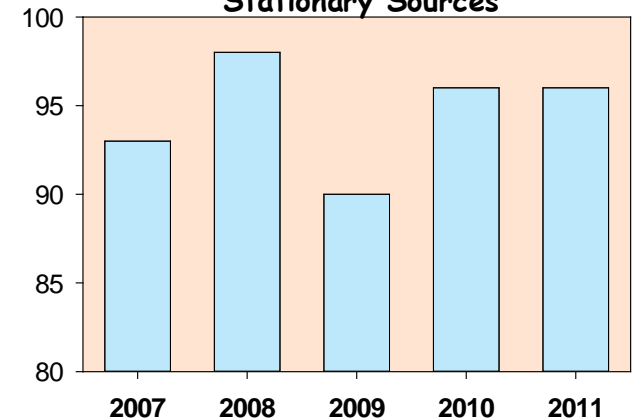


**(A) Number of Compliance Inspections of Regulated Stationary Sources**



**(B) Changes in Stationary Source Regulations -** The Federal, State, and local regulations governing air quality are frequently updated as needs change. To learn more, read the endnotes on pages 63-72.

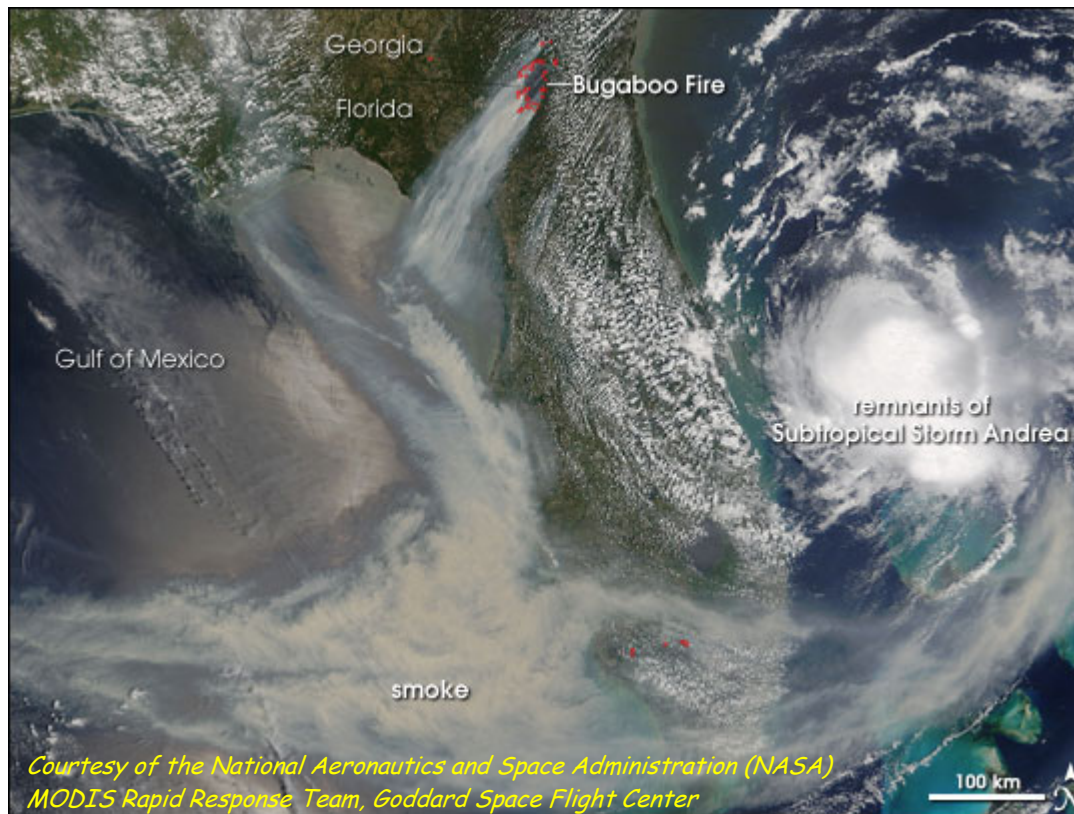
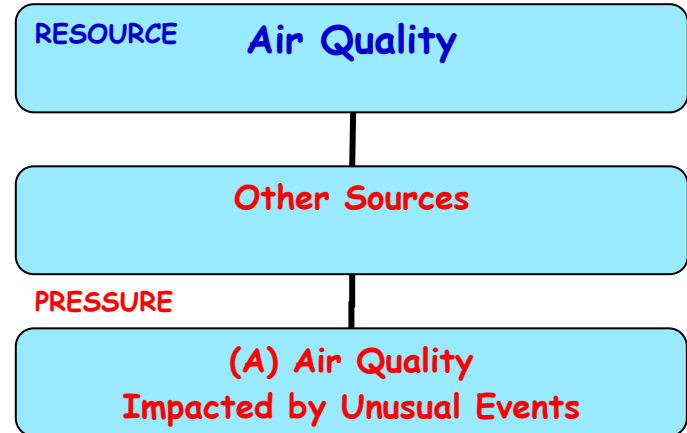
**(C) Compliance Rate of Regulated Stationary Sources**



Endnotes for the Air Quality Benchmarks are on pages 63-72.

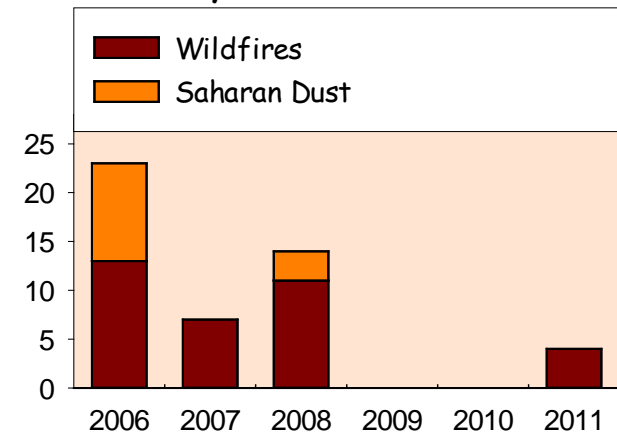
# PRESSURES ON AIR QUALITY - Other Sources

**Air Quality Impacted by Unusual Events** - Large quantities of dust, originating in the African Sahara desert, are periodically blown across the Atlantic Ocean and can, on certain days, impact air quality. Other factors, such as fireworks, wildfires, and open burning, can also have an effect on the air quality in Broward County. Tracking of these events began in 2006. To learn more, see the endnote on page 63-72.



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

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

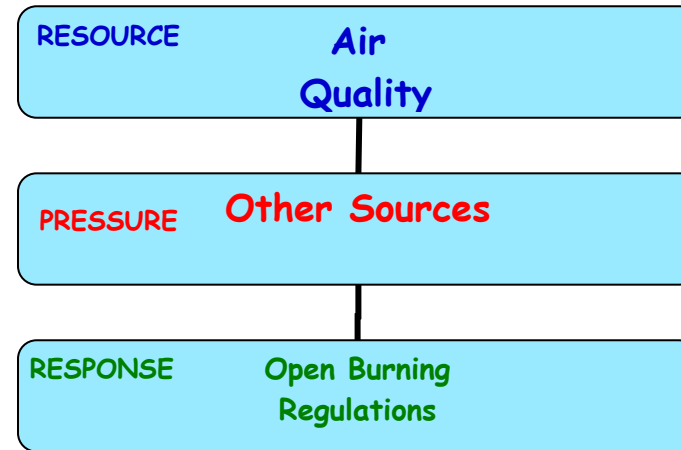


Endnotes for the Air Quality Benchmarks are on pages 63-72.

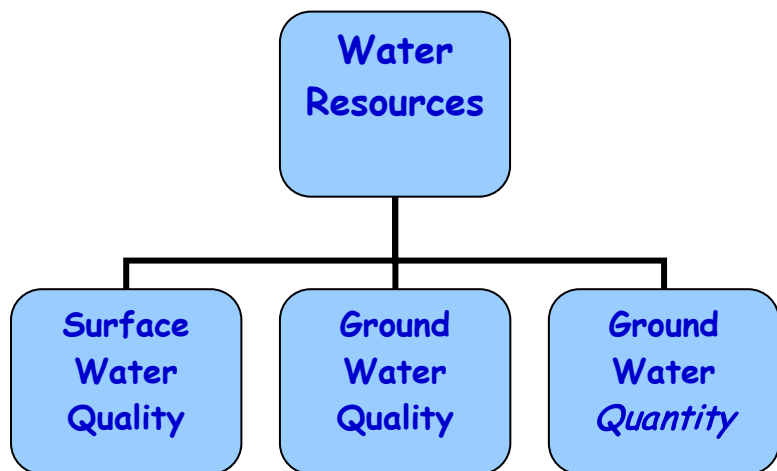


# RESPONSES TO PRESSURES ON AIR QUALITY - Other Sources

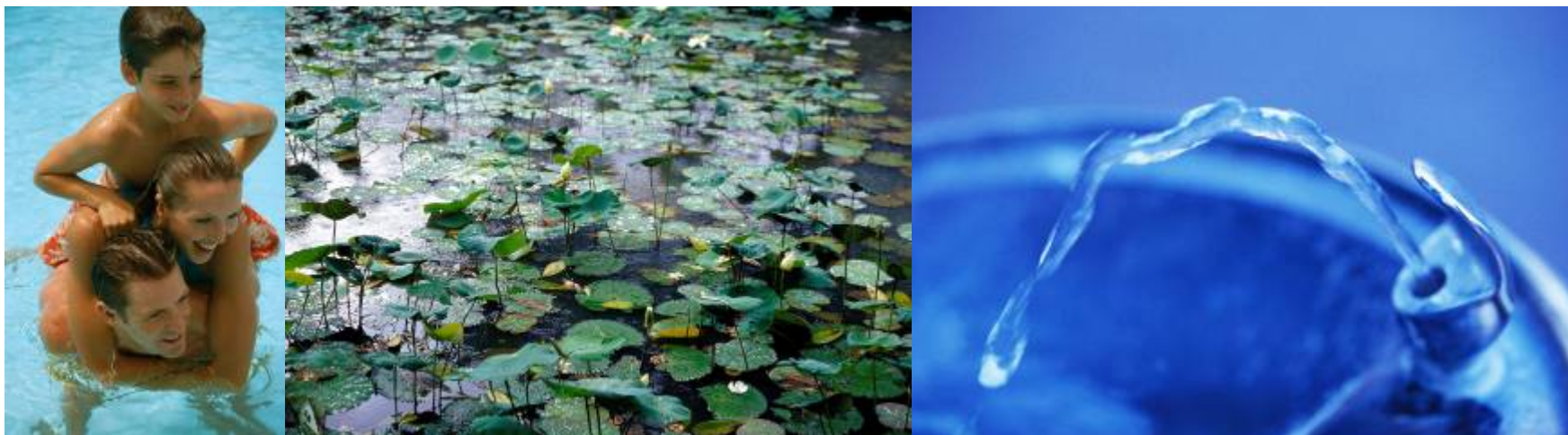
**Open Burning Regulations:** In Broward County, open burning is regulated under Broward County Code Chapter 27, Article IX. To reduce the impact of smoke from open burning operations in Broward County, open burning is subject to required operational practices including minimum set-back distances and prohibitions on certain materials. Broward County also coordinates with local officials and agencies to ensure comprehensive compliance with all open burning regulations. In the unusual event of a nearby large-scale fire (e.g. wildfires, forest fires, burning of sugar cane fields) that affects air quality in Broward County, the Broward County Air Quality Program issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases. For more information, please see the endnotes on pages 63-72.



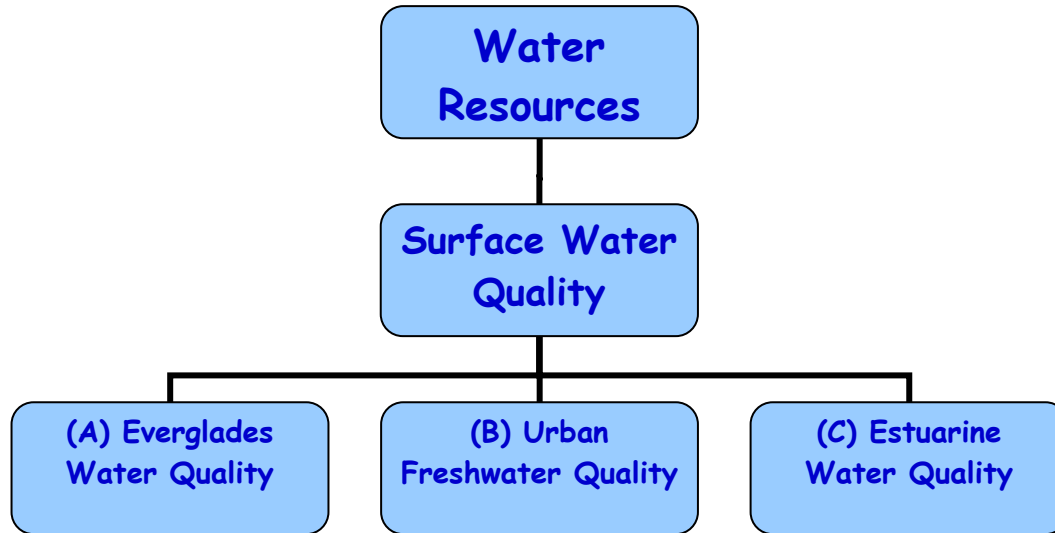
# WATER RESOURCES



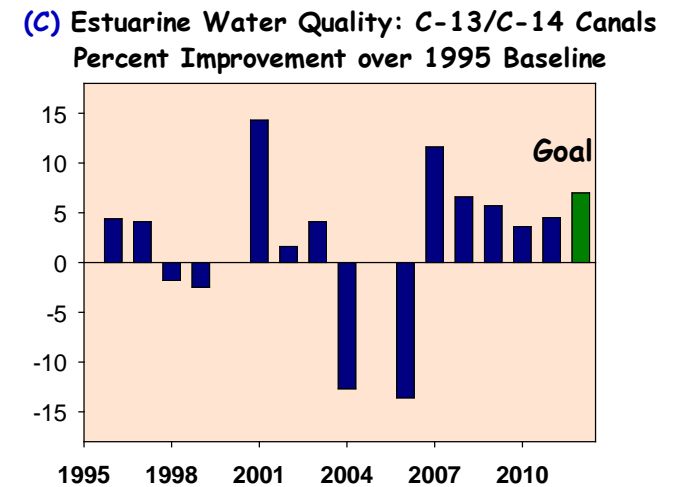
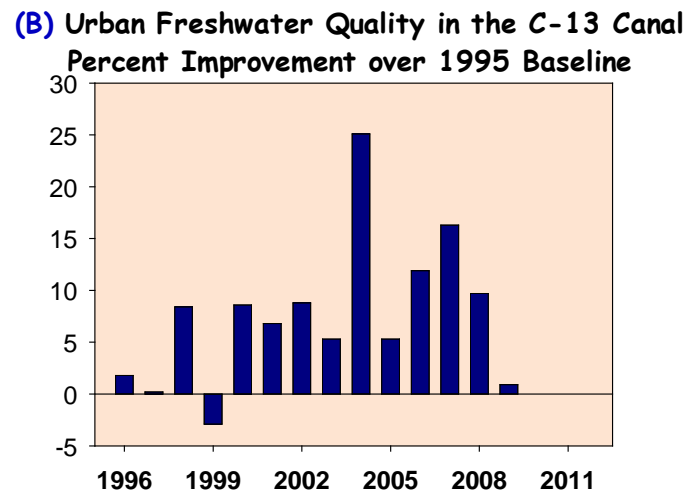
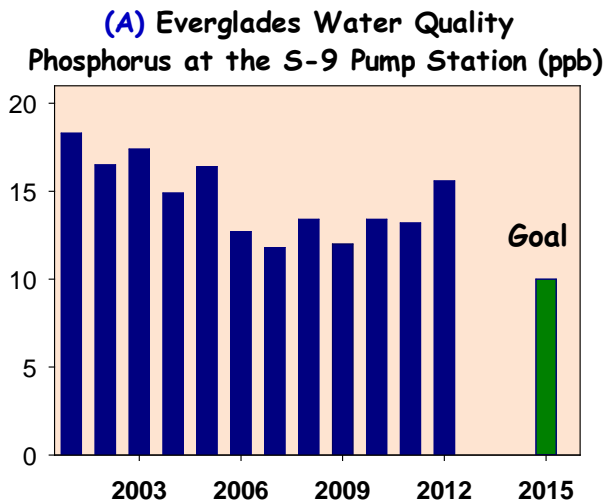
**Water** is what makes our planet unique. The availability of an adequate supply of clean water is one of the primary criteria that allow human and ecological communities to exist in a given location. South Florida hosts a network of canals, an underground source of drinking water called the Biscayne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



# WATER RESOURCES - Surface Water

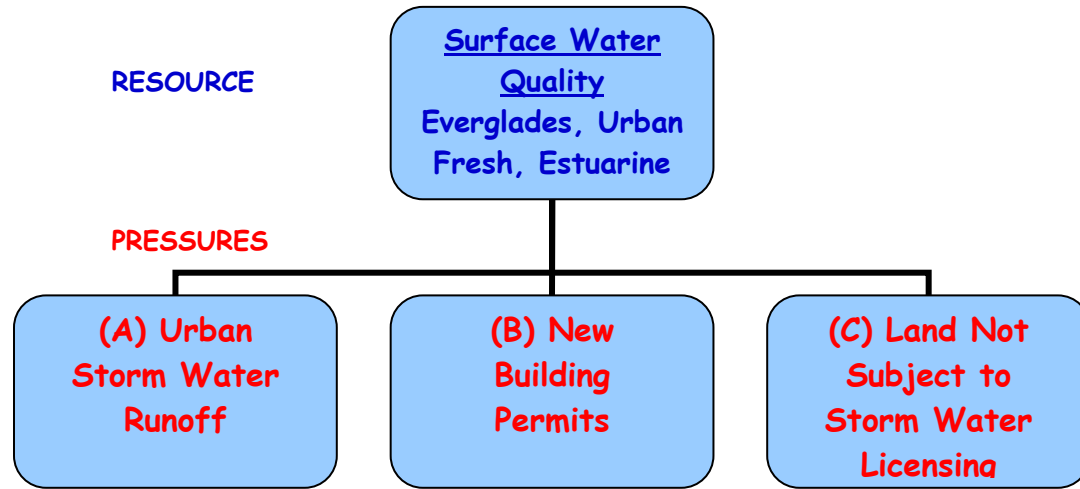


**Surface Water** - Surface water includes our vast network of urban canals and lakes, the brackish estuarine waters of tidal rivers, the Intracoastal Waterway, and the natural areas that encompass the Everglades ecosystem. The water quality requirements and standards differ among these different environments. In this section, we see how the existing water quality compares to the 2012 goals.



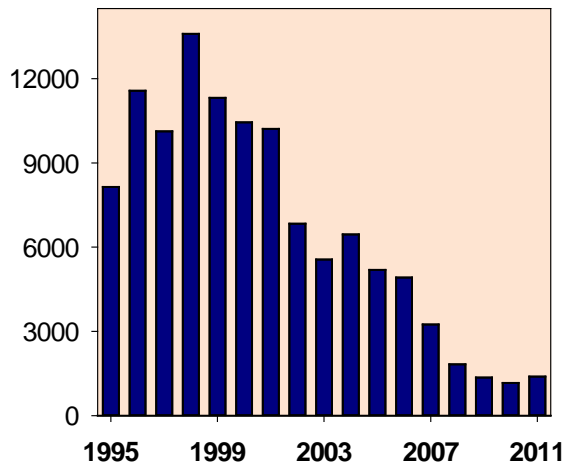
Endnotes for the Water Resource Benchmarks are on pages 72-94.

# PRESSURES ON WATER QUALITY - Surface Water

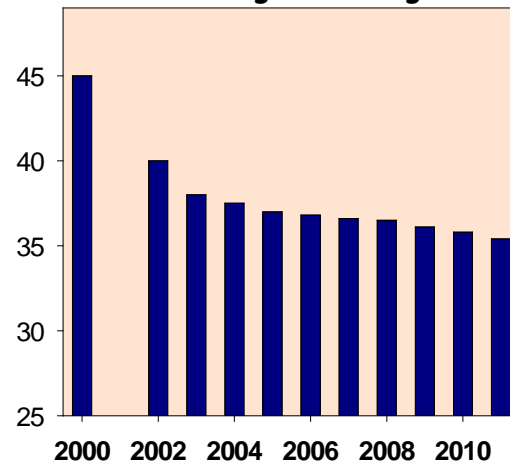


**(A) Urban Storm Water Runoff** - Urban storm water is a major contributor of pollutants to our waterways. Fertilizers, pet waste, roadways, and poorly managed construction sites are part of the problem. In addition, older areas of the County were built without the infrastructure to clean up the runoff before it enters our waterways. For more information, read the endnote on pages 72-94.

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



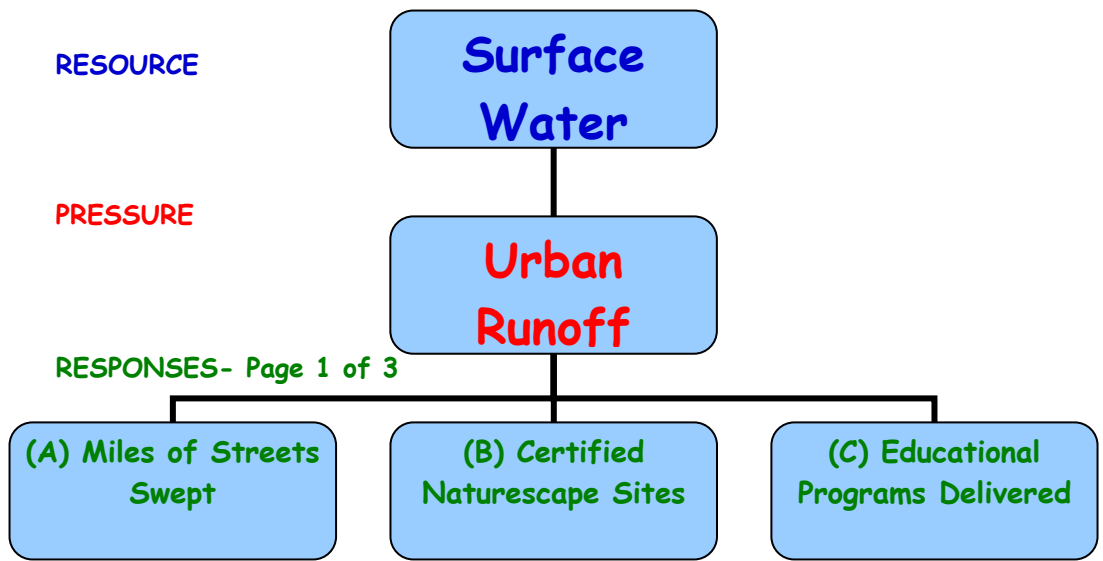
**(C) Percentage of Developed Land Not Subject to Surface Water Management Regulation**



Endnotes for the Water Resource Benchmarks are on pages 72-94.

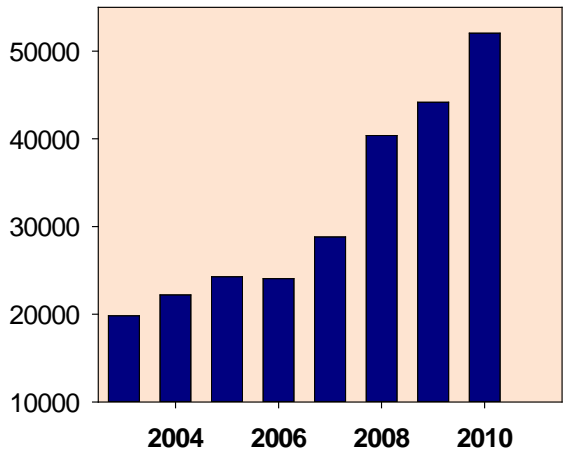


# RESPONSES TO PRESSURES ON WATER QUALITY - Surface Water

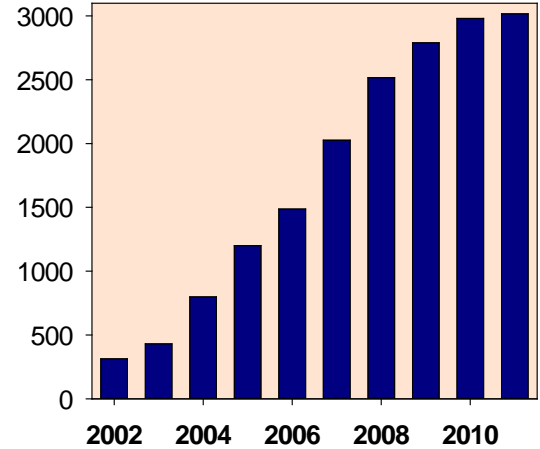


This driveway is pervious. It prevents stormwater runoff by allowing water to percolate and recharge the aquifer.

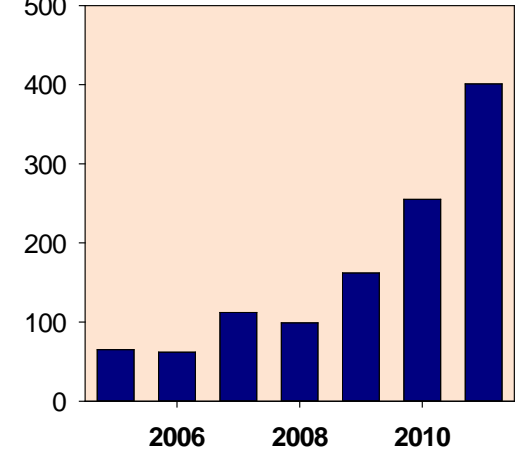
**(A) Miles of Streets Swept**



**(B) Total Number of Certified Naturescape Sites**

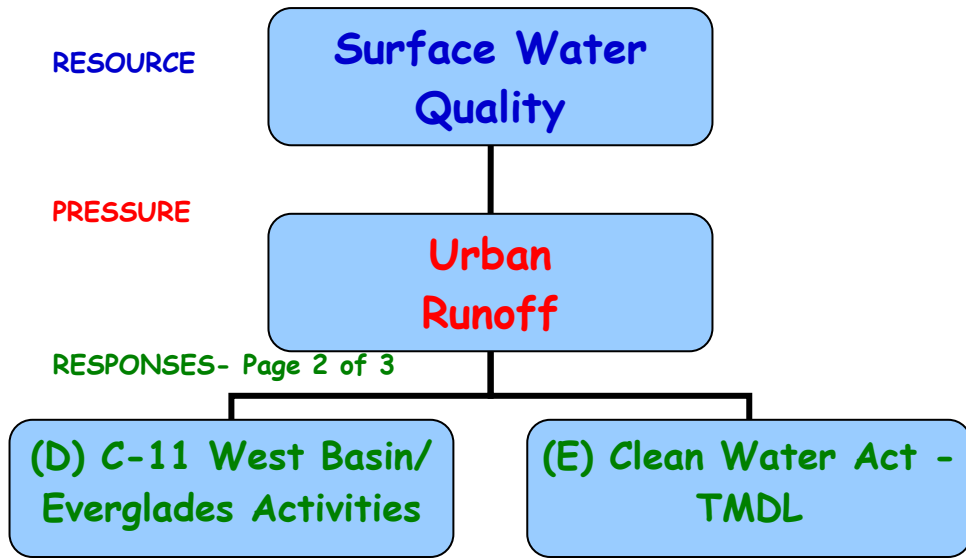


**(C) Number of Educational Programs Delivered**



Endnotes for the Water Resource Benchmarks are on pages 72-94.

# RESPONSES TO PRESSURES ON WATER QUALITY - Surface Water

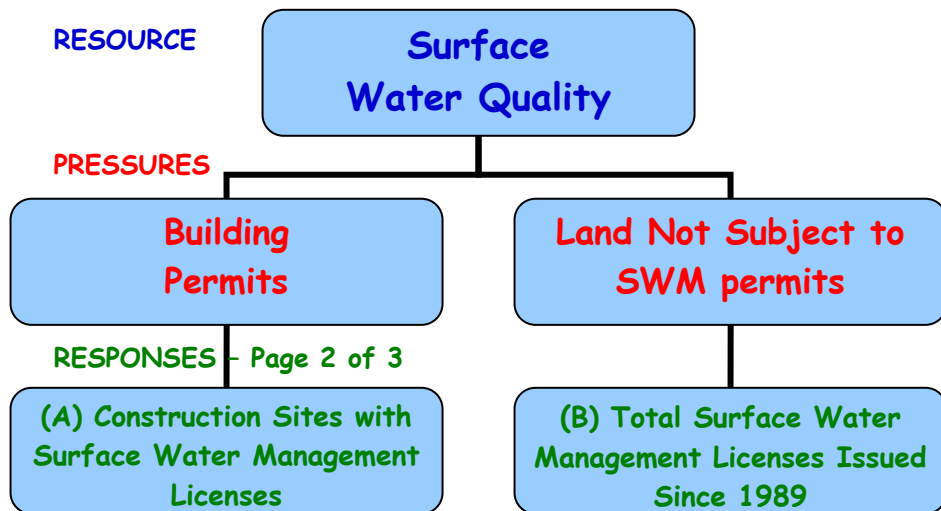


**(D) C-11 West Basin/ Broward Everglades Working Group Activities** - This group (BEWG) was convened in 2004 to bring greater focus to pollution reduction efforts in the C-11 West Canal Basin in support of Everglades Restoration. The BEWG has developed a plan to reduce phosphorus entering the Everglades. To learn more, see the endnotes on pages 72-94.

**(E) Clean Water Act TMDL**- A Total Maximum Daily Load, or TMDL, is the amount of a pollutant a surface water body can assimilate and still meet water quality standards. TMDLs are established by the State for all waters designated as impaired for one or more pollutants. The goal is to reduce pollutant loads to impaired waters to allow the water body to recover and meet its designated use. To learn more, see the endnotes on pages 72-94.

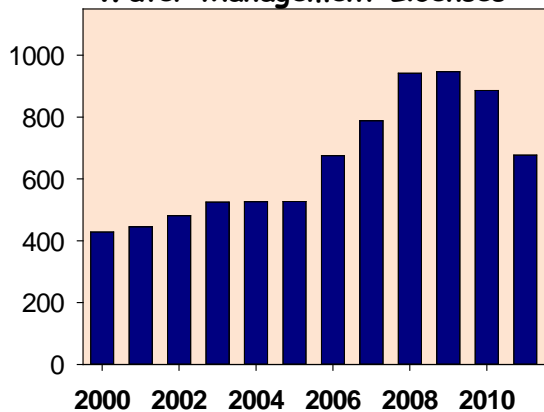
Endnotes for the Water Resource Benchmarks are on pages 72-94.

# RESPONSES TO PRESSURES ON WATER QUALITY - Surface Water

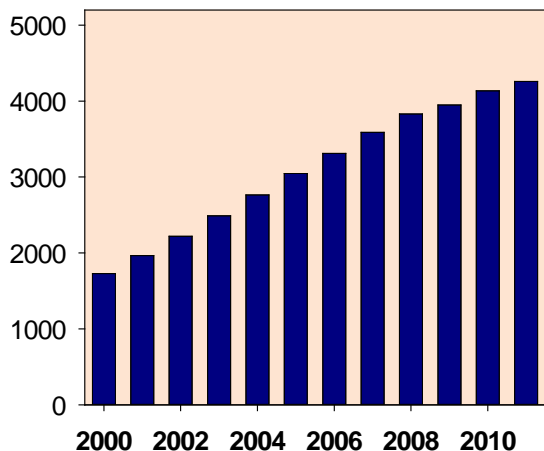


**Construction Activities and Surface Water Management (SWM) Licenses** - Inspection of sites during construction ensures that muddy runoff does not end up in our waterways. The SWM license ensures that storm water is held on site for pretreatment by swales, wet and dry retention areas (see below) and other means.

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

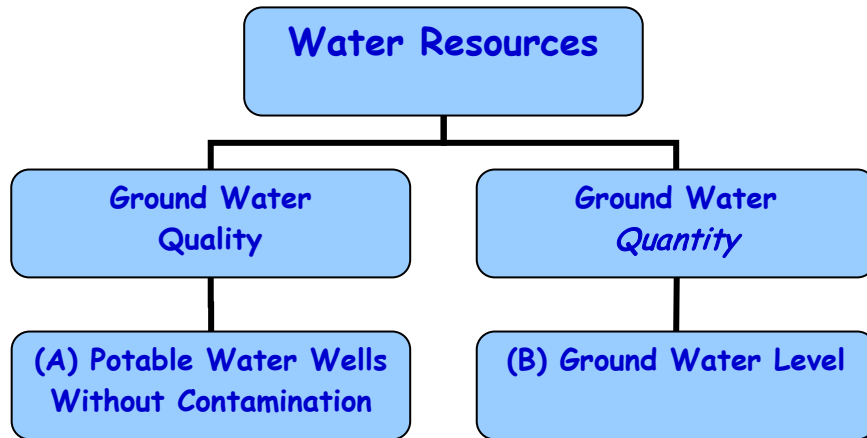


**(B) Total Surface Water Management Construction Licenses Issued Since 1989**



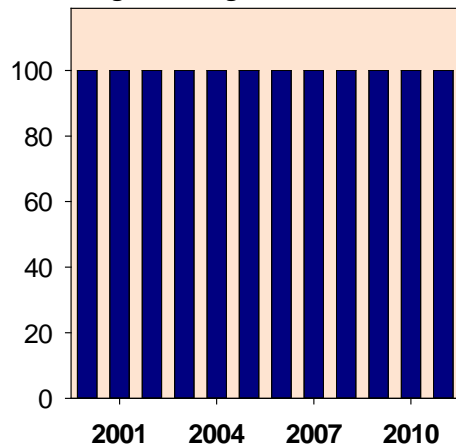
Endnotes for the Water Resource Benchmarks are on pages 72-94.

# WATER RESOURCES - Ground Water

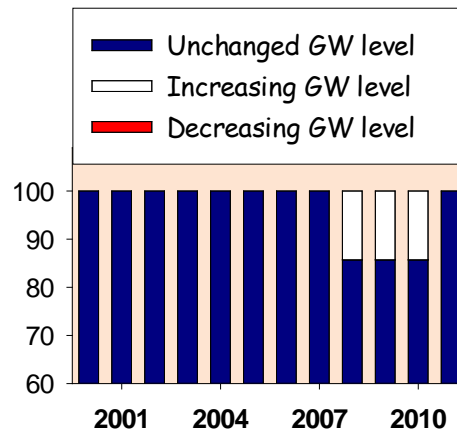


**Ground Water** - The overwhelming majority of our drinking water comes from the Biscayne Aquifer. Protecting the quality of that drinking source from hazardous materials and other pollutants is paramount. Ground water levels must be maintained to prevent impacts to wetlands, to hold back salt water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

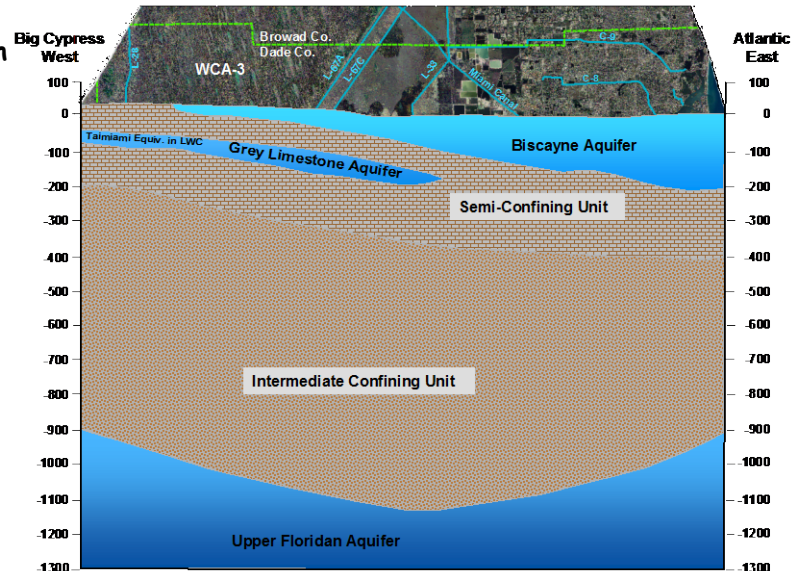
**(A) Percent of Potable Water Wells Meeting Drinking Water Standards**



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



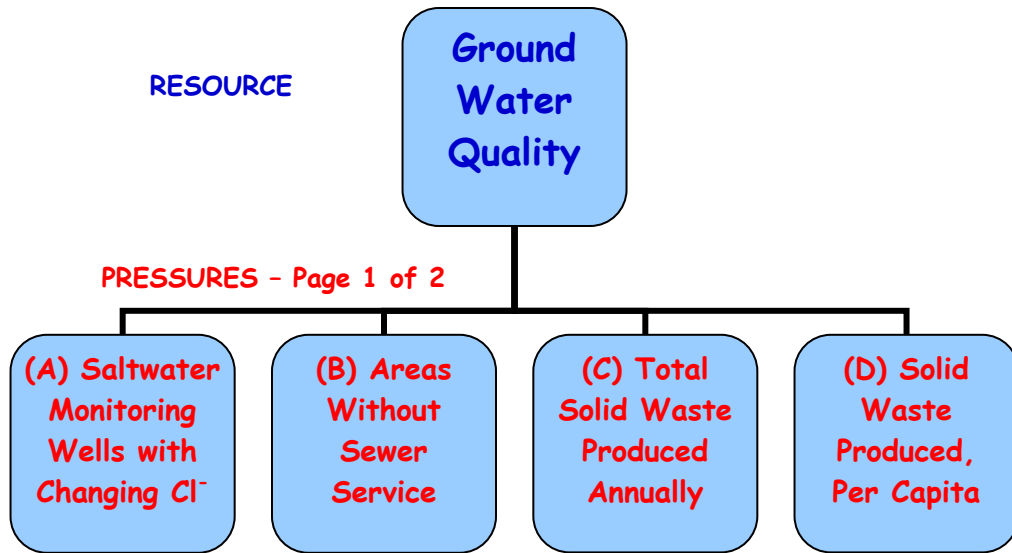
**Generalized Cross Section of Our Geology**



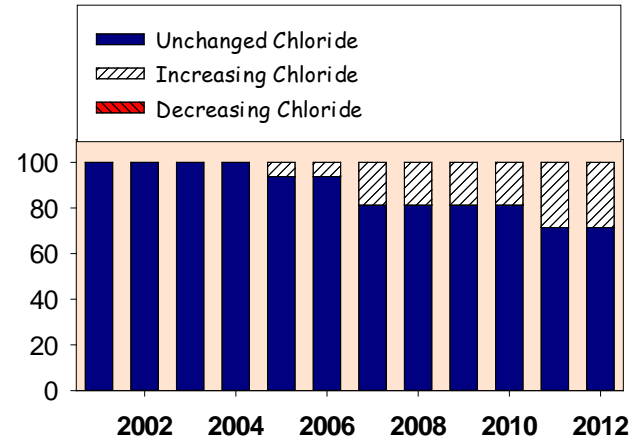
Endnotes for the Water Resource Benchmarks are on pages 72-94.



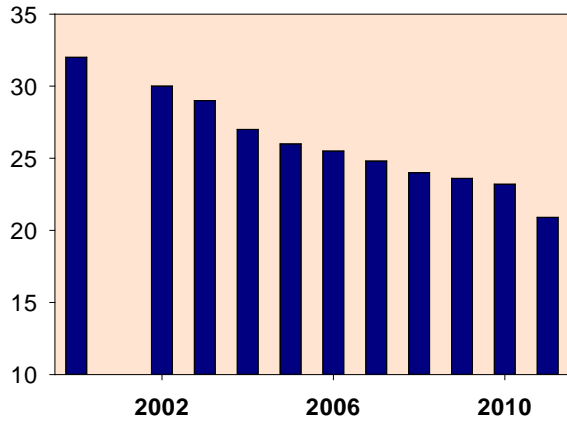
# PRESSURES ON WATER QUALITY - Ground Water



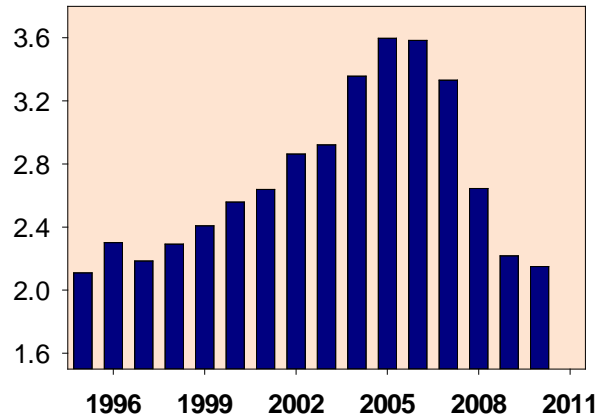
(A) Percent Saltwater Monitoring Wells with Changing Chloride Concentrations, 2000 baseline



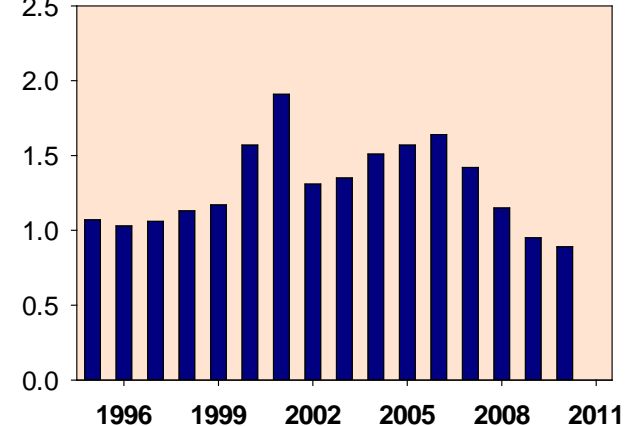
(B) Percent Broward County Where Central Domestic Sewer Service is Not Available



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

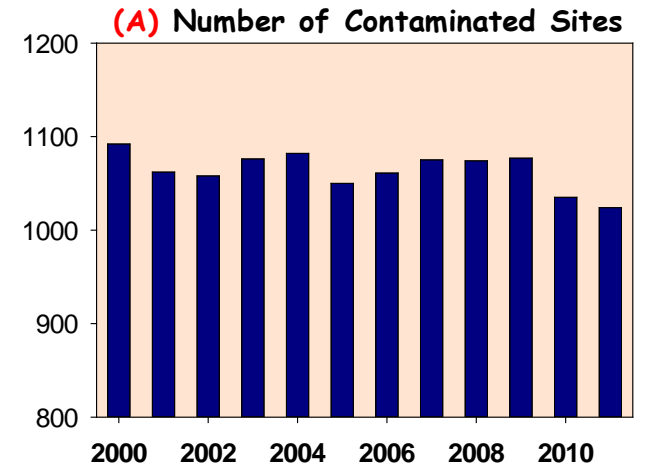
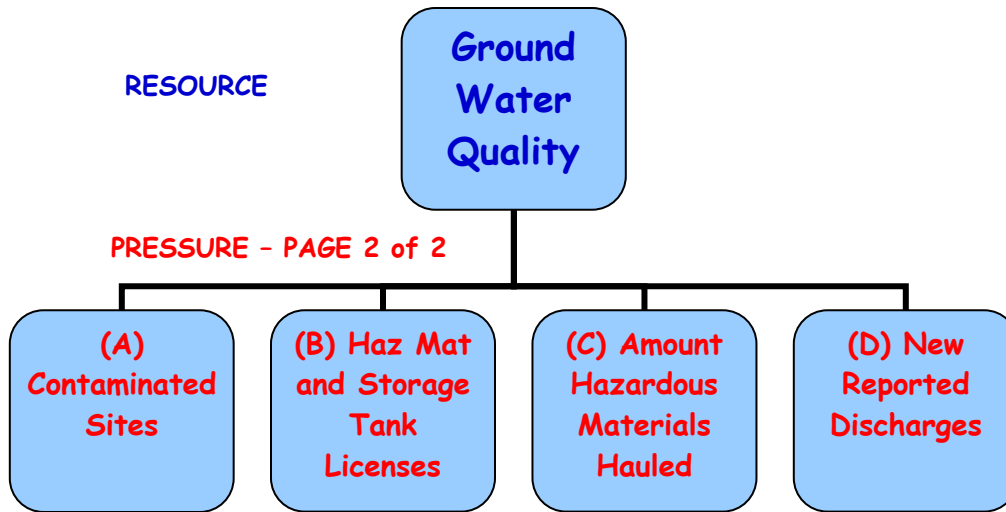


(D) Solid Waste Produced, Tons/Year/Person

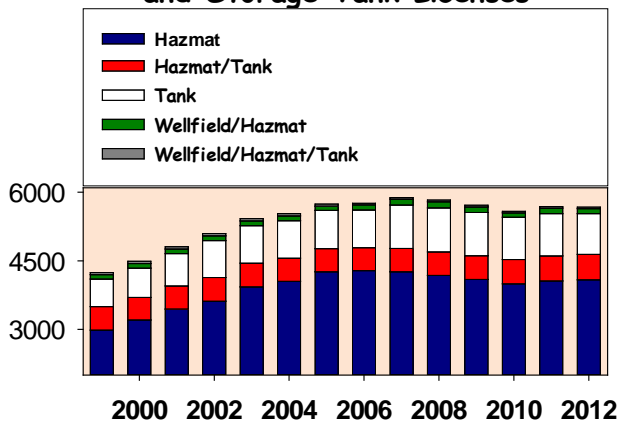


Endnotes for the Water Resource Benchmarks are on pages 72-94.

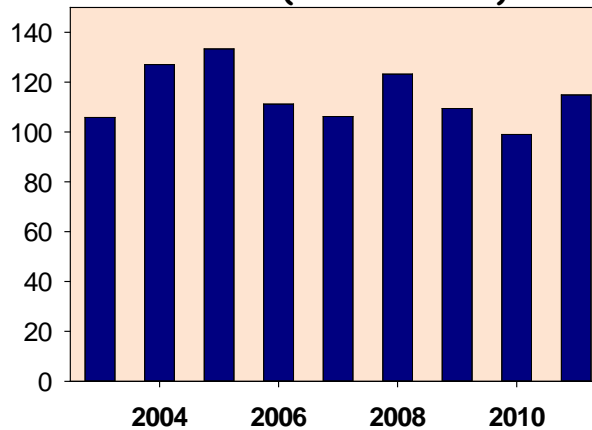
# PRESSURES ON WATER QUALITY - Ground Water



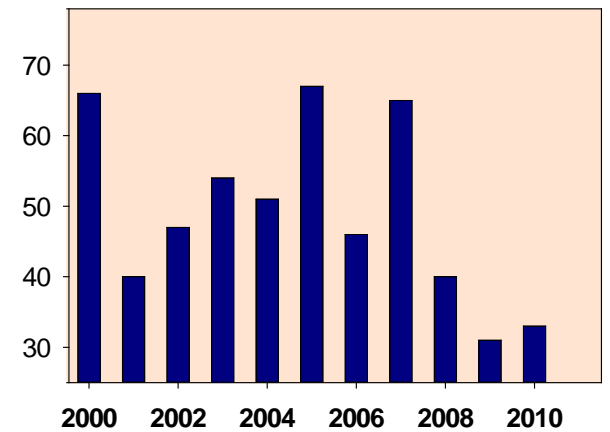
(B) Number of Hazardous Materials and Storage Tank Licenses



(C) Amount Hazardous Materials Hauled (Million Gallons)

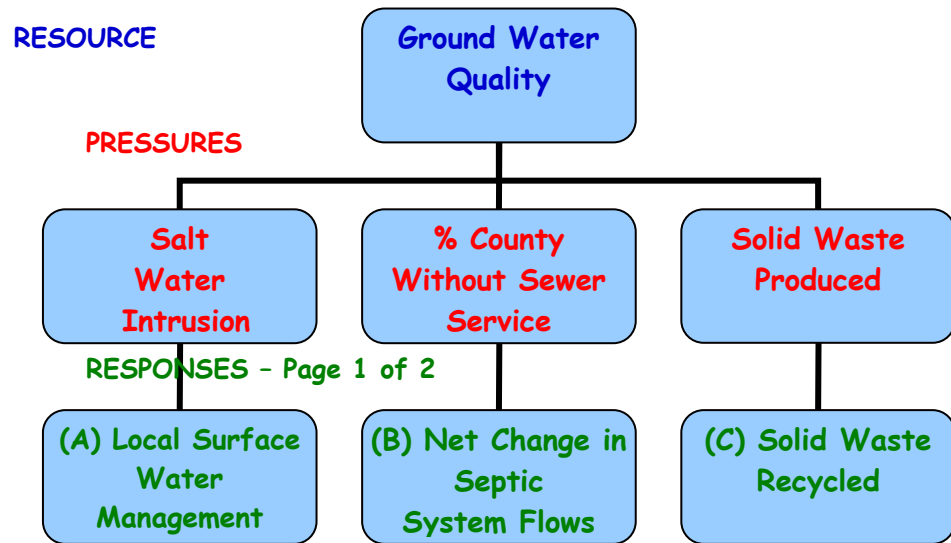


(D) Number of New Reported Discharges



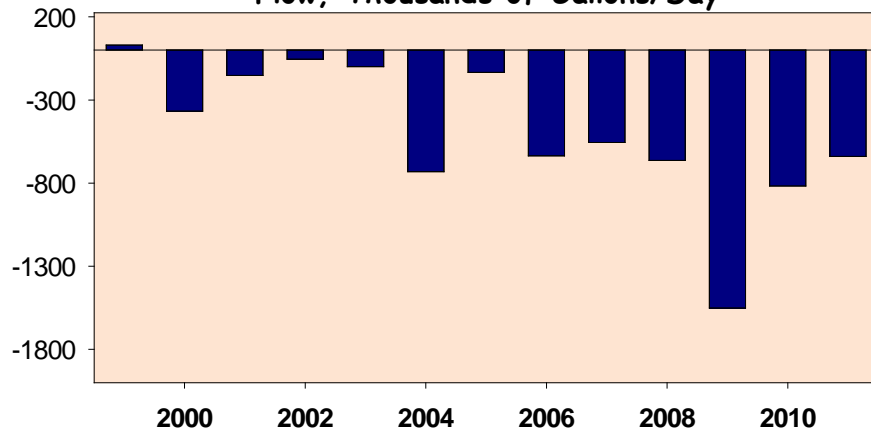
Endnotes for the Water Resource Benchmarks are on pages 72-94.

# RESPONSES TO PRESSURES ON WATER QUALITY - Ground Water

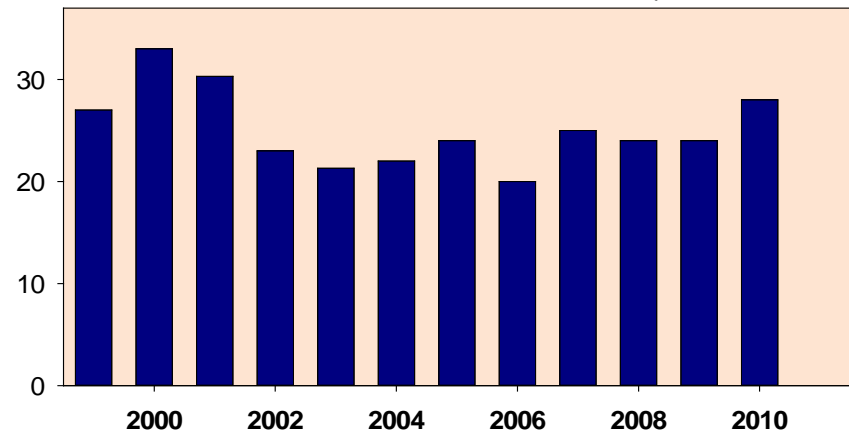


**(A) Local Surface Water Management -** Broward County has been investigating innovative ways to improve surface water management to increase storage and water quality treatment within the secondary canal system. Such improvements reduce pollutant loads to the Everglades and coastal ecosystems and serve to increase aquifer recharge. To learn more, read the endnote on pages 72-94.

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

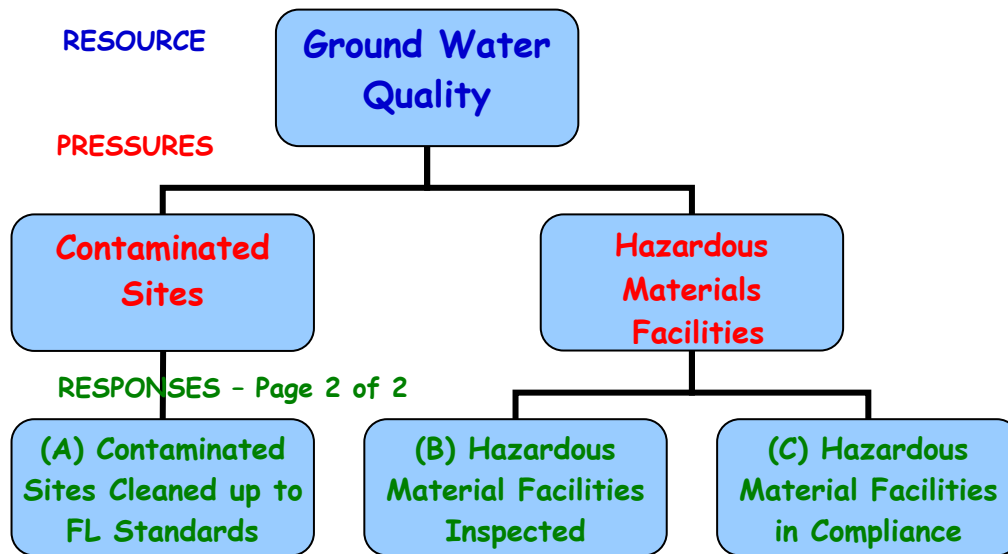


**(C) Percent of Solid Waste Recycled**

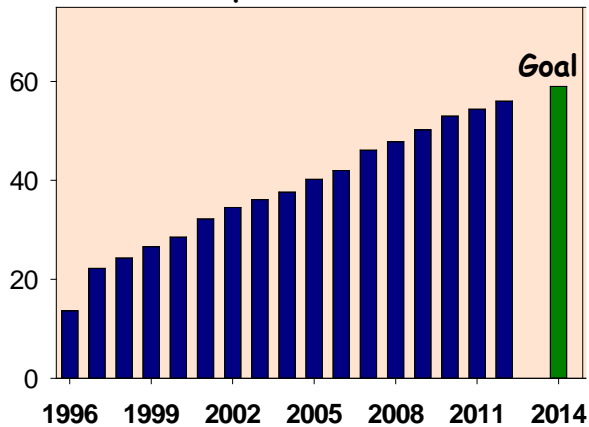


Endnotes for the Water Resource Benchmarks are on pages 72-94.

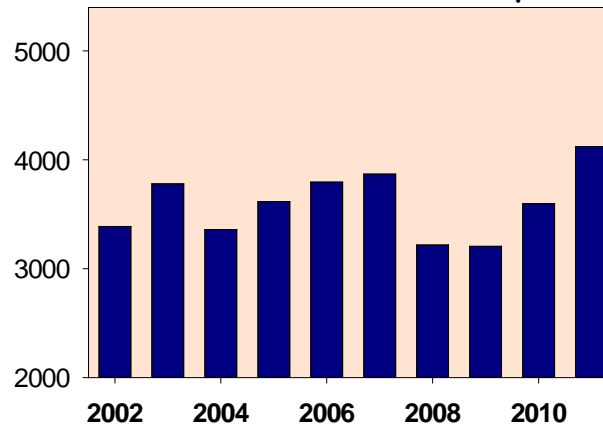
# RESPONSES TO PRESSURES ON GROUND WATER QUALITY



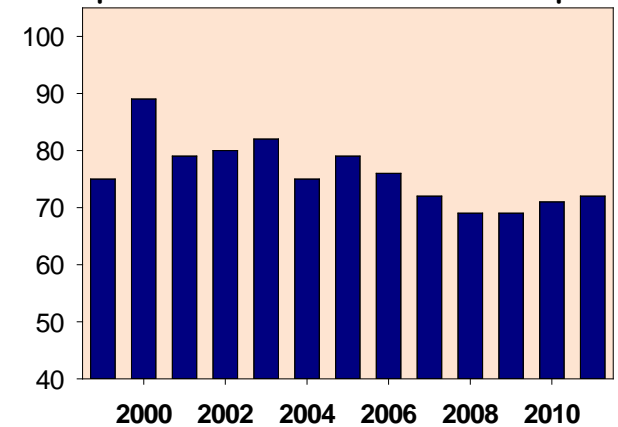
**(A) Percentage of Contaminated Sites Cleaned Up to State Standards**



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

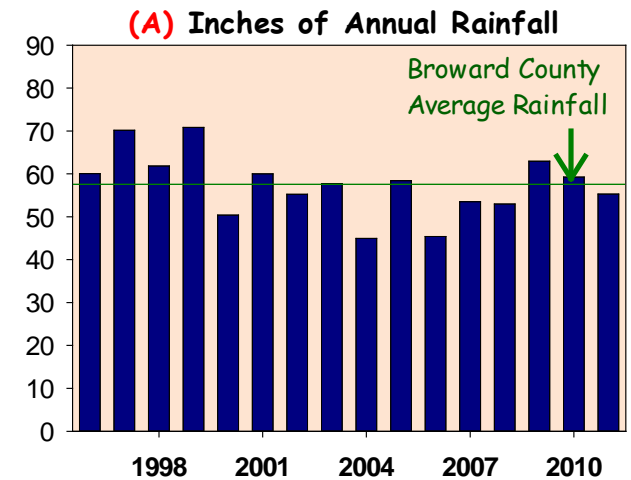
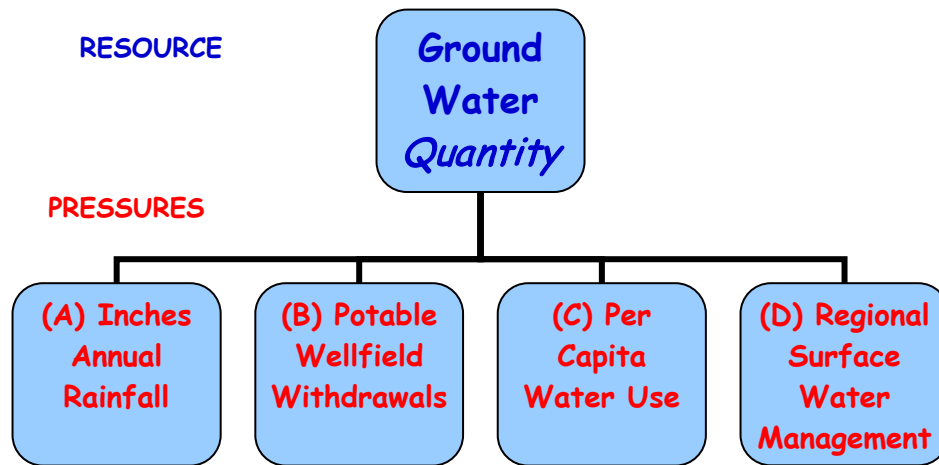


**(C) Percent Licensed Hazardous Material Sites Inspected and Found to Be in Compliance**

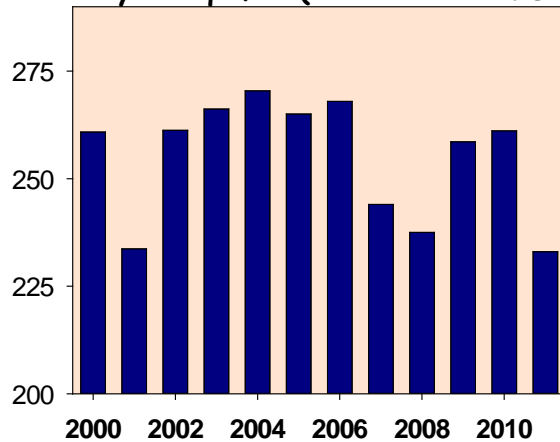


Endnotes for the Water Resource Benchmarks are on pages 72-94.

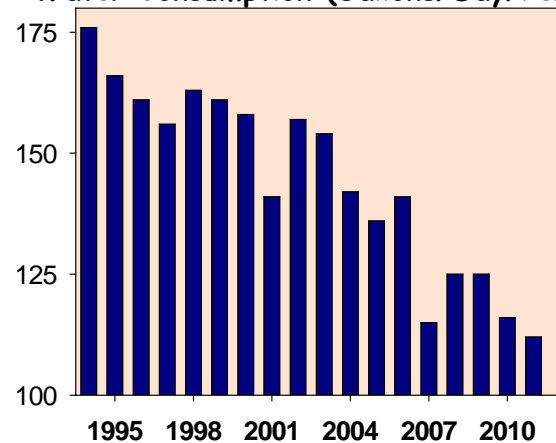
# PRESSURES ON WATER QUANTITY - Ground Water



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



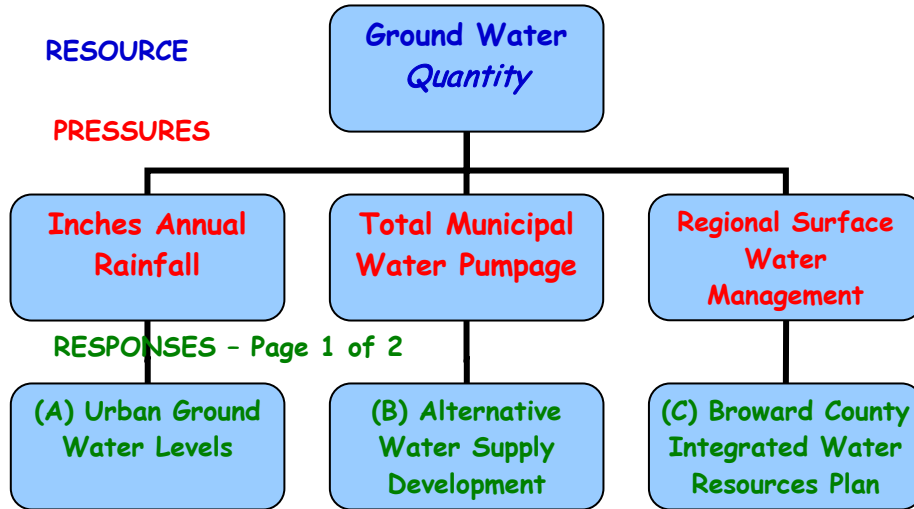
**(C) Broward County Water and Wastewater Services Water Consumption (Gallons/Day/Person)**



**(D) Regional Surface Water Management -** The Comprehensive Everglades Restoration Plan and recent policy changes at the SFWMD are reducing freshwater flows into urban Broward County. This may have impacts on local ground water levels, urban wetland systems and salt water intrusion. To learn more, read the endnote on pages 72-94.

Endnotes for the Water Resource Benchmarks are on pages 72-94.

# RESPONSES TO PRESSURES ON GROUND WATER QUANTITY

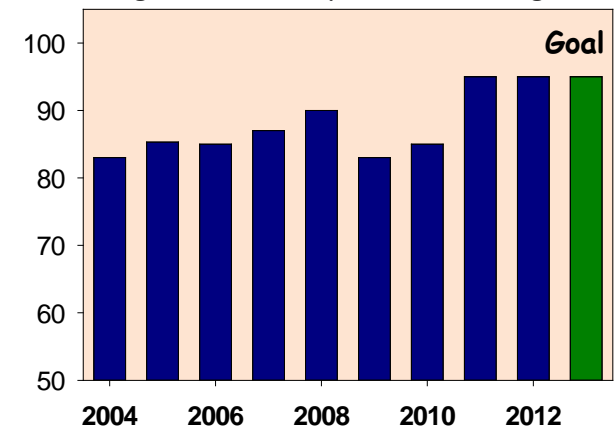


Example of Alternative Water Supply - Pompano reclaimed wastewater distribution

**(A) Maintenance of Urban Ground Water Levels -** Urban ground water levels are directly connected to the integrity of the Biscayne Aquifer, the health and function of urban wetlands, the operation of drainage infrastructure, and Everglades restoration. To learn more about efforts to maintain the ground water levels, read the endnote on pages 72-94.

**(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 pages 72-94.

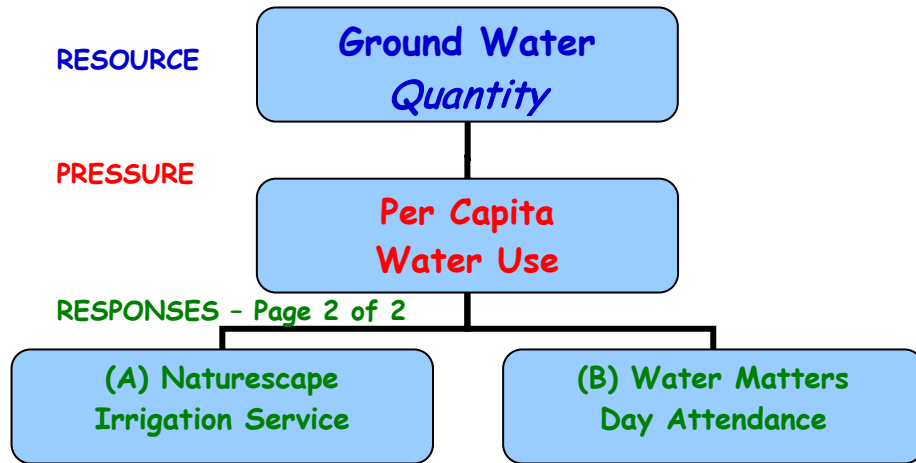
**(C) Percent Participation of Local Water Managers in County-wide Planning Efforts**



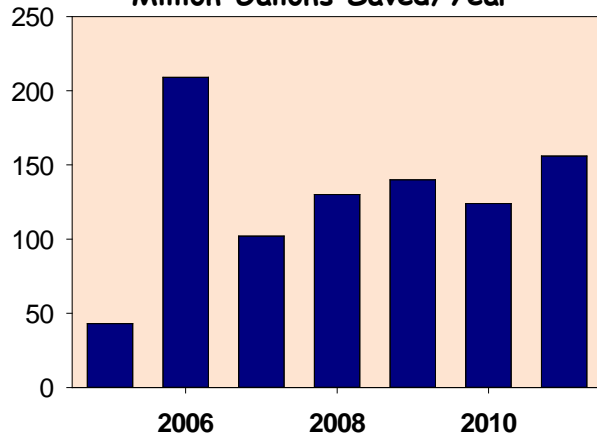
Endnotes for the Water Resource Benchmarks are on pages 72-94.



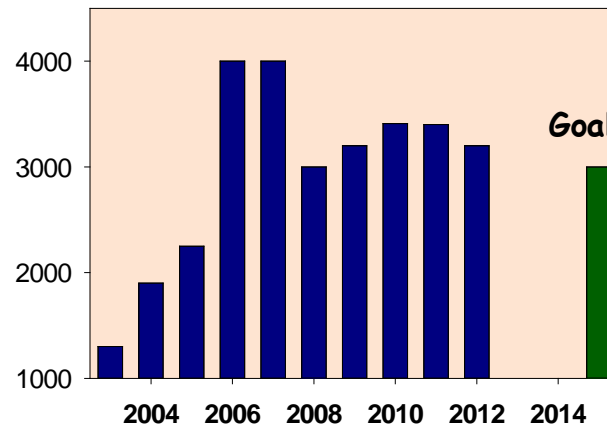
# RESPONSES TO PRESSURES ON GROUND WATER QUANTITY



(A) Naturescape Irrigation Service  
Million Gallons Saved/Year



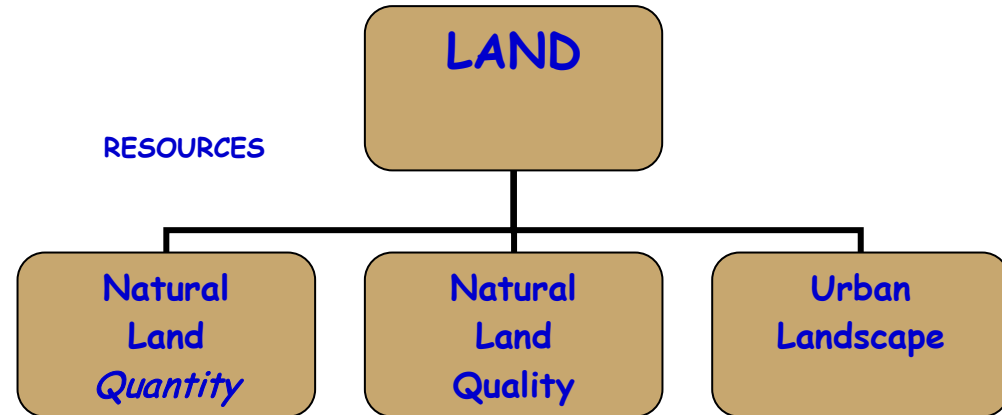
(B) Water Matters Day Attendance



Endnotes for the Water Resource Benchmarks are on pages 72-94.

# LAND RESOURCES

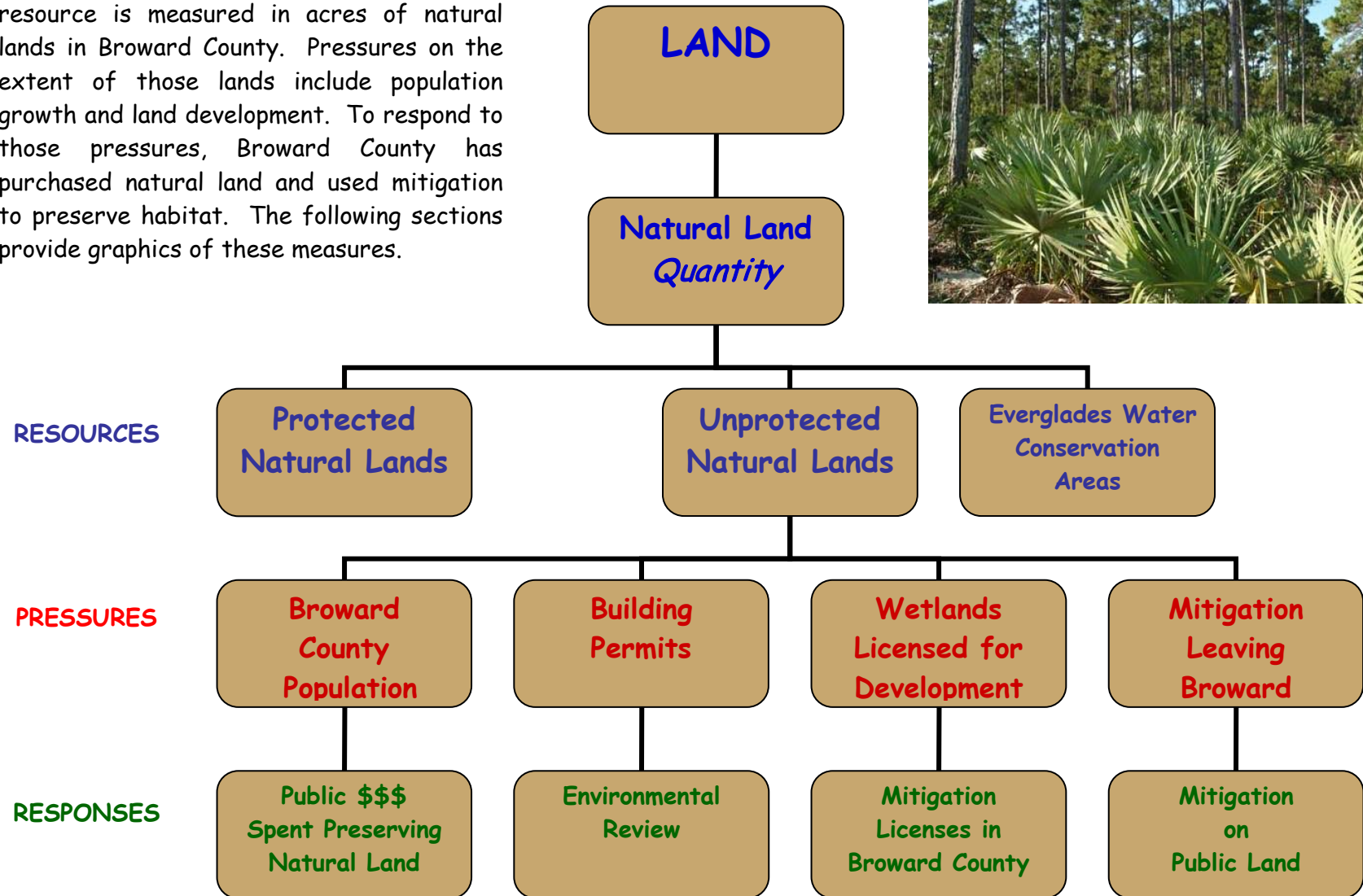
**Land Resources** - Our critical land resources include natural areas which preserve habitat (Quantity), the extent to which those lands reflect indigenous Florida plants and animals (Quality) and the Urban Landscape. This last resource encompasses how public and private entities create human and natural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



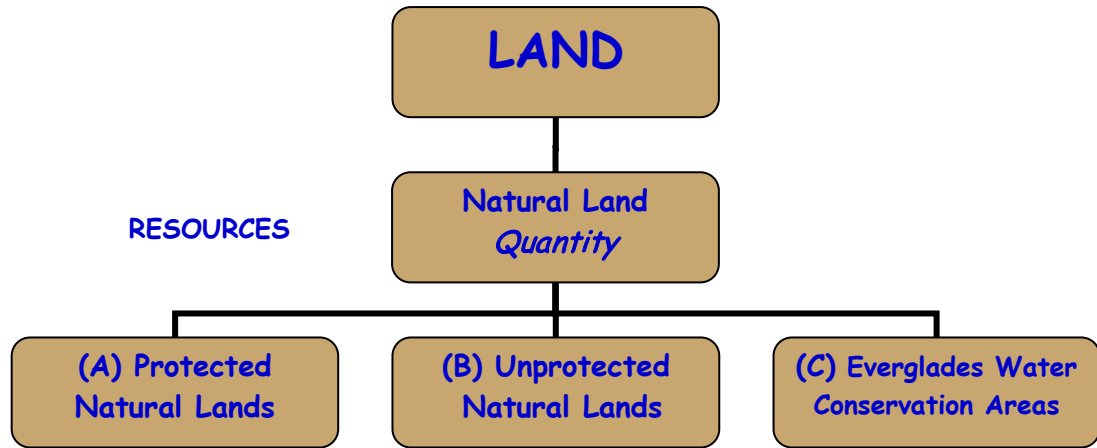


# LAND RESOURCES - Natural Land Quantity

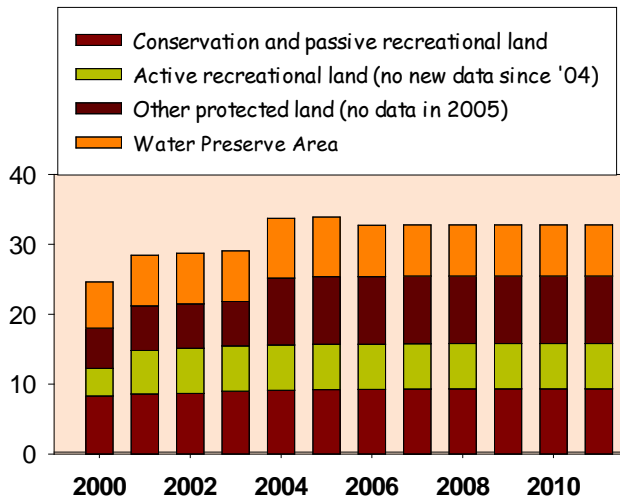
**Natural Land Quantity** - This environmental resource is measured in acres of natural lands in Broward County. Pressures on the extent of those lands include population growth and land development. To respond to those pressures, Broward County has purchased natural land and used mitigation to preserve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



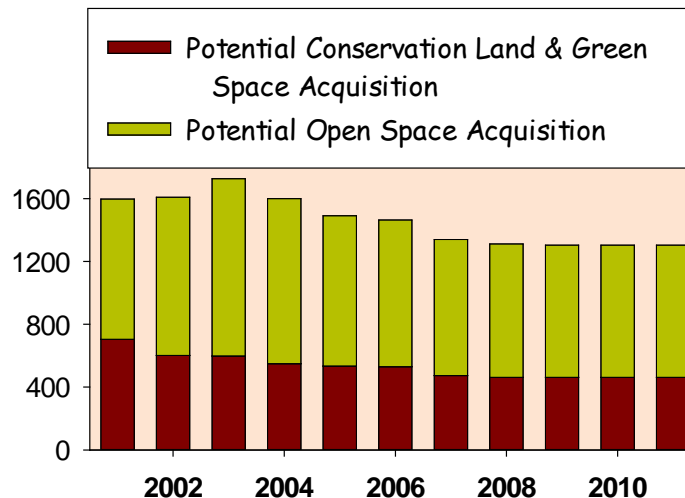
# LAND RESOURCES - Natural Land Quantity



**(A) Acres of Protected Lands, Thousands**



**(B) Acres of Unprotected (Developable) Land**

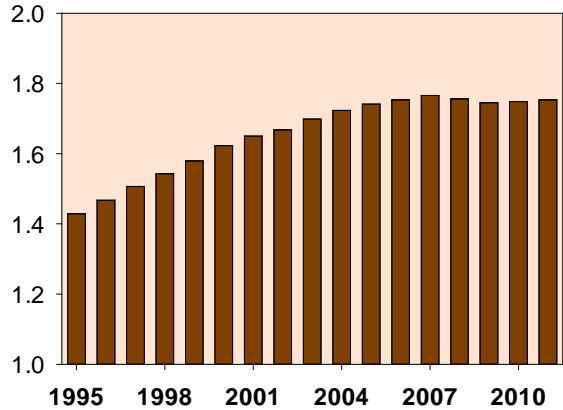


**(C) Everglades Water Conservation Areas -**  
 Approximately two-thirds of Broward County lands exist as Water Conservation Areas (WCA's) in the Everglades. Four WCA's serve as a buffer between developed regions and the Everglades while providing wetland habitat. To learn more about WCAs, see the endnotes on pages 95-111.

Endnotes for the Land Benchmarks are on pages 95-111.

# PRESSURES ON NATURAL LAND QUANTITY

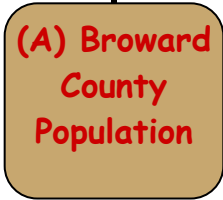
(A) Broward County Population, Millions



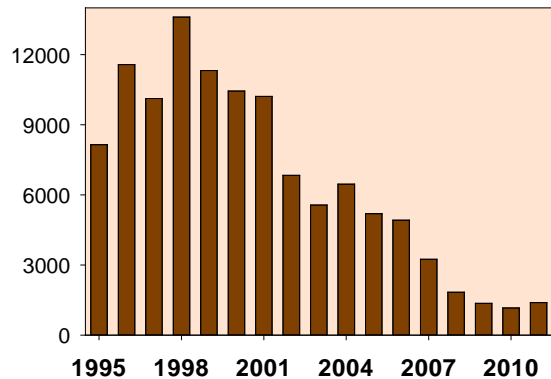
RESOURCE



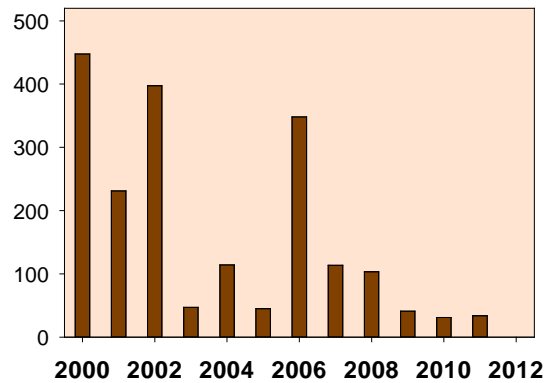
PRESSURES



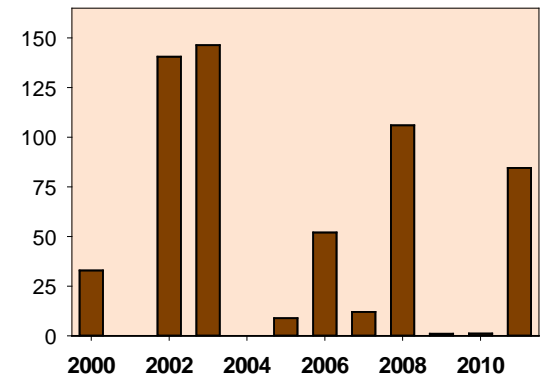
(B) Building Permits - New Structures/  
Non-Residential Addition Approvals Issued



(C) Wetlands Licensed For  
Development, Acres

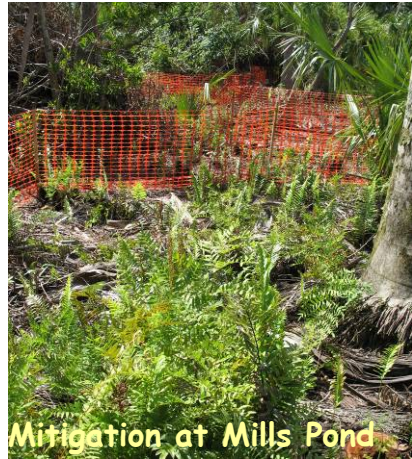


(D) Mitigation Leaving Broward County,  
Acres

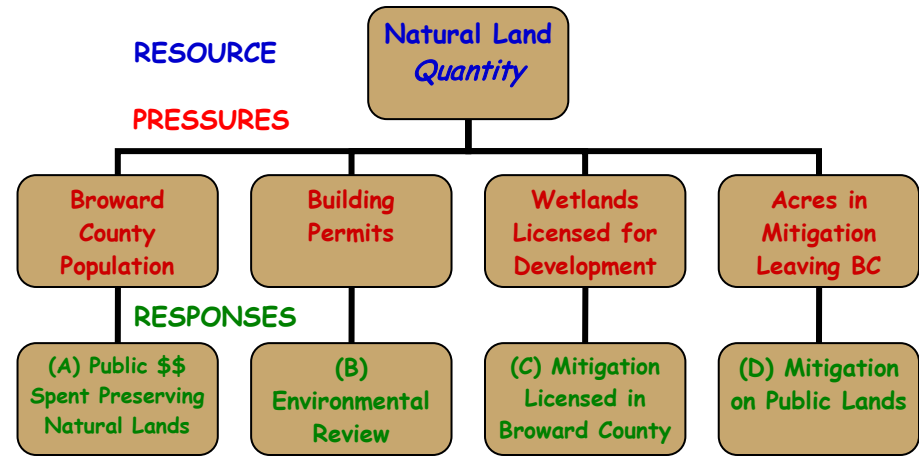
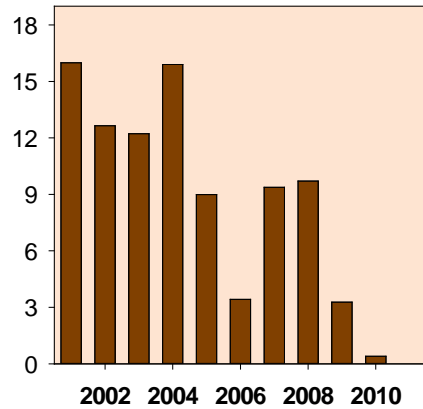


Endnotes for the Land Benchmarks are on pages 95-111.

# RESPONSES TO PRESSURES ON NATURAL LAND QUANTITY



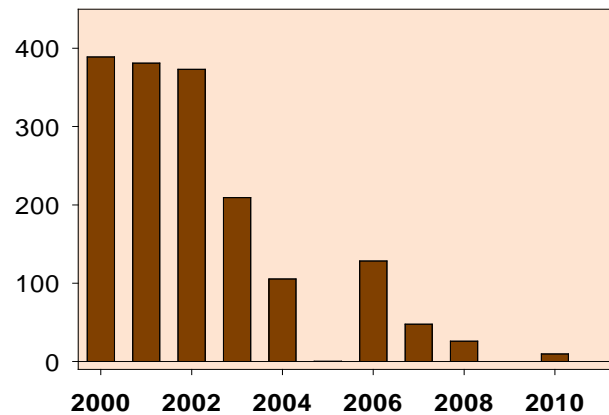
**(A) Public Dollars Spent to Preserve Natural Lands, Millions**



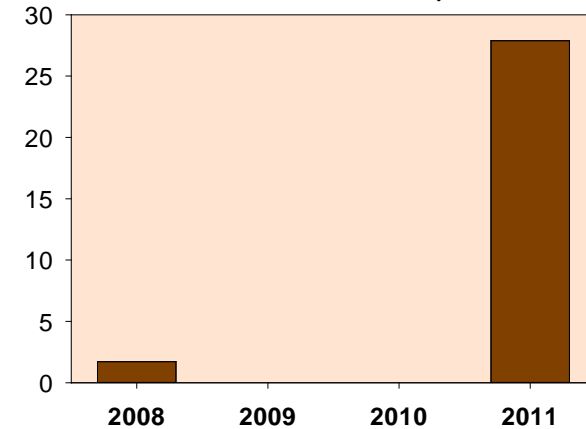
**(B) Environmental Review**

- All proposed developments are reviewed to ensure proper land use and to protect natural land resources from impacts. Wetland permitting ensures that mitigation for impacts is kept within Broward. For more information, see the endnotes on pages 95-111.

**(C) Acres of Mitigation Licensed in Broward County**



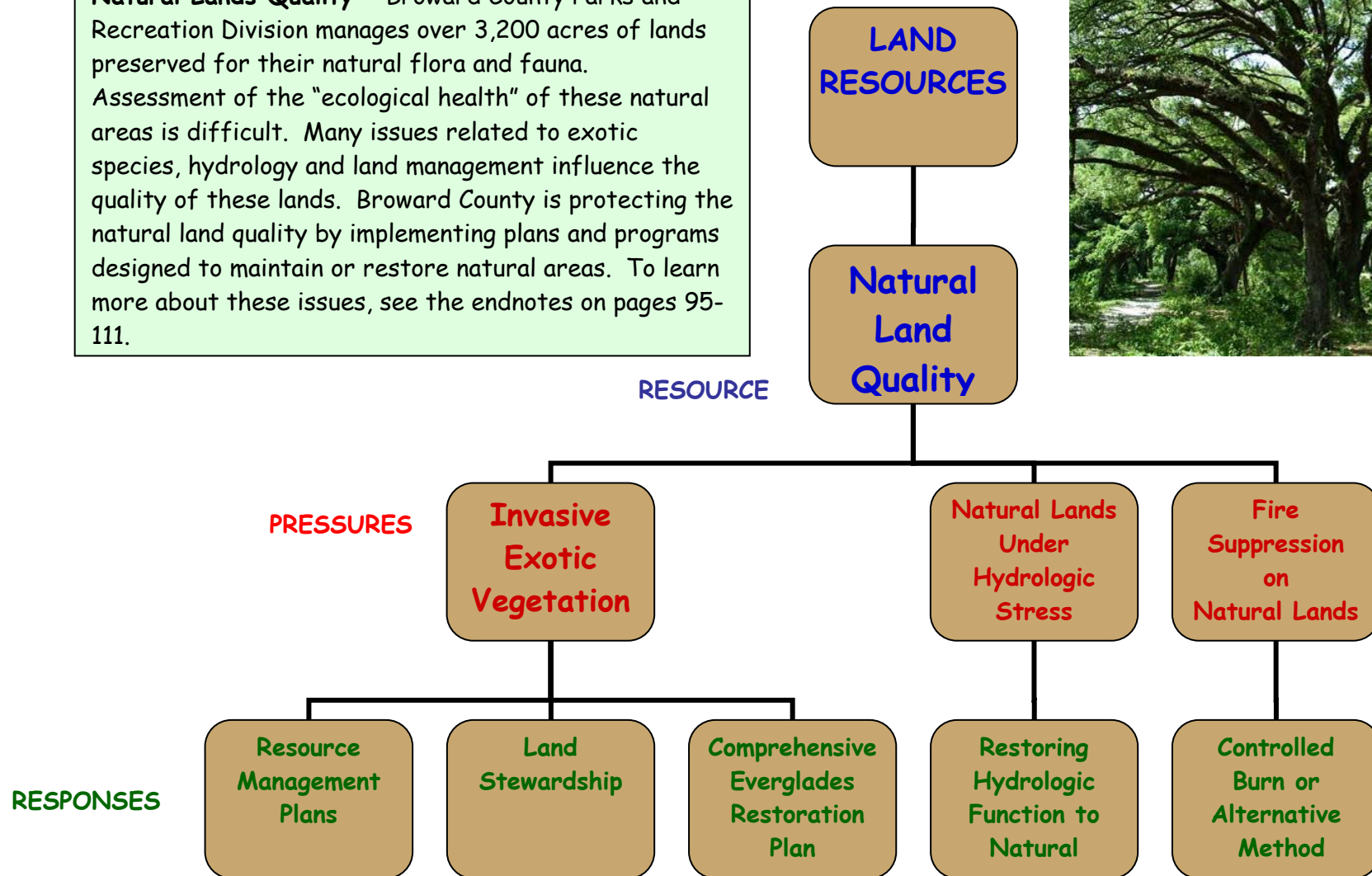
**(D) Acres of Mitigation on Public Land in Broward County**



Endnotes for the Land Benchmarks are on pages 95-111.

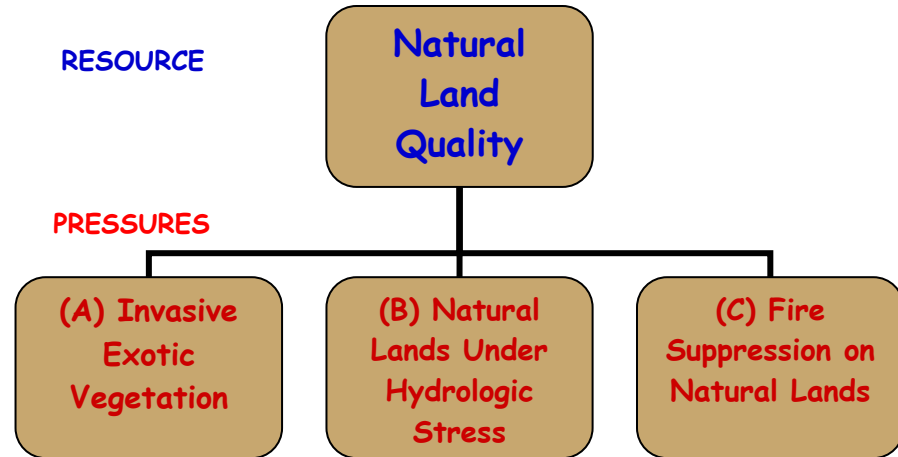
# LAND RESOURCES - Natural Land Quality

**Natural Lands Quality** - Broward County Parks and Recreation Division manages over 3,200 acres of lands preserved for their natural flora and fauna. Assessment of the "ecological health" of these natural areas is difficult. Many issues related to exotic species, hydrology and land management influence the quality of these lands. Broward County is protecting the natural land quality by implementing plans and programs designed to maintain or restore natural areas. To learn more about these issues, see the endnotes on pages 95-111.





# PRESSURES ON NATURAL LAND QUALITY



**(A) Invasive Exotic Vegetation** - Many species of plants from other countries have naturalized in Florida's subtropical climate. These non-native, invasive exotic plants provide less benefit to our ecosystem than do our native plants. The exotics have a high potential to crowd out indigenous vegetation that native Florida wildlife relies on for food and shelter. The problem is widespread from your backyard throughout the Everglades. To learn more, see the endnotes on pages 95-111.

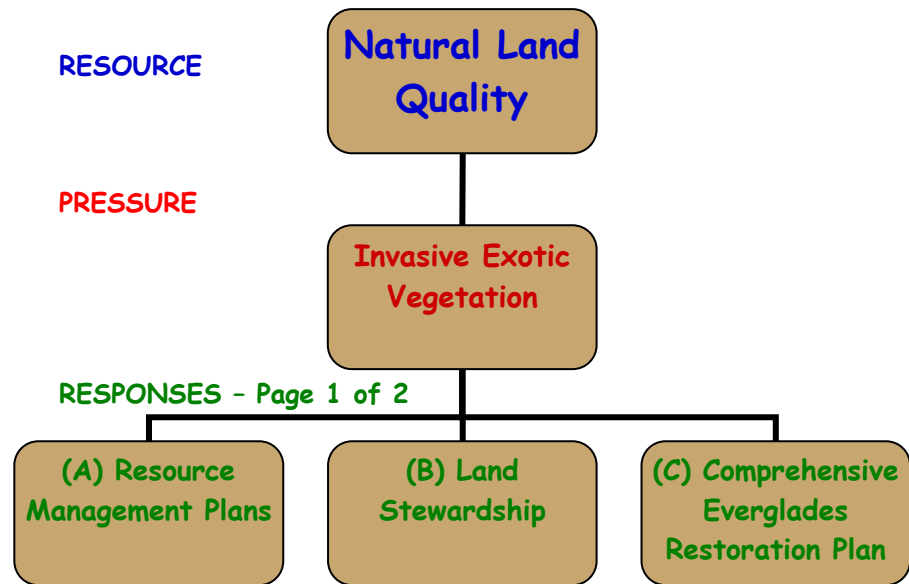
**(B) Natural Lands under Hydrologic Stress** - Many natural wetland areas in Broward County have been altered by historical development and drainage practices. The construction of the canal systems altered the ground water level. While this provided flood protection for residents, it also impacted wetlands by depressing water levels necessary for maintaining wetland plant species. To learn more, see the endnotes on pages 95-111.

**(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 pages 95-111.

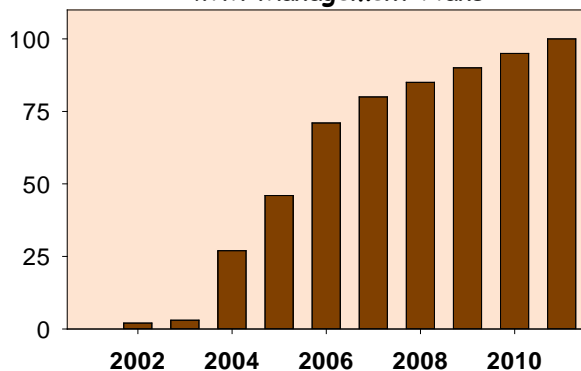
# RESPONSES TO PRESSURES ON NATURAL LAND QUALITY



**Resource Management Plans** - For all acquired natural lands, Resource Management Plans are created to direct how the resources should be managed to ensure that they remain viable natural communities. These plans include securing the site, removing trash and debris, removing invasive exotic species, replanting native vegetation, and providing for public access. The resource management plans may include ecological restoration, re-watering of impacted wetland, or plans for burning fire dependent communities.



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

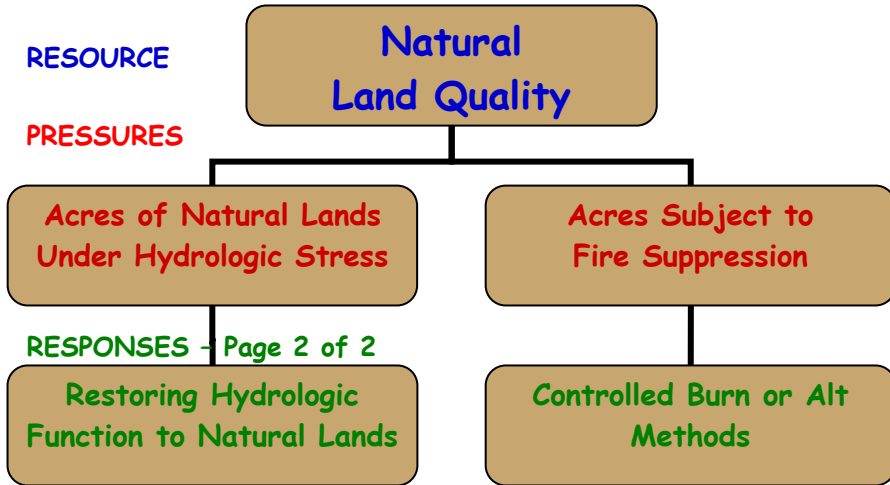


**(B) Land Stewardship** - Resource Management Plans are a small part of a larger effort to provide stewardship for the land. Other efforts include the initiation of two new grant programs "Parks for People" and "Partners in Preservation". The County recently created a land stewardship program. For more information, see the endnotes on pages 95-111.

**(C) Comprehensive Everglades Restoration Plan** - While two-thirds represents a large quantity of Broward County lands established as conservation areas, the issue of quality must be considered. The function and water quality of WCA's are being addressed through projects undertaken as a part of the Comprehensive Everglades Restoration Plan. For more information, see the endnotes on pages 95-111.

Endnotes for the Land Benchmarks are on pages 95-111.

# RESPONSES TO PRESSURES ON NATURAL LAND QUALITY



**Restoring Hydrologic Function to Natural Lands** - Many natural wetland areas in Broward County have been altered by historical development practices and other drainage alterations. Broward County has undertaken efforts to restore hydrologic function to some of the damaged wetlands. Pumps are being installed to increase water flow to the wetlands and raise ground water levels to support native wetland plants. To learn more, read the endnote on pages 95-111.

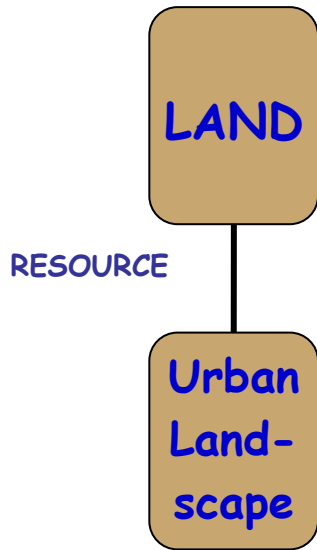


**Controlled Burn or Alternative Management Methods** - Prescribed burning accomplishes many land management objectives including reducing the risk of wildfires while recycling nutrients into the soil. Native fire-tolerant species, including wildflowers and grasses, become established in open areas created by fires thus increasing the overall diversity of the plant community. To learn more, read the endnote on pages 95-111.



# LAND RESOURCES - URBAN LANDSCAPE

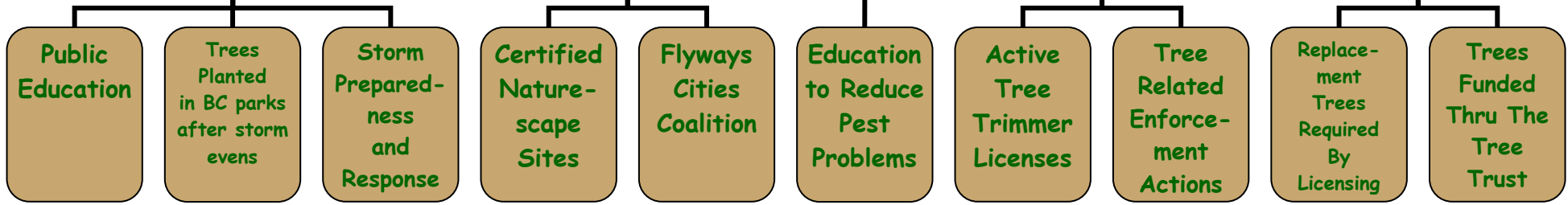
**(A) Urban Landscape** - The trees in the median, the sod in the swales, and the flowers in your garden all contribute to the urban landscape. The tree canopy in 2010 was measured at 19%. Both natural and urban forces such as tropical storms, pests, habitat and tree loss impact the urban landscape. Broward County has many educational, regulatory and incentive programs to maintain the aesthetic and ecological value of the urban landscape. To learn more, see the endnotes on page 95-111.



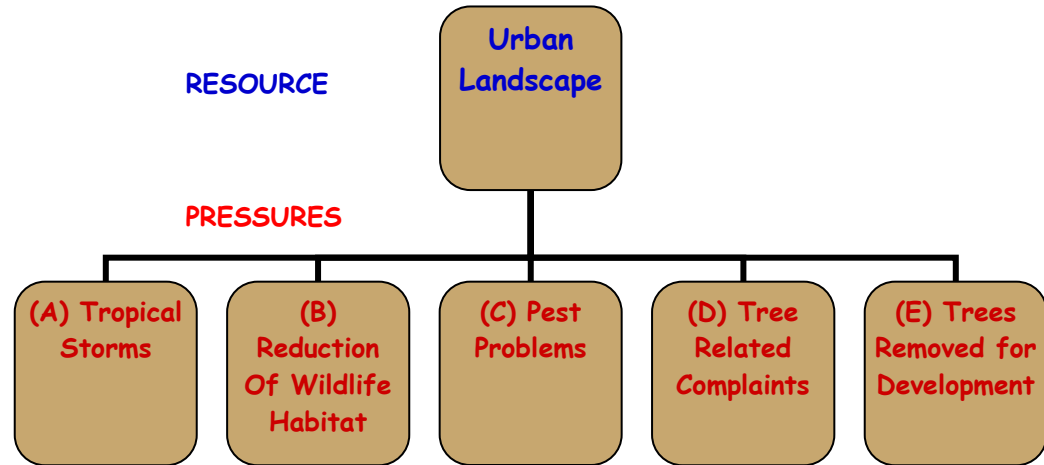
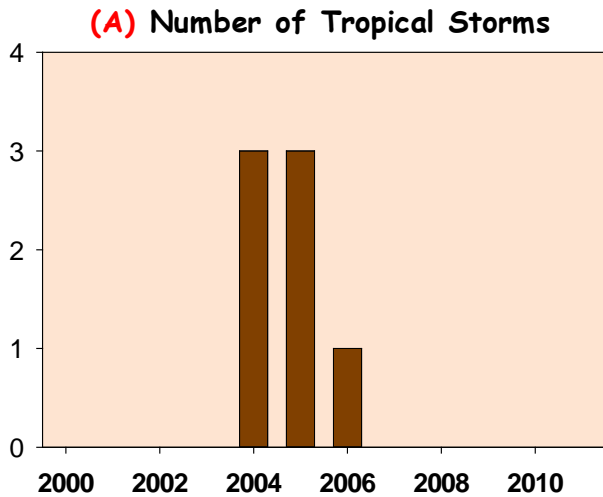
## PRESSURES



## RESPONSES

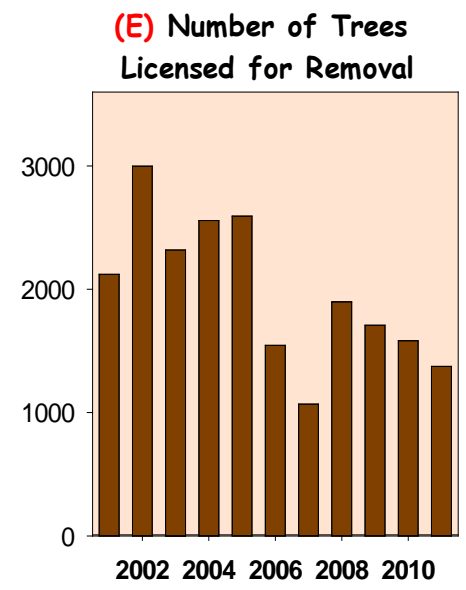
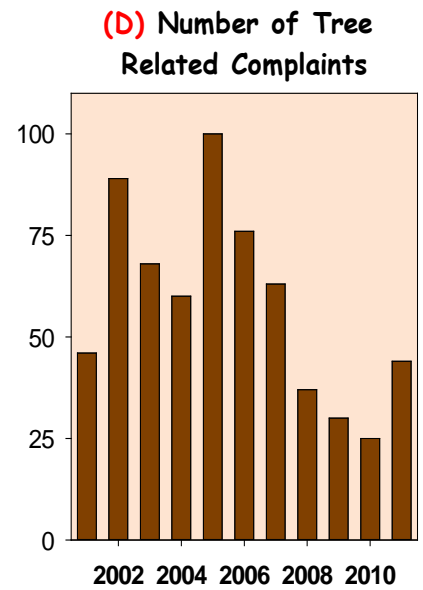


# PRESSURES ON URBAN LANDSCAPE



**(B) Reduction of Wildlife Habitat** - Continued development across Broward County reduces natural lands and vacant areas needed to provide habitat for wildlife. The indirect consequences of habitat loss and fragmentation may carry grave consequences for animal welfare and for conservation. For more information, read the endnotes on pages 95-111.

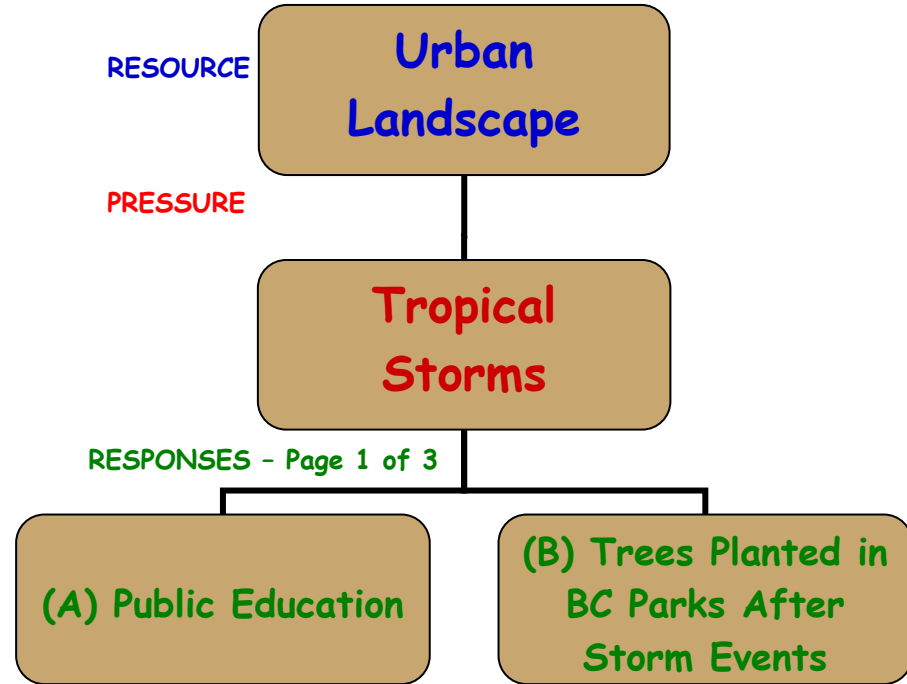
**(C) Emerging Pest Problems** - Exotic insects, lac scale and other infestations upon the health of the urban landscape have been increasing in recent years. Native vegetation often has no natural defenses against these introduced pests. For more information, read the endnotes on pages 95-111.



Endnotes for the Land Benchmarks are on pages 95-111.

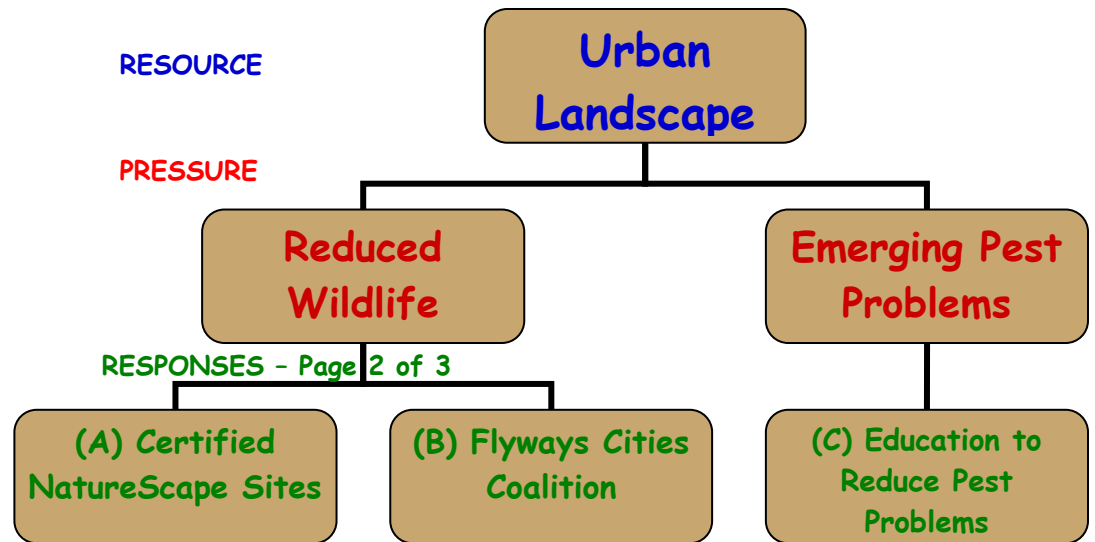
# RESPONSES TO PRESSURES ON URBAN LANDSCAPE

**(A) Public Education** - In response to urban forestry issues following Hurricane Wilma, the Broward County Environmental Protection Department (now the Environmental Protection and Growth Management Department) created the "Trees After the Storm - Replanting Storm-Safe Trees" web-site to answer frequently asked tree questions, sponsored the Broward Beautiful Trees & Hurricane Impact Summit, purchased and distributed 30,000 Florida Urban Forestry Council brochure posters Right Tree Right Place - Selecting and Planting Trees for the South Florida Urban Forest Brochures, and created the NatureScape publication "Gone With The Wind...Storm." For more information, see the endnote on page 95-111.

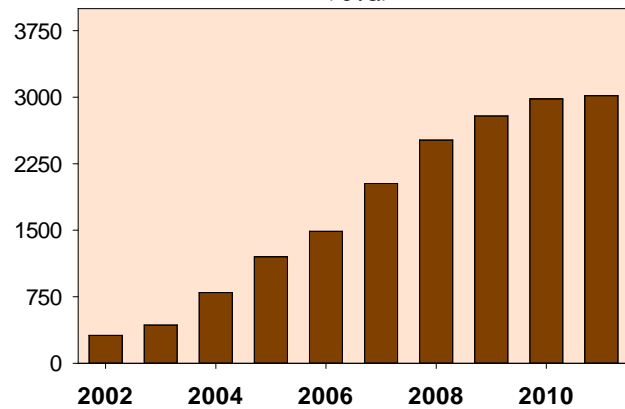


**(B) Trees Planted in Broward County Parks After Storm Events** - Many trees which provide shade and scenery for Broward County park users were lost due to recent tropical storms. Since 2005, the Parks and Recreation Division has replaced over 10,000 trees with species that can better withstand future storms. To learn more, read the endnote on page 95-111.

# RESPONSES TO PRESSURES ON URBAN LANDSCAPE

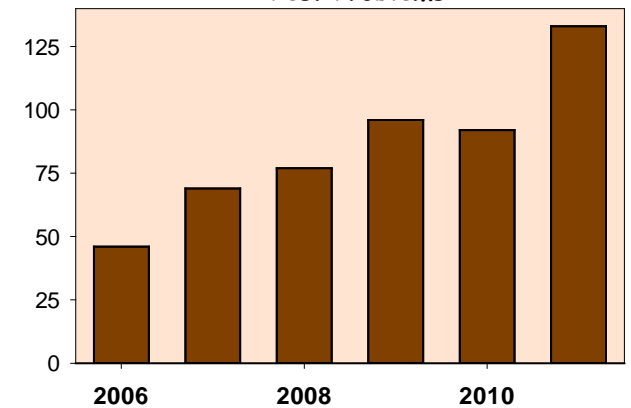


(A) Certified NatureScape Sites, Total



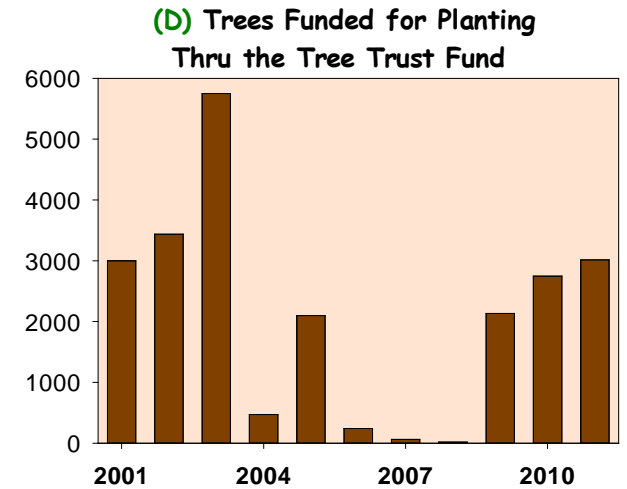
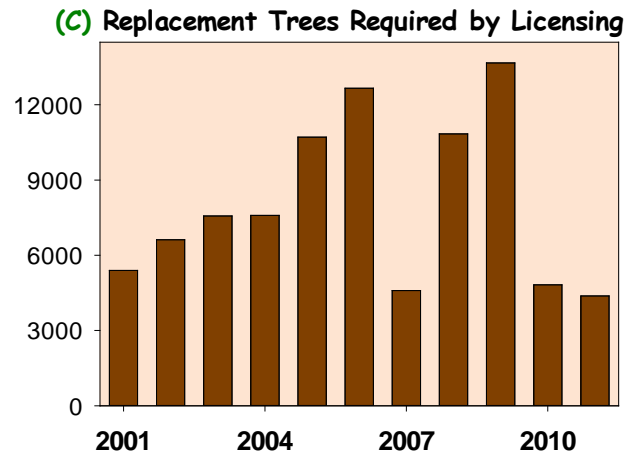
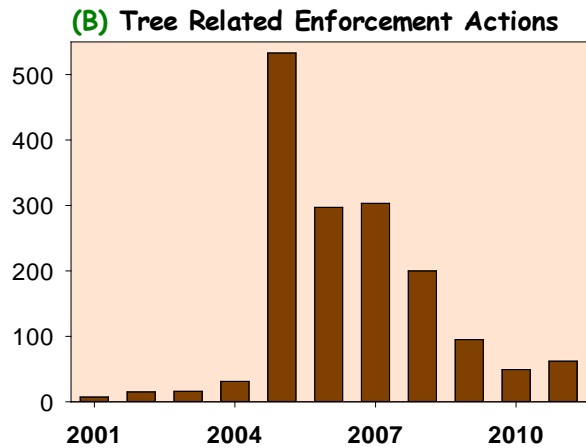
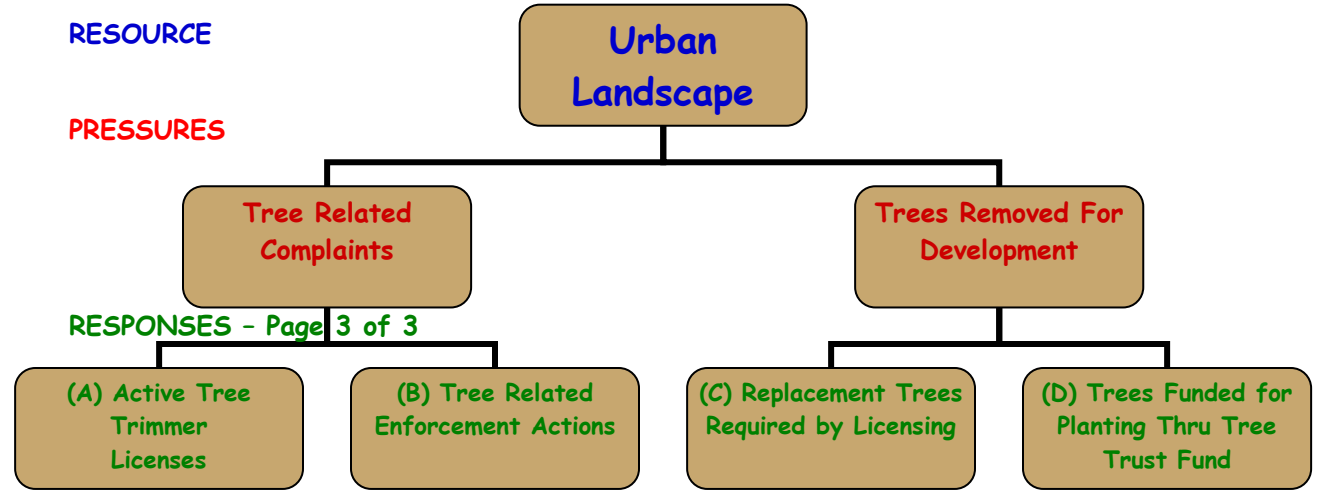
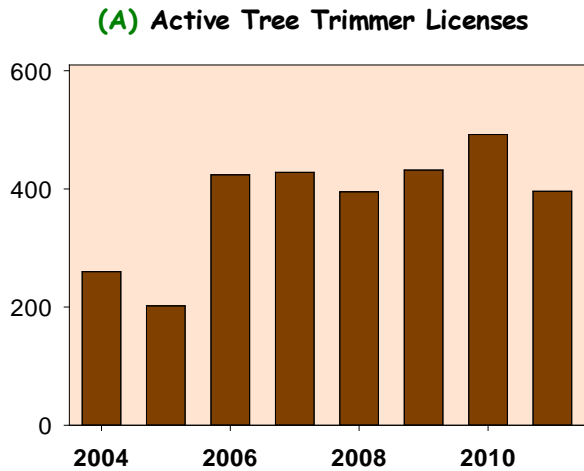
(B) Greater Ft. Lauderdale Flyways Cities Coalition- Flyways are corridors of bird migration. They feature sites that offer food, shelter, and areas for congregation. The Coalition goals include improving key habitats and encouraging community stewardship of flyways. To learn more, read the endnote on pages 95-111.

(C) Educational Events to Reduce Pest Problems



Endnotes for the Land Benchmarks are on pages 95-111.

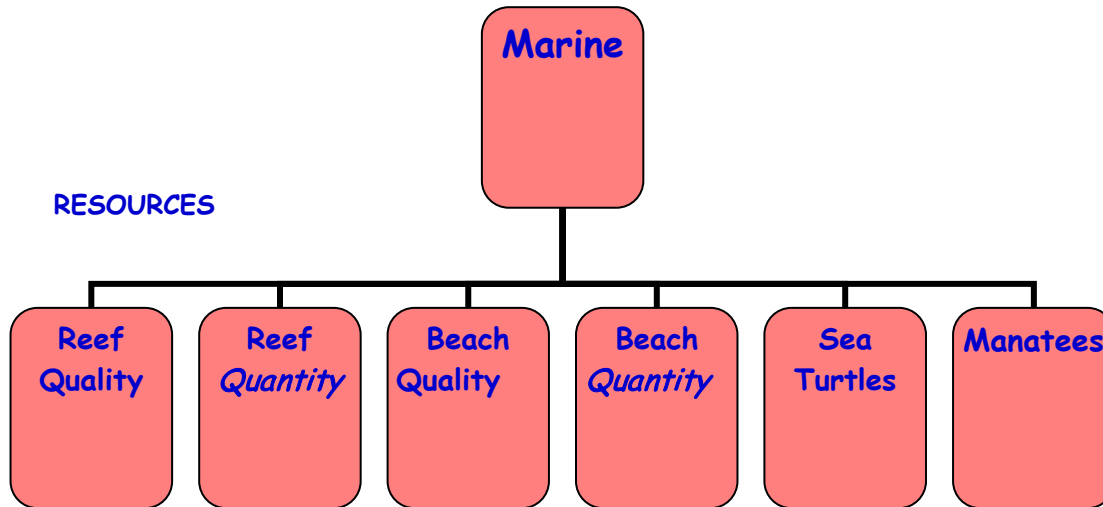
# RESPONSES TO PRESSURES ON URBAN LANDSCAPE



Endnotes for the Land Benchmarks are on pages 95-111.



# MARINE RESOURCES

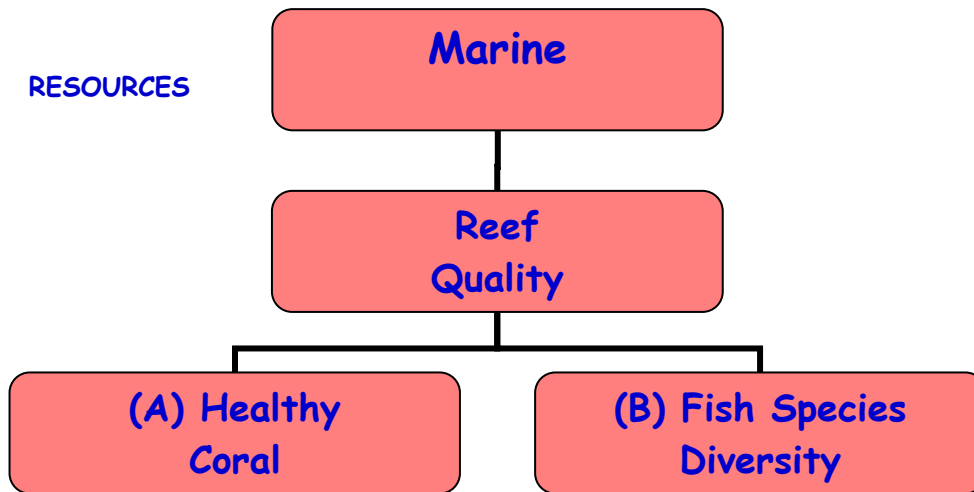


**Marine Resources** - The coastal environmental of Broward County is a major contributor to our quality of life and our economy. The beach and coral reefs provide natural habitat, tourism destinations and protection from storms. These marine resources include endangered sea turtles and manatees.



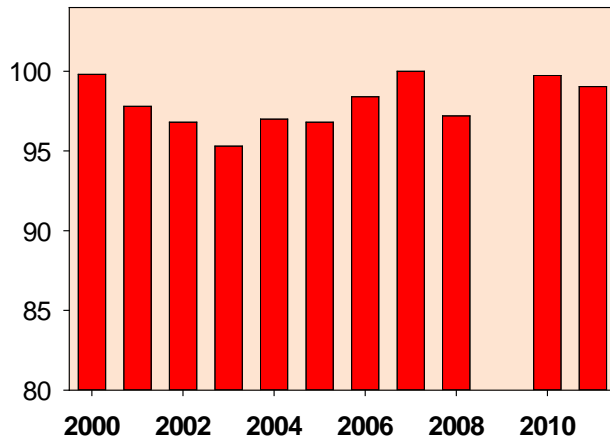


# MARINE RESOURCES - Reef Quality

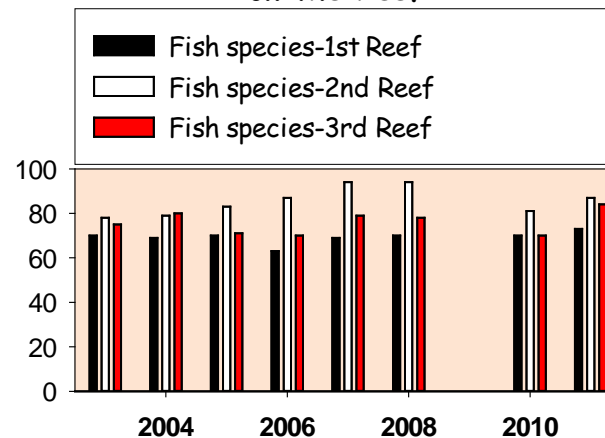


**Coral Reefs** - Coral reefs and their associated sea life are important natural resources for recreational fishing and diving industries in Broward County. The sound ecological condition of the reef community is a key indicator of the general condition of all marine resources of the Broward coastline.

(A) Percent Healthy Coral

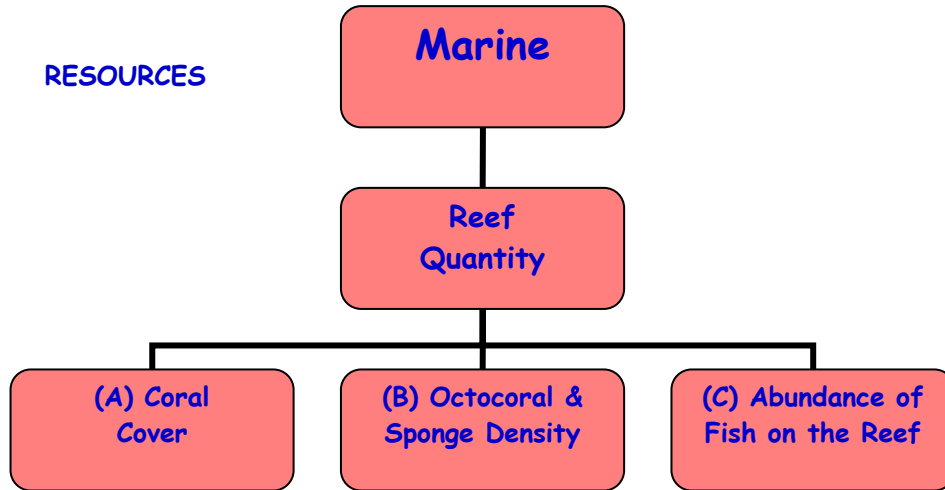


(B) Number of Fish Species Observed on the Reef



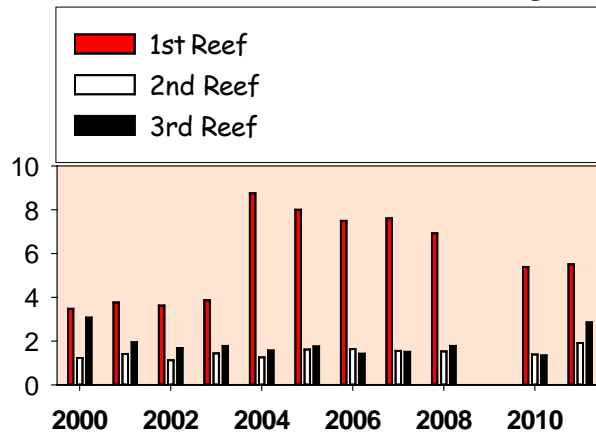
Endnotes for the Marine Resources Benchmarks are on pages 111-136.

# MARINE RESOURCES - Reef Quantity

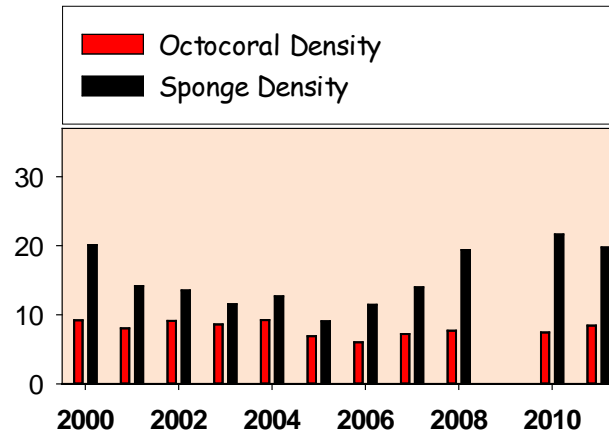


**Coral Reefs** - The abundance of corals, sponges, and fish are dependent upon the structure of the reef, the water quality and conditions around the reefs. All of these components are important to create a functional ecosystem. In Broward County, three reefs run parallel to the shoreline at various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

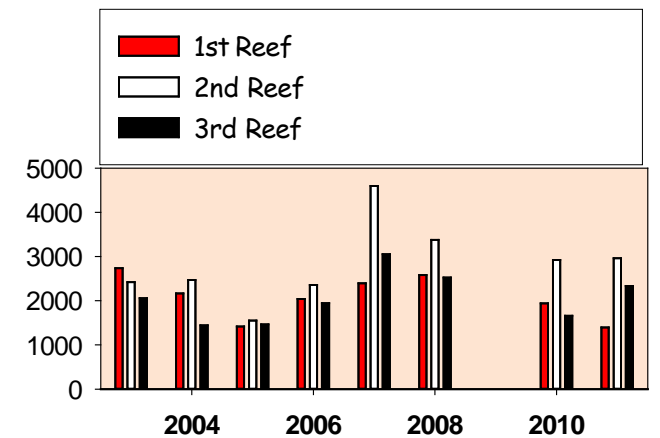
**(A) Percent Live Coral Coverage**



**(B) Octocoral and Sponge Density**

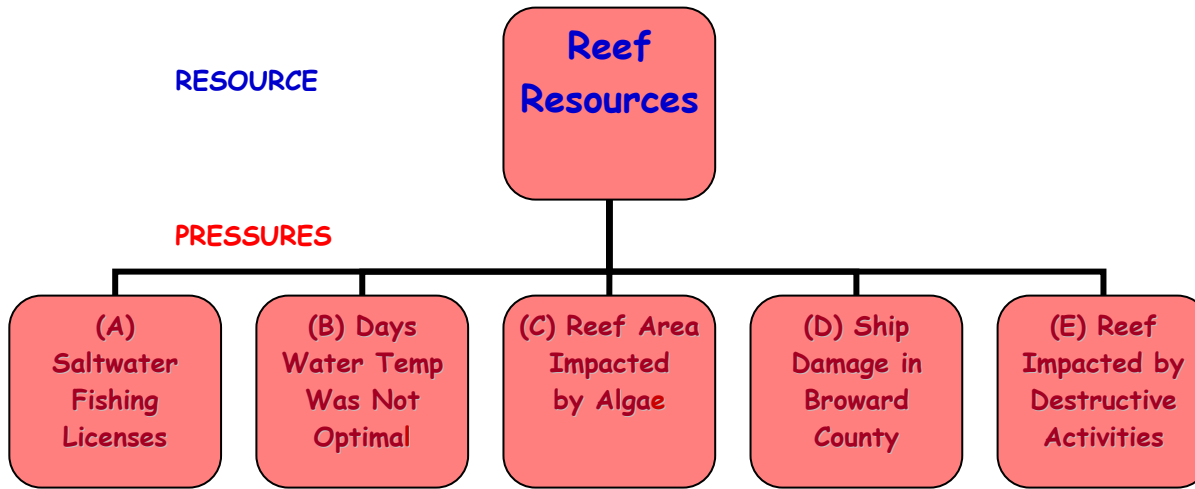


**(C) Number of Fish Surveyed on the Reef**

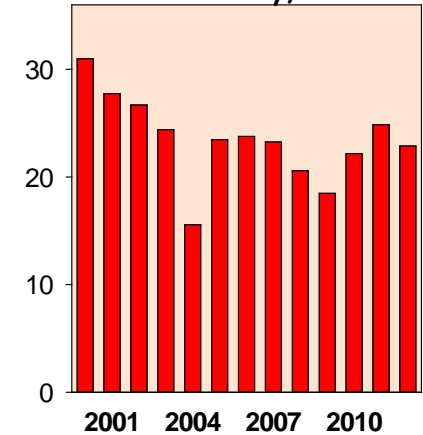


Endnotes for the Marine Resources Benchmarks are on pages 111-136.

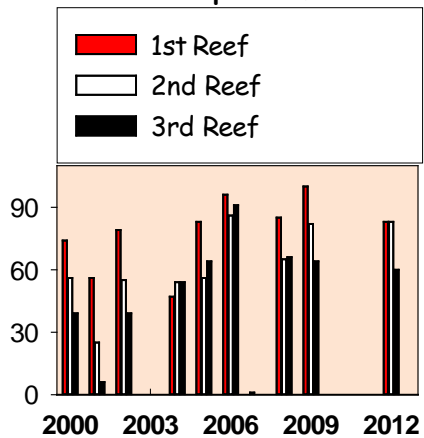
# PRESSURES ON REEF RESOURCES



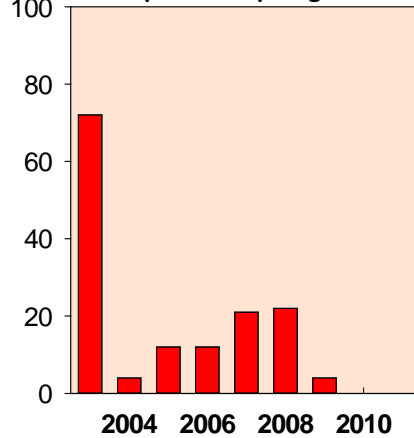
(A) Saltwater Fishing Licenses Issued in Broward County, Thousands



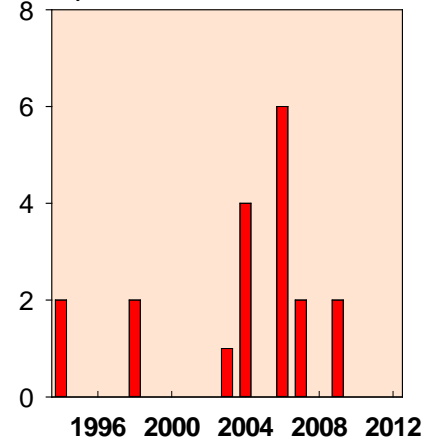
(B) Number of Days Water Temperature Was Not Optimal for Corals



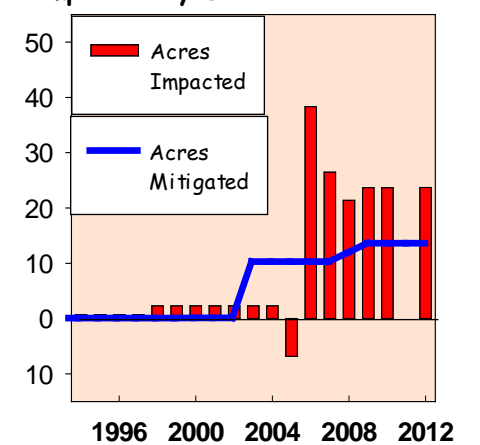
(C) Percent Reef Monitoring Sites Impacted by Algae



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

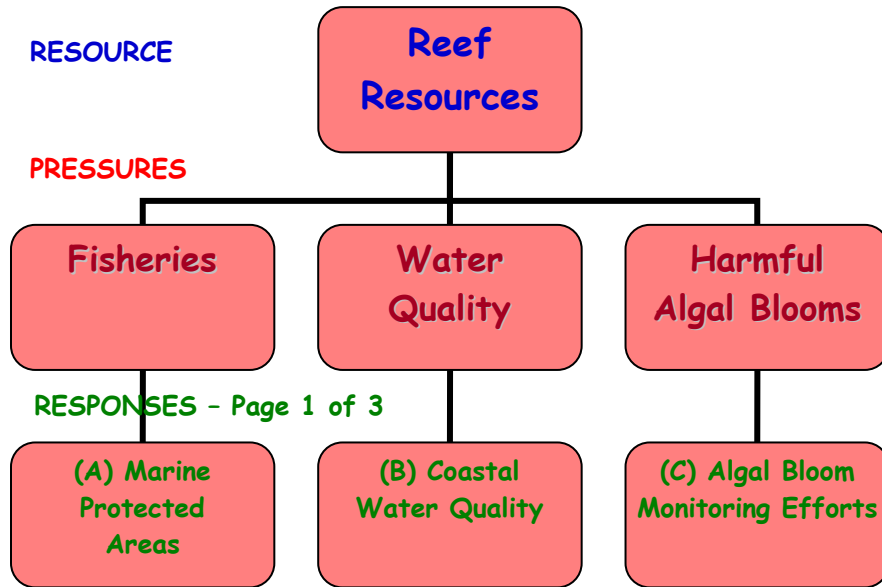


(E) Cumulative Acres of Reef Impacted by Destructive Activities



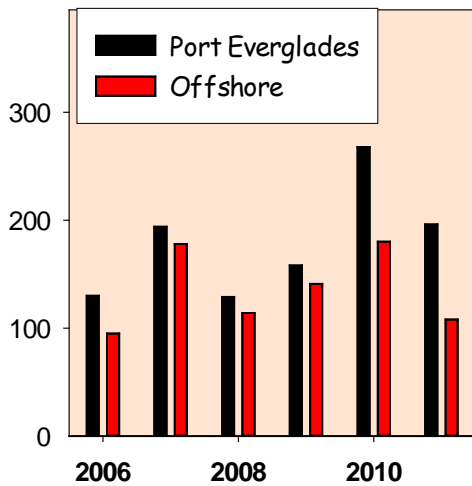
Endnotes for the Marine Resources Benchmarks are on pages 111-136.

# RESPONSES TO PRESSURES ON REEF RESOURCES

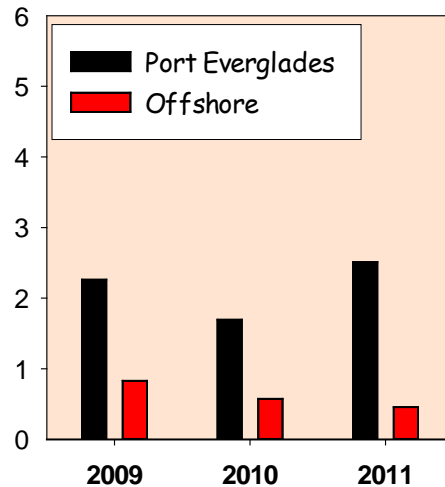


**(A) Marine Protected Areas** - MPAs have been used effectively to conserve biodiversity, manage natural resources, protect endangered species, reduce user conflicts, provide educational and research opportunities, and enhance commercial and recreational activities in other areas. MPAs are a tool that could be used to preserve Broward's reefs. Florida Department of Environmental Protection's Southeast Florida Coral Reef Initiative has developed local strategies for managing coral reef resources in SE Florida including evaluating the potential of a scientifically-based marine zoning plan. To do this, they will identify criteria useful for zoning reef resources as special, sensitive and representative areas needing enhanced management through local input in order to develop zoning alternatives by county. To learn more, read the endnotes on pages 111-136.

**(B) Coastal Water Quality**  
Total Nitrogen ug/l



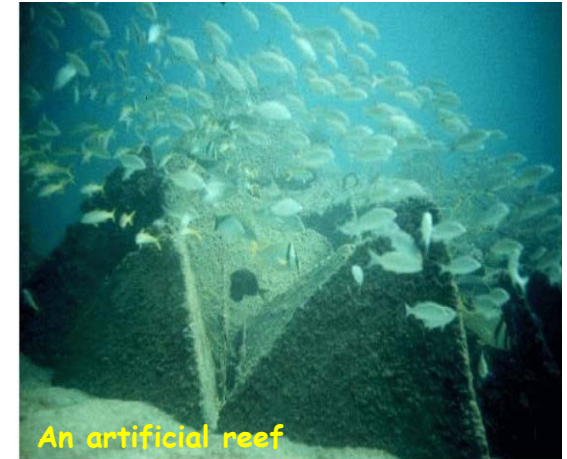
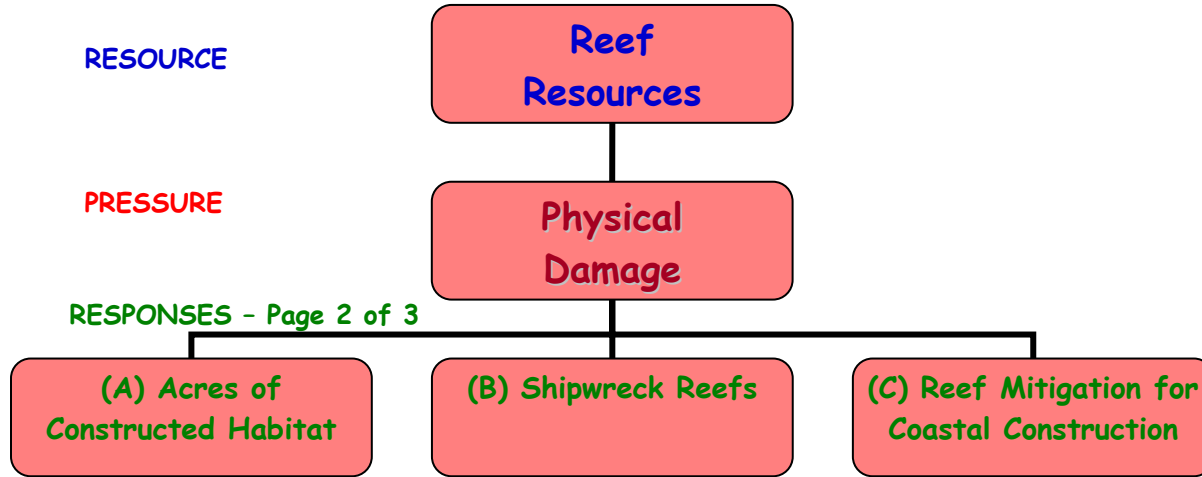
**(B) Coastal Water Quality**  
Chlorophyll mg/l



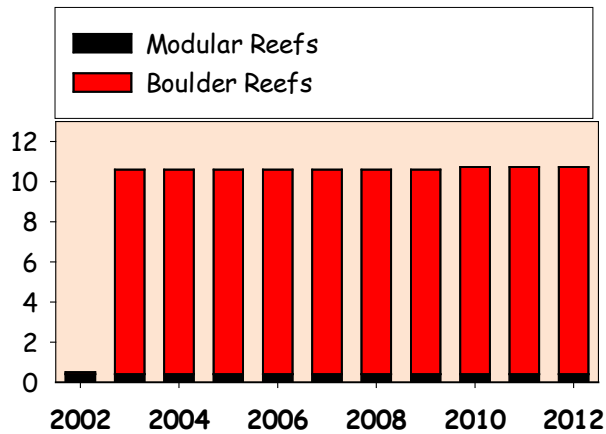
**(C) Algal Bloom Monitoring Efforts** - Twenty five sites off Broward County are monitored annually for the presence of algal blooms. To learn more, read the endnotes on pages 111-136.

Endnotes for the Marine Resources Benchmarks are on pages 111-136.

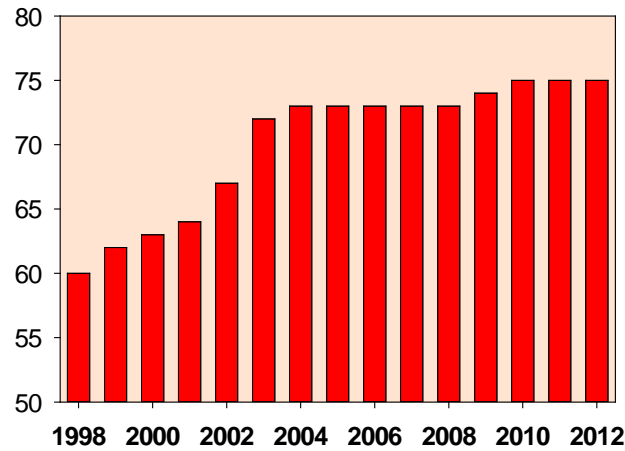
# RESPONSES TO PRESSURES ON REEF RESOURCES



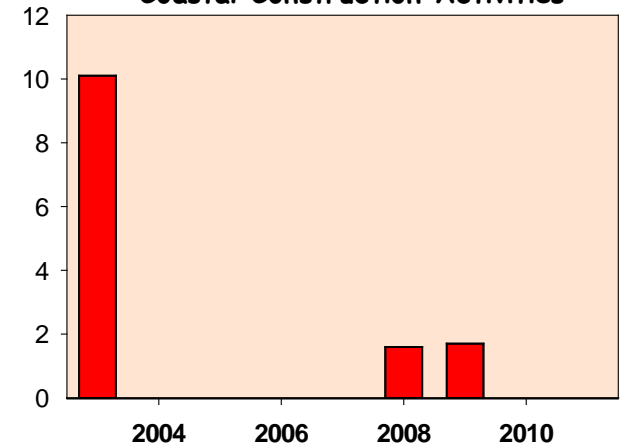
(A) Acres of Constructed Habitat



(B) Number of Shipwreck Reefs

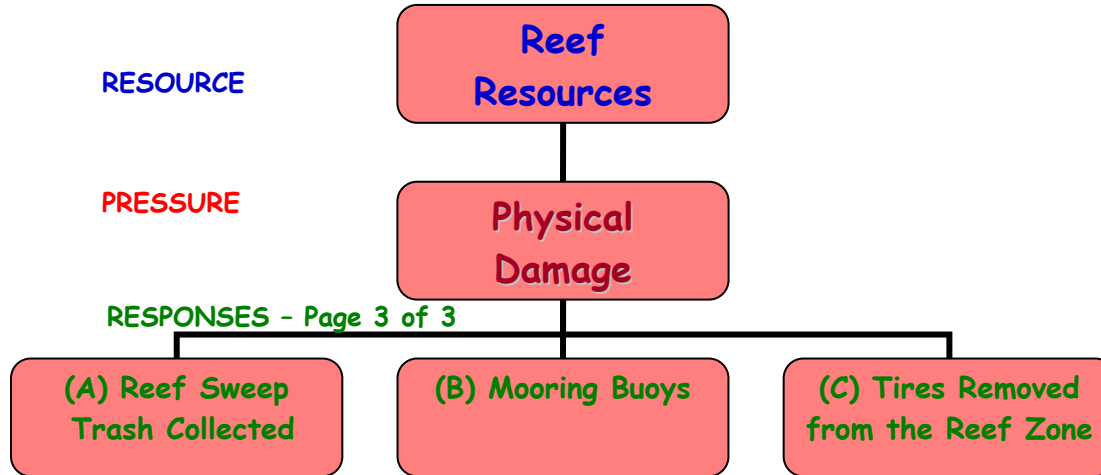


(C) Acres of Reef Mitigation for Coastal Construction Activities

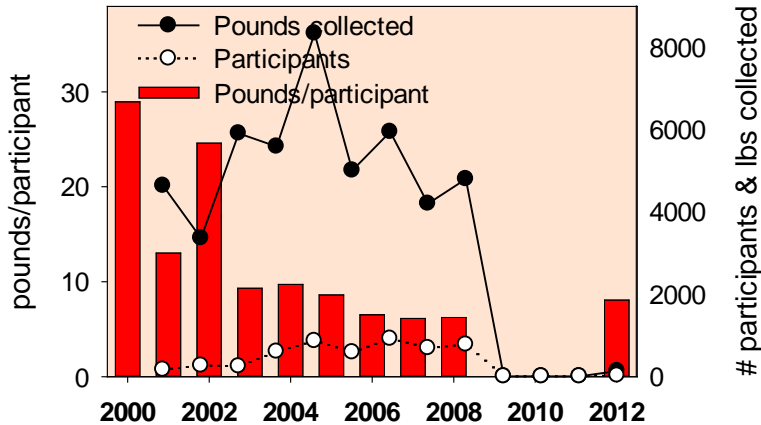


Endnotes for the Marine Resources Benchmarks are on pages 111-136.

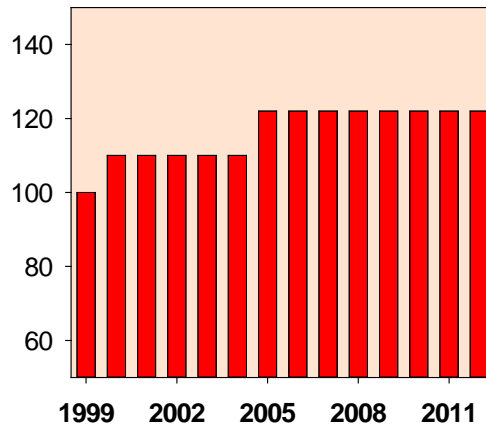
# RESPONSES TO PRESSURES ON REEF RESOURCES



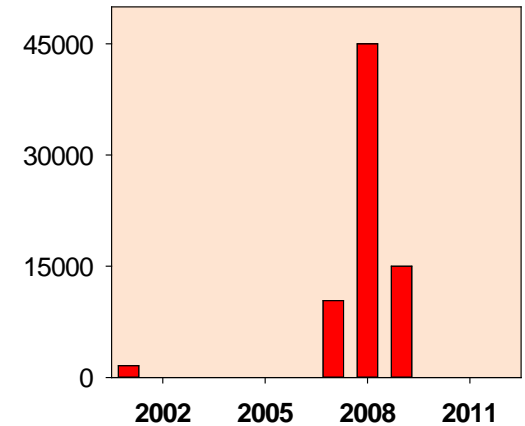
**(B) Marine Debris Clean-up Campaigns, Pounds of Litter Collected/Participant/Event**



**(C) Number of Mooring Buoys**



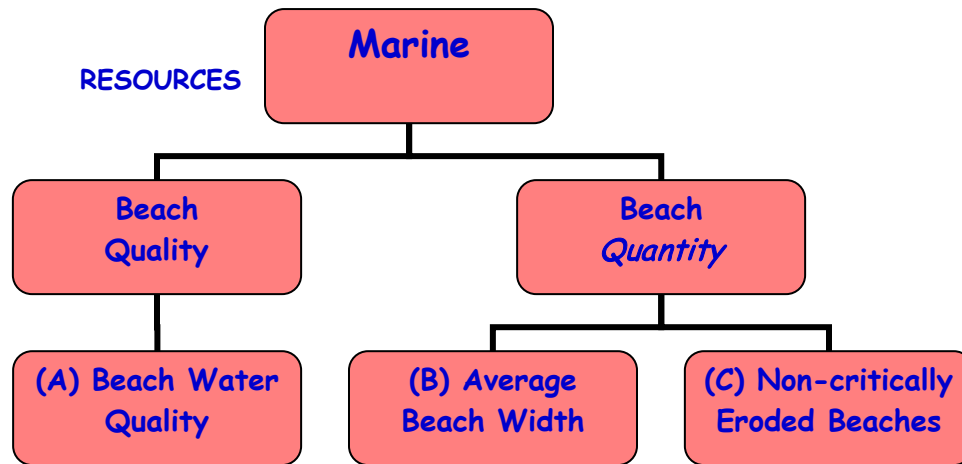
**(D) Number of Tires Removed From the Reef Zone**



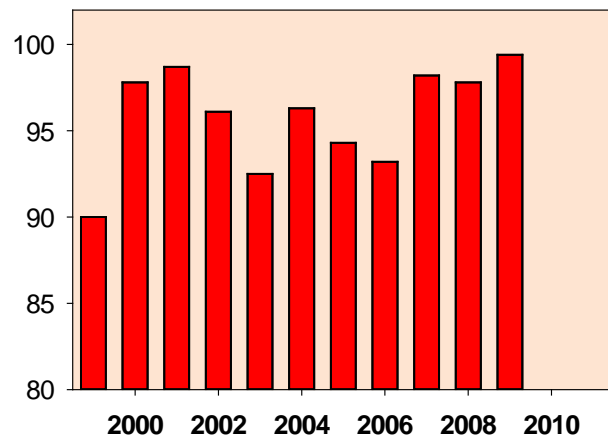
Endnotes for the Marine Resources Benchmarks are on pages 111-136.



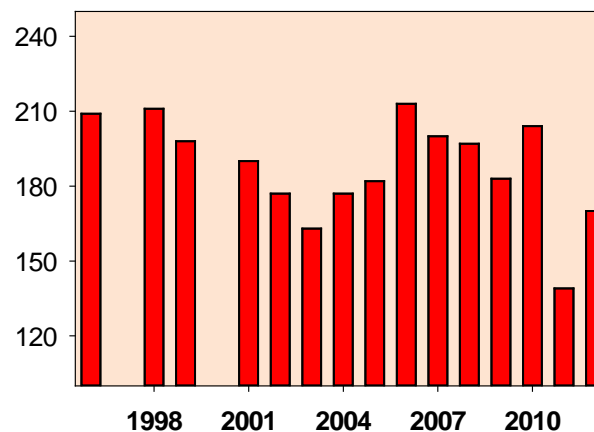
# MARINE RESOURCES- Beach Quality and Quantity



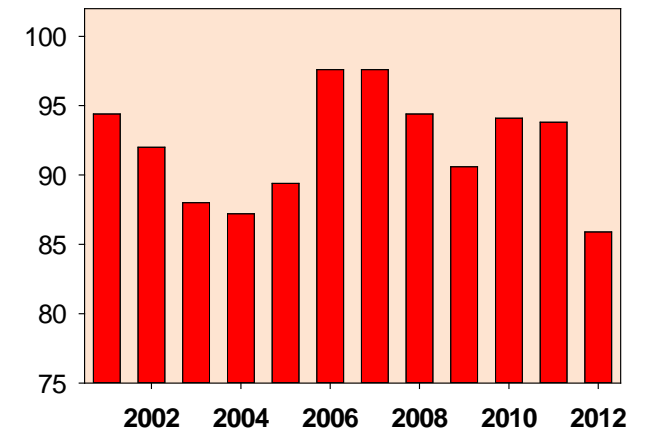
**(A) Percent of Beach Water Quality Results Rated "Good"**



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

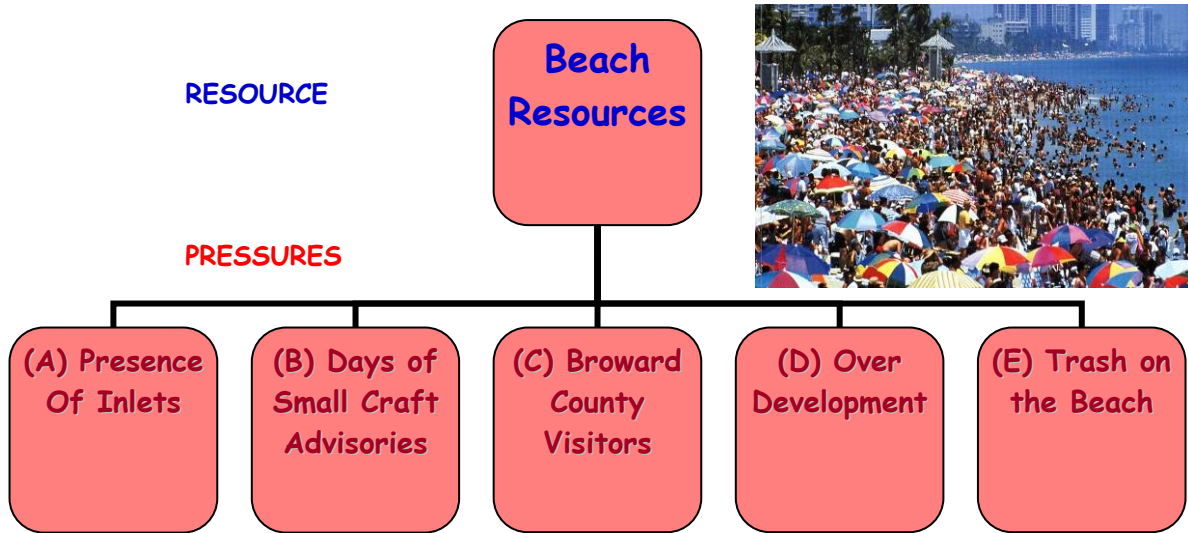


**(C) Percent of Non-critically Eroded Beaches**



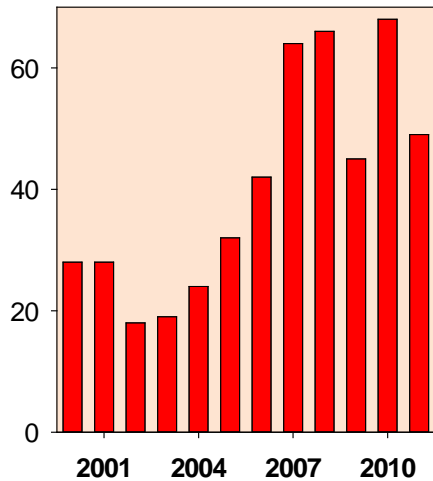
Endnotes for the Marine Resources Benchmarks are on pages 111-136.

# PRESSURES ON BEACH RESOURCES

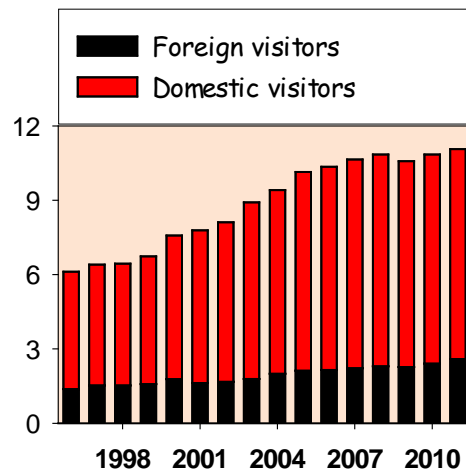


**(A) Presence of Inlets -** Inlets, composed of jetties and dredged channels, interrupt the movement of sand, causing buildup to the north and erosion to the south of the channel. To learn more, read the endnotes on pages 111-136.

**(B) Days of Small Craft Advisories**



**(C) Number of Visitors to Broward County, Millions**

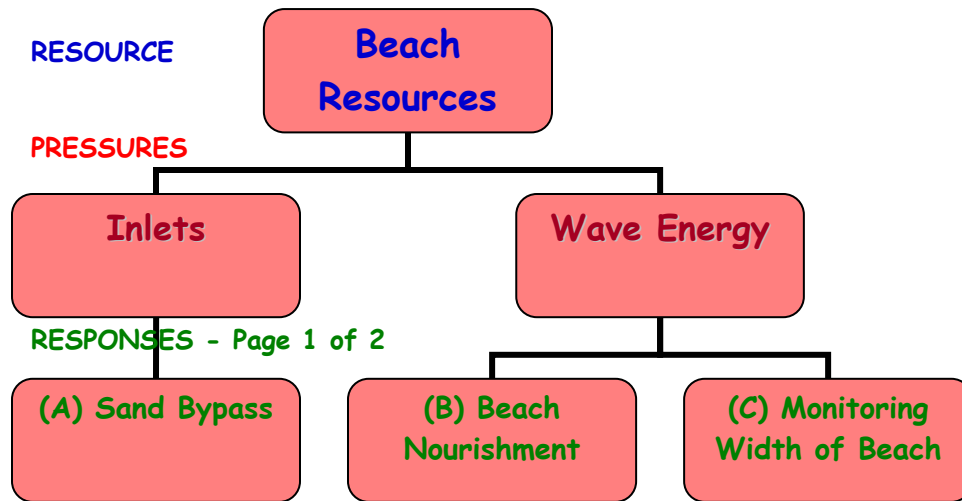


**(D) Over Development -** Coastal development, in areas prone to tropical storms, can place lives and property at risk and stress natural resources. Properly controlling beachfront development leads to more sustainable economies and environmental resources. To learn more, read the endnote on pages 110-134.

**(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 pages 111-136.

Endnotes for the Marine Resources Benchmarks are on pages 111-136.

# RESPONSES TO PRESSURES ON BEACH RESOURCES

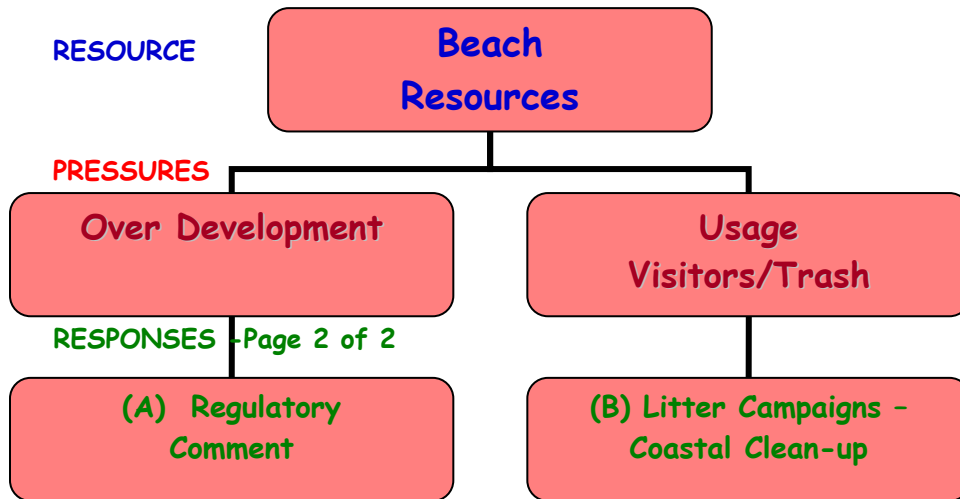


**(A) Sand Bypass** - Sand bypassing is conducted to reduce erosion of beaches which are impacted by stabilized inlets like Port Everglades. Sand bypassing captures sand which accumulates on the updrift side of a stabilized inlet or that might be lost into the channel and mechanically move the sand to the downdrift side. To learn more, read the endnotes on pages 111-136.

**(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 pages 111-136.

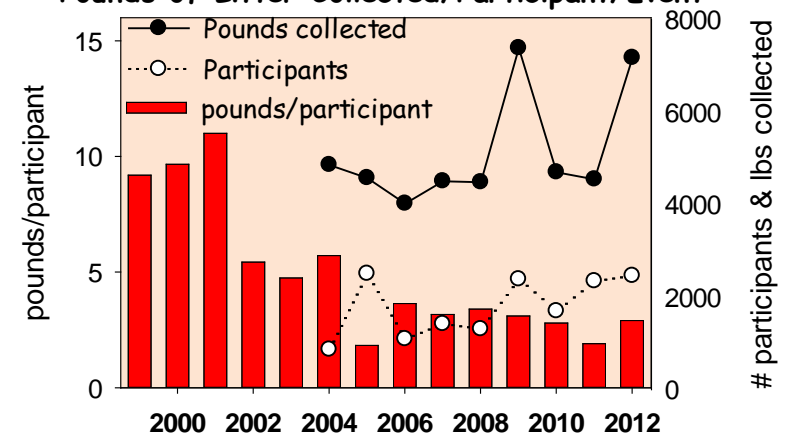
**(C) Monitoring the Condition of the Beach** - Monitoring the condition of the beach is essential to understanding how the beach behaves. Monitoring includes regular surveys of the extent and elevation of the sand. Aerial photos are often used for this purpose. To learn more, read the endnotes on pages 111-136.

# RESPONSES TO PRESSURES ON BEACH RESOURCES



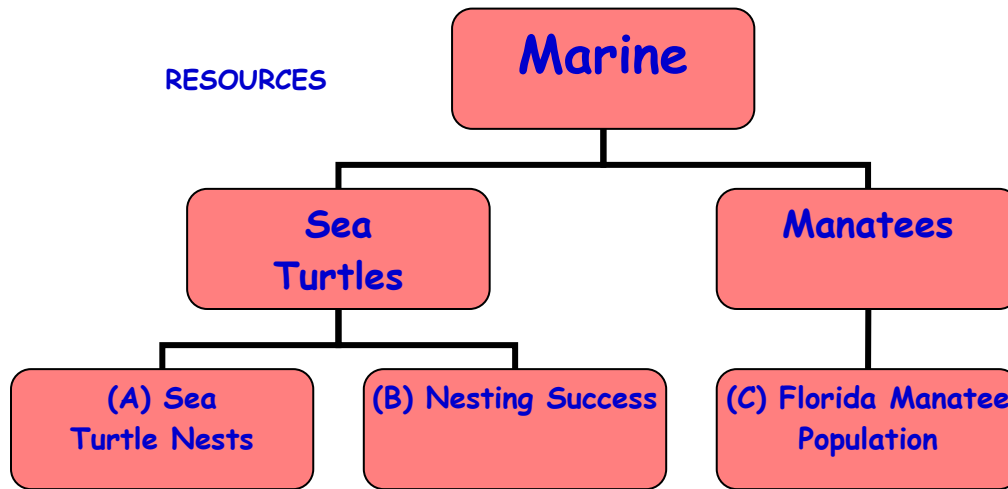
**(A) Regulatory Comment on Beach Resources** - Florida's Department of Environmental Protection (FDEP) administers the statewide Coastal Construction Control Line Program (CCCL). This program provides protection for beaches, dunes and their associated wildlife, while assuring reasonable use of private property. Broward County staff refers prospective permittees to the proper contact points at FDEP and provides information to potential developers of beachfront property regarding the state's CCCL permitting requirements. To learn more, read the endnotes on pages 111-136.

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

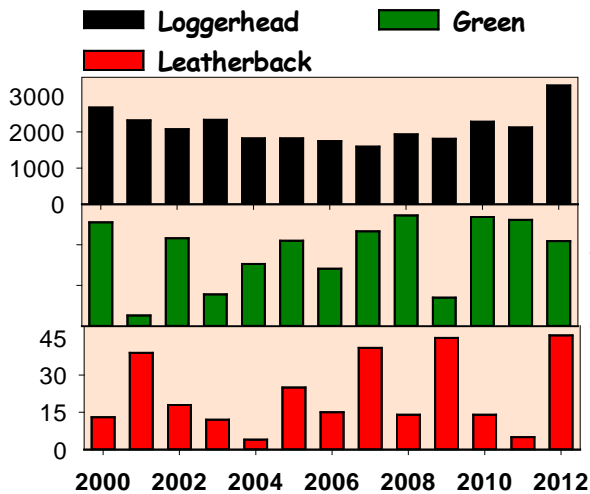


Endnotes for the Marine Resources Benchmarks are on pages 111-136.

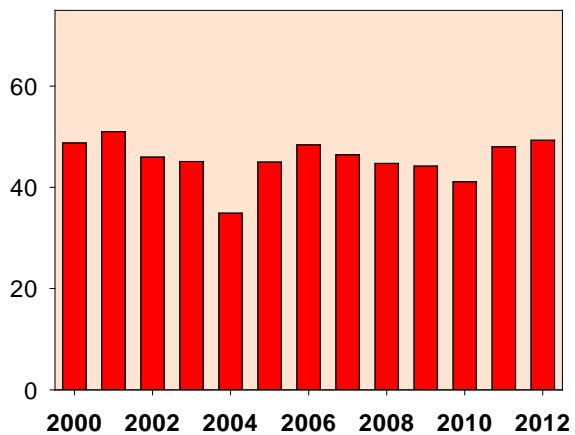
# MARINE RESOURCES- Marine Wildlife



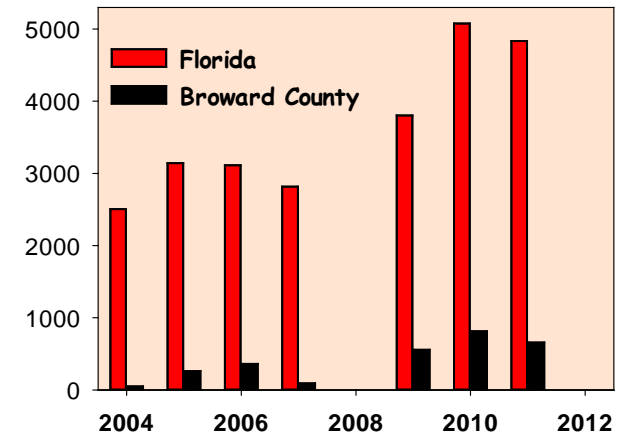
(A) Number of Sea Turtle Nests



(B) Percent of Sea Turtle Nesting Success



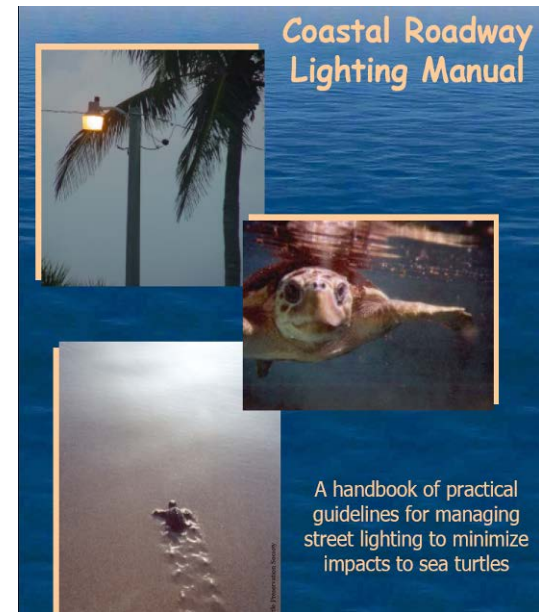
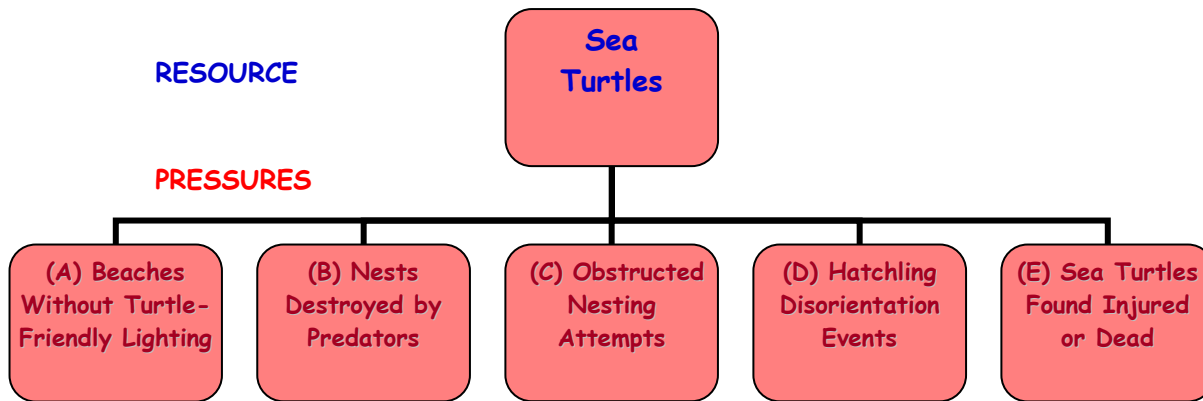
(C) Florida West Indian Manatee Population



Endnotes for the Marine Resources Benchmarks are on pages 111-136.

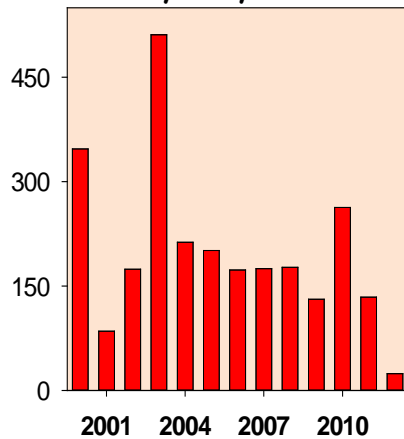


# PRESSURES ON MARINE WILDLIFE - Sea Turtles

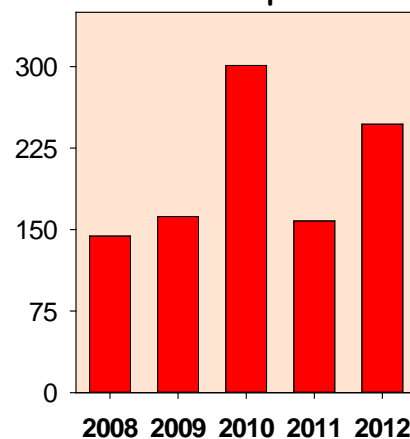


**(A) Beaches Without Turtle-Friendly Lighting** - Even active enforcement of lighting ordinance enacted in 5 of the 8 coastal municipalities in Broward County has not resulted in enough light reduction to have areas of the beach considered "turtle friendly". To learn more, read the endnote on pages 111-136.

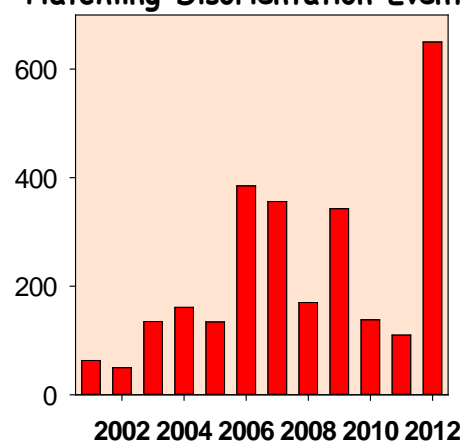
**(B) Number of Sea Turtle Nests Destroyed by Predators**



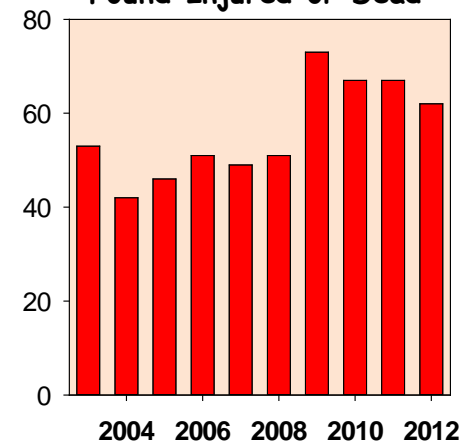
**(C) Obstructed Nesting Attempts**



**(D) Number of Sea Turtle Hatchling Disorientation Events**



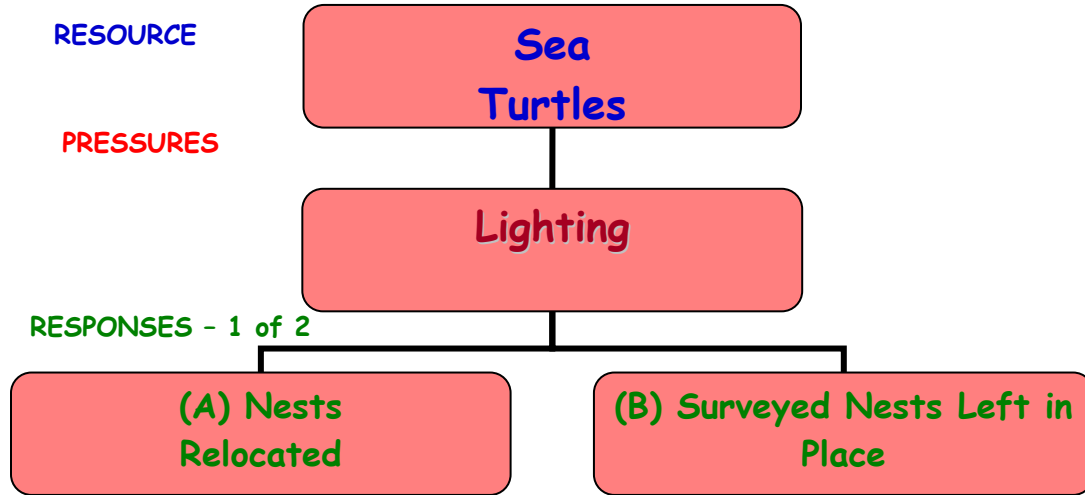
**(E) Juvenile or Adult Sea Turtles Found Injured or Dead**



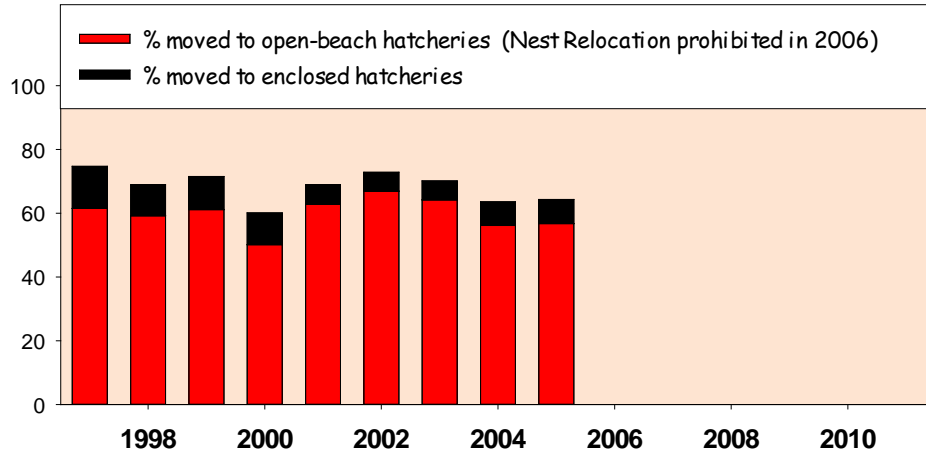
Endnotes for the Marine Resources Benchmarks are on pages 111-136.



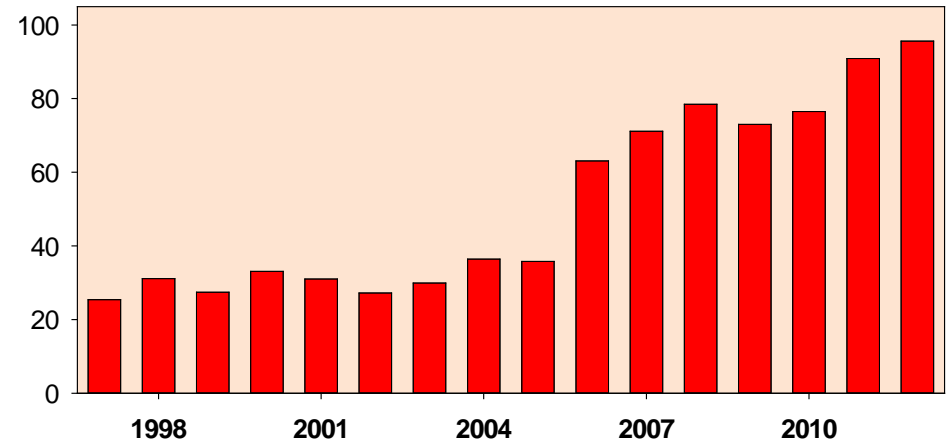
# RESPONSES TO PRESSURES ON MARINE WILDLIFE - Sea Turtles



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

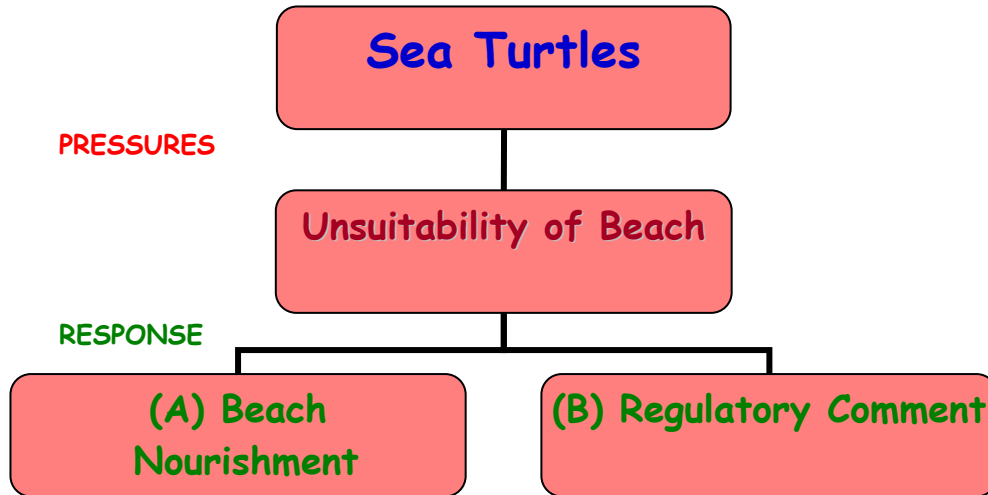


**(B) Percent of Surveeyed Nests Left in Place**



Endnotes for the Marine Resources Benchmarks are on pages 111-136.

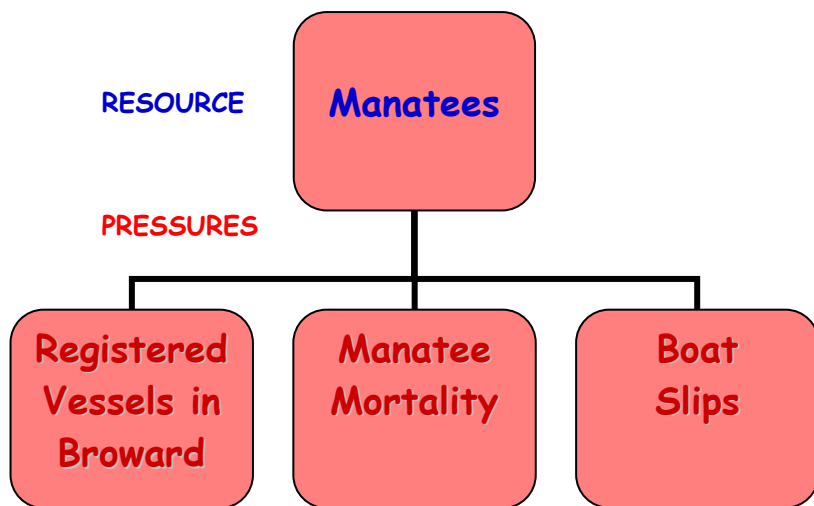
## RESPONSES TO PRESSURES ON MARINE WILDLIFE - Sea Turtles



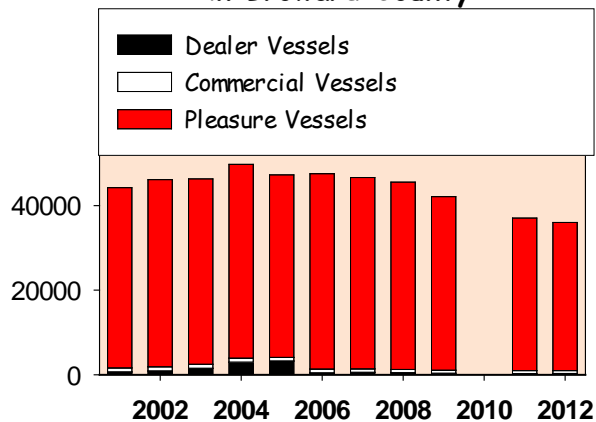
**(A) Beach Nourishment** - Adding sand to restore the historical width and slope of the beaches also serves to preserve critical nesting habitat for sea turtles. Grain size and composition of the replacement sand is important. To learn more, read the endnotes on pages 111-136.

**(B) Regulatory Comment on Beach Resources** - The statewide Coastal Construction Control Line Program includes review of the application by the Florida Fish and Wildlife Conservation Commission for impacts to sea turtles and certain shorebirds. County staff may serve as liaison between the state and the applicant to protect sea turtles and their habitat. To learn more, read the endnotes on pages 111-136.

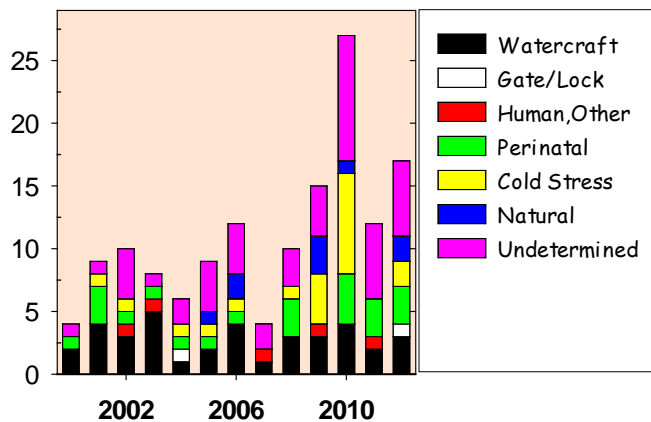
# PRESSURES ON MARINE WILDLIFE - Manatees



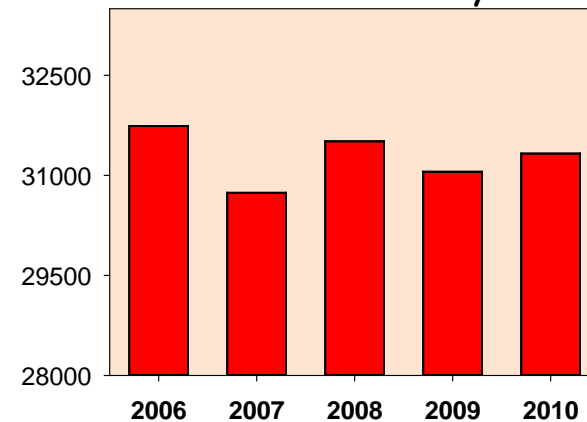
**(A) Numbers of Vessels Registered in Broward County**



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



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



Endnotes for the Marine Resources Benchmarks are on pages 111-136.

# RESPONSES TO PRESSURES ON MARINE WILDLIFE - Manatees

RESOURCE

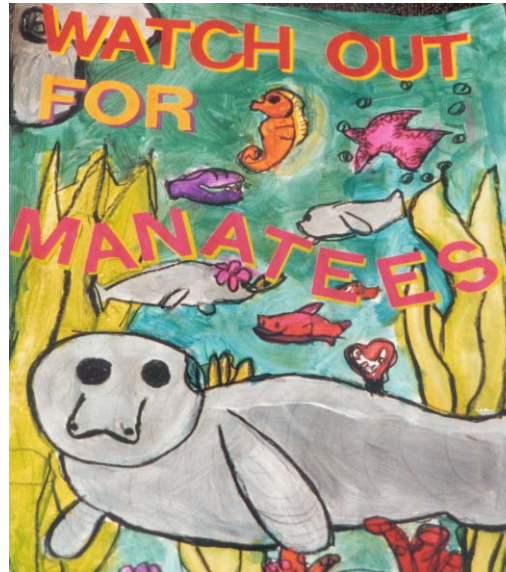
Manatees

PRESSURE

Human Encounters

RESPONSES

Broward County's Manatee Protection Plan



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

**Manatee Protection** - Broward County has completed the Broward County's Boat Facility Siting Plan (BFSP) and incorporated it with the previously-approved Boating Safety and Manatee Education elements of the Manatee Protection Plan (MPP). In December 2007, the MPP received approval from the Florida Fish and Wildlife Conservation Commission (FWC) and the US Fish and Wildlife Service (FWS). Broward County maintains numerous education and awareness efforts alone and in conjunction with other government and non-profit environmental agencies. The efforts include regular distribution of educational materials, public forums, informational kiosks, educator toolboxes, and a manatee webpage on the Broward County website. For more information, see the endnotes on pages 111-136.

# ENDNOTES

## CLIMATE

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

**Measurement:** This is the change in annual average temperature as measured against the baseline of average annual temperature for the period of 1950-1970 at the Fort Lauderdale weather station number 083163 located at latitude 26 06 N and between longitude 80 09W and 80 12 W since 1948. The data is from the National Climatic Data Center historical listing for National Weather Service Cooperative Network (<http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?f13163>).

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

**Trends:** Since 1971, only six of the 40 years in the record have shown an average annual temperature below the 1950-1970 baseline. The average annual temperature in 2010 was one of those years. However, the temperatures of 2010 provide an example of the potential for extreme temperatures associated with a changing climate. The average monthly temperatures for January, February, March and December were below the values for 2000-2009. In contrast, the months of June, July, and August had average temperatures above those previous ten years. In 2011, the average annual temperature was over 1.5 degrees above the baseline.

**Data source:** Calendar year data. Raw data is from the Southeast Regional Climate Center and North Carolina State University, [sercc@climate.ncsu.edu](mailto:sercc@climate.ncsu.edu). Calculations made by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management, Nancy J. Gassman, PhD (954) 519 - 1295

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

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

**Explanation:** One impact of global climate change is the melting of the polar ice caps and other land based ice sheets. This increases the volume of water in the world's oceans resulting in a change in sea level. As ocean temperatures increase, the water expands also contributing to rising sea levels. As an oceanic peninsula with relatively flat topography, Florida's coastline is particularly vulnerable to significant deviations in mean sea level.

**Trends:** The trend since 1920 has been a variable increase in sea level. In 2008, the average sea level was 9.57 inches greater than the 1920 baseline. Since 2009, the annual average has been decreasing each year to the 2011 value of 8.82 inches above the 1920 baseline. These up and down excursions in the average annual tide are seen throughout the tidal record from the last 100 years.

**Data source:** Calendar year data. Raw data is from the Permanent Service for Mean Sea Level (PSMSL) based in Liverpool at the Proudman Oceanographic Laboratory (POL) which is a component of the UK Natural Environment Research Council (NERC) ([http://www.pol.ac.uk/psmsl/psmsl\\_individual\\_stations.html](http://www.pol.ac.uk/psmsl/psmsl_individual_stations.html)). Calculations made by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management, Nancy J. Gassman, PhD (954) 519 - 1295



**GLOBAL AVERAGE CARBON DIOXIDE (PARTS PER MILLION)**

**Measurement:** Carbon dioxide and other greenhouse gases are measured at a global network of air sampling sites maintained by the Global Monitoring Division of National Oceanographic and Atmospheric Administration's Earth System Research Laboratory (NOAA/ESRL). They analyze the data and calculate the global average carbon dioxide concentration based on these sites. Data are expressed as parts per million (ppm). Annual uncertainty is estimated at 0.10 ppm.

**Explanation:** This benchmark demonstrates the trend in mean carbon dioxide globally averaged over the marine surface sites. Increasing concentrations of carbon dioxide in the atmosphere create a greenhouse effect causing an increase in the heat retention of the Earth's atmosphere. The burning of fossil fuels for electrical generation and transportation is a major source of greenhouse gases. Efforts are underway globally and locally to control and reduce the amount of gas emissions to attempt to stabilize and eventually reduce the atmospheric concentration of greenhouse gases.

**Trends:** Although these concentrations are only shown from 1980 to the present, the level of carbon dioxide in the atmosphere has been on the rise annually for over one hundred years. The carbon dioxide concentration in 2011 was 390.45 ppm over 30 ppm greater than in the year 2000 and a 15% increase over the 1980 concentration.

**Data source:** Calendar year data. Raw data obtained from the National Oceanographic and Atmospheric Administration's Earth System Research Laboratory at [http://www.esrl.noaa.gov/gmd/ccgg/trends/#global\\_data](http://www.esrl.noaa.gov/gmd/ccgg/trends/#global_data), Dr. Pieter Tans, NOAA/ESRL, [www.esrl.noaa.gov/gmd/ccgg/trends](http://www.esrl.noaa.gov/gmd/ccgg/trends)

**BROWARD COUNTYWIDE GREENHOUSE GAS EMISSIONS (MILLION TONNES eCO<sub>2</sub>)**

**Measurement:** This is a measurement in the total amount of greenhouse gas emissions (GHG) generated in Broward County. GHG emissions generated by human activities in Broward County come from a variety of sources including vehicles, energy consumption, waste generation, etc. On November 13, 2008, the Board adopted Resolution 2008-822 establishing a GHG reduction target of eighty percent below the current year (2007 emissions inventory) by 2050, and Resolution 2008-823 authorizing membership in the International Council for Local Environmental Initiatives (ICLEI) and supporting the Cities for Climate Protection Campaign. Broward County is following ICLEI's Five Milestones Process for the development of a community-wide action plan. The first inventory of community-wide GHG emissions, performed for the year 2007, was a critical step in developing Broward County's climate action strategy. The full report may be found at [www.broward.org/NaturalResources/ClimateChange/Documents/finalcommwidereportjune09.pdf](http://www.broward.org/NaturalResources/ClimateChange/Documents/finalcommwidereportjune09.pdf). The inventory was updated in 2012 for the years 2007-2010

([www.broward.org/NaturalResources/ClimateChange/Documents/BrowardCommunitywide\\_GHGEmissionsInventory2012FINALwappendix.pdf](http://www.broward.org/NaturalResources/ClimateChange/Documents/BrowardCommunitywide_GHGEmissionsInventory2012FINALwappendix.pdf)). These inventories serve as the foundation for measuring the success of regional efforts to reduce emissions, and provide the basis for identifying improvements in the regional strategy, as needed.

**Explanation:** One of the main factors contributing to global climate change is carbon dioxide (CO<sub>2</sub>) emissions. Due to human activities such as the combustion of fossil fuels, the concentration of atmospheric carbon dioxide has increased by about 35% since the beginning of the age of industrialization. This is a community level greenhouse gas inventory which identifies major sectors contributing to local emissions.

**Trends:** Broward County community-wide GHG emissions were analyzed within the Residential, Commercial, Industrial, Transportation, Waste and Other sectors using ICLEI (Local Governments for Sustainability) methodology and Clean Air Climate Protection (CACP) software. During calendar year 2007, the Broward community as a whole emitted approximately 23,608,647 metric tons (tonnes) of eCO<sub>2</sub> or more than 12 tonnes of eCO<sub>2</sub> per capita (a "tonne" is approximately 2,200 pounds). Emissions decreased in 2009 (22,302,241 tonnes of eCO<sub>2</sub>) and again in 2010 (22,177,409 tonnes of eCO<sub>2</sub>). These decreases may be attributed to reduce to economic impacts and to education campaigns to reduce emissions.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention,



### **BROWARD COUNTY GOVERNMENT OPERATIONS GREENHOUSE GAS EMISSIONS (MILLION TONNES eCO<sub>2</sub>)**

**Measurement:** This is a measurement of the total amount of GHG emissions from Broward County government operations by source category for 1997, 2007, 2008, 2009, 2010 and 2011. The CACP 2009 Software was used as the methodology for the development of the GHG emission inventory. The CACP software was developed by the ICLEI and Torrie Smith Associates. The CACP Software calculates the GHG emissions generated by energy use, fuel use, and solid waste. The total amount of GHG emissions (CO<sub>2</sub>, nitrous oxide [N<sub>2</sub>O] and methane [CH<sub>4</sub>]) by a source are aggregated by the software and reported in units of carbon dioxide equivalents (eCO<sub>2</sub>), a commonly used unit that combines GHG of differing impact on the earth's climate into one weighted unit.

**Explanation:** On June 12, 2007, the Broward County Board of County Commissioners adopted Resolution 2007-391 to reduce greenhouse gas (GHG) emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. Broward County developed a Broward County government operations report in 2008, including a GHG emissions inventory for baseline year 1997, a reduction target, and recommendations on GHG reduction strategies. The Broward County Government Operations Climate Change Report is available at [www.broward.org/NaturalResources/ClimateChange/Documents/FY12AnnualProgressReport\\_twopage.pdf](http://www.broward.org/NaturalResources/ClimateChange/Documents/FY12AnnualProgressReport_twopage.pdf). Annual progress reports that include GHG emissions inventories and GHG reduction actions implemented are available at [www.broward.org/NaturalResources/ClimateChange/Pages/GovernmentWorkgroup.aspx](http://www.broward.org/NaturalResources/ClimateChange/Pages/GovernmentWorkgroup.aspx).

**Trends:** From 2007 to 2011 Broward County government has experienced reductions in GHG emissions. Broward County's Government operations FY2011 carbon footprint was 250,255 tonnes eCO<sub>2</sub>, a net reduction of 5,781 tonnes eCO<sub>2</sub> compared to FY2010. This is equivalent to the annual GHG emissions from 1,134 passenger vehicles. Approximately 74 percent of the emissions were generated by electricity use at Port Everglades, the Fort Lauderdale-Hollywood International Airport, Wastewater Services, Streetlights and other County facilities; a net decrease of 3 percent compared to FY2010 due primarily to reduced electricity use. To meet the established FY2015 target of 222,099 tonnes, Broward County Government must reduce an additional 7,039 tonnes of eCO<sub>2</sub>, annually.

**Data source:** Fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Feliciano, (954) 519 - 1260

## **RESPONSES TO THE PRESSURES ON CLIMATE**

### **BROWARD COUNTY GOVERNMENT OPERATIONS GREENHOUSE GAS EMISSIONS REDUCTIONS**

**Measurement:** This is a measurement of the total amount of GHG emission reductions from Broward County government operations by source category comparing the emissions from fiscal year (FY) 2010 to FY 2011. The CACP 2009 Software was used as the methodology for the development of the GHG emission reduction inventory. The CACP software was developed by the ICLEI and Torrie Smith Associates. The CACP Software calculates the GHG emission reductions achieved by energy efficiency measures, fuel savings, and waste reduction initiatives at government level. The CACP Software calculates CO<sub>2</sub> emission reduction directly from the amount of fuel or energy saved and from the amount of waste recycled or incinerated. The total amount of GHGs (CO<sub>2</sub>, nitrous oxide [N<sub>2</sub>O] and methane [CH<sub>4</sub>]) reduced by a source are aggregated by the software and reported in units of carbon dioxide equivalents (eCO<sub>2</sub>), a commonly used unit that combines GHG of differing impact on the earth's climate into one weighted unit.

**Explanation:** On June 12, 2007, the Broward County Board of County Commissioners adopted Resolution 2007-391 to reduce greenhouse gas

(GHG) emissions in Broward County and to support the U.S. Mayors' Climate Protection Agreement. Broward County developed a Broward County government operations report, including a GHG emissions inventory for baseline year 1997, an inventory of early voluntary actions to reduce GHGs and recommendations on GHG reduction strategies. The Broward County Government Operations Climate Change Report is available at [www.broward.org/NaturalResources/ClimateChange/Pages/BrowardCountyClimateChangeReport.aspx](http://www.broward.org/NaturalResources/ClimateChange/Pages/BrowardCountyClimateChangeReport.aspx).

**Trends:** The estimated 2011 GHG emission reduction from the quantified measures resulted in 3,026 tonnes eCO<sub>2</sub> and a total cost savings of \$555,160. The most significant reductions were achieved in the Building & Facilities and Wastewater Facilities sectors. Increases in emission from the Vehicle Fleet reflect changes in transit ridership representing an increase in government emissions that offsets community emissions from single occupancy vehicles. Annual progress reports that include GHG emissions inventories and GHG reduction actions implemented are available at <http://www.broward.org/NaturalResources/ClimateChange/Pages/GovernmentWorkgroup.aspx>.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Feliciano, (954) 519 - 1260

### **BROWARD COUNTY CLIMATE CHANGE TASK FORCE**

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

**Explanation:** Global climate change has emerged as a phenomenon of critical concern worldwide. According to the Intergovernmental Panel on Climate Change: warming of the climate system is unequivocal; global concentrations of GHG have increased markedly as a result of human activities; global air and ocean temperatures are increasing; and average sea level is rising globally. The Broward County Board of County Commissioners approved the creation of a Climate Change Task Force to develop recommendations for a coordinated countywide strategy in mitigating the causes, and addressing the local implications, of global climate change.

The goals of the climate change program include:

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

**Trends:** The Broward County Climate Change Task Force completed work on and approved the "[Broward Climate Change Action Plan -Addressing our Changing Climate](#)" at their March 18, 2010 meeting. The Action Plan was developed in fulfillment of the Broward County Board of County Commissioners' charge to the Task Force to develop recommendations for a countywide climate program designed to mitigate the causes of and adapt to the consequences of climate change. The Board approved the Action Plan on May 4, 2010. Substantial progress has been made on the implementation of the plan. The action plan and other Task Force materials are available at <http://www.broward.org/NaturalResources/ClimateChange>.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Nancy J. Gassman, PhD, (954) 519 - 1295

### **SOUTHEAST FLORIDA REGIONAL CLIMATE CHANGE COMPACT**

**Narrative:** Recognizing the vulnerability of the Southeast Florida region, Broward, Miami-Dade, Monroe and Palm Beach County Commissioners entered into a cooperative agreement to accomplish four things. The Counties agreed to coordinate positions on State and Federal legislation and seek adaptation funding. They initiated the creation of a regional climate team to develop a SE FL Regional Climate Change Action Plan with regional mitigation and adaptation strategies. Recognizing the value of regional discussions, they determined that the SE FL Regional Climate

Leadership Summit should be held annually.

**Explanation:** The first Southeast Florida Regional Climate Leadership Summit was held Friday, October 23, 2009, hosted by the Broward County Board of County Commissioners in partnership with Miami-Dade, Monroe and Palm Beach counties. Participating were local officials, federal and state legislators, regional transportation, planning and water management authorities and members of the regional Climate Change/Green Task Forces representing the four counties. The purpose of this precedent-setting summit was to develop a regional collaboration that will support a coordinated climate change strategy. At the conclusion of the summit, the four participating County representatives endorsed a landmark [Regional Climate Change Compact](#), later approved by all four county commissions, in which they agreed to an ongoing collaboration on regional climate change issues. The Compact Counties formed a staff steering committee and coordinated on numerous policy statements including one to ban oil drilling in Florida waters and encouraging alternative forms of fuel. The second annual summit was held in October, 2010 in Miami-Dade. The draft Regional Climate Action Plan was released at the third annual summit in Key Largo in December 2011 and finalized in October 2012. More information on Compact may be found at [www.southeastfloridaclimatecompact.org](http://www.southeastfloridaclimatecompact.org).

**Trends:** Technical products including a sea-level rise vulnerability analysis, a sea level rise projection and regional develop greenhouse gas have been developed for the region. The Regional Climate Change Action Plan has been finalized and will be presented to the County Commissions in the late in 2012 for approval.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Nancy J. Gassman, PhD, (954) 519 - 1295

## AIR RESOURCES

### PERCENTAGE OF DAYS WHEN OUTDOOR AIR QUALITY WAS GOOD

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

**Explanation:** Poor air quality can affect public health, especially the health of children, the elderly, and people with pre-existing respiratory problems, such as asthma. The United States Environmental Protection Agency (U.S. EPA) has established National Ambient Air Quality Standards (NAAQS) for the criteria pollutants [ozone (O<sub>3</sub>), particulate matter (PM), oxides of nitrogen (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and lead (Pb)] to ensure adequate public health and environmental protection. The U.S. EPA developed the national Air Quality Index (AQI) to reflect air quality on any given day. An AQI is calculated for each of the criteria pollutants monitored based upon the methods established by the U.S. EPA and the highest AQI value of these for any given day is designated as that day's AQI. Daily AQI information for Broward County is available to the public by dialing (954) 519-1280 or on the web at [www.broward.org/pollutionprevention/airquality](http://www.broward.org/pollutionprevention/airquality).

**Trends:** NAAQS and AQI are dynamic systems designed to accomplish two objectives: 1) to establish acceptable air quality standards; and 2) to inform the public about the level of air pollution in their community and the associated health risks. The NAAQS and the AQI are routinely scrutinized by the U.S. EPA's Clean Air Scientific Advisory Committee to ensure that the latest medical and health related research are considered when the NAAQS are set. Therefore, the concentration ranges associated with the different levels of the AQI may change from year to year. Further complicating trend analysis and comparative studies of air quality are the local and regional variations in meteorological conditions which play a large part in dispersing or retaining air pollutants in our urban area. In Broward, yearly ambient air quality is a measure of the percentage of days in a calendar year that are ranked in the "good" category based upon the current AQI. Recent trends show a period of improvement in yearly ambient air quality (2001-2003) followed by a slight decrease (2004). The improvement was due to control technology

implemented to prevent high ozone days. The decrease was due to the addition of PM<sub>2.5</sub> real-time data to the AQI determination. This better reflected the impact of smoky conditions on the AQI. The ability to monitor PM<sub>2.5</sub> concentrations in real-time was due to new instrumentation previously not available or approved for real time PM<sub>2.5</sub> monitoring. Therefore, ambient air quality was not necessarily worsening; rather the new standards made it more challenging for any given day to achieve a rating of "good" on the AQI. Additionally, changes by the U.S. EPA to the NAAQS for ozone may affect future trends. In previous editions of the Environmental Benchmark Report, an "AQI goal" for the year was included in the graph of this resource. However, it has been removed from the report because changes made to the NAAQS have changed the way the U.S. EPA calculates the AQI. These changes have made it difficult to determine an appropriate goal for this resource. The AQI was in the good range for 347 days (95%) and in the moderate range for 18 days (5%) in 2011. This equaled a 6% increase in the amount of good air days as compared to 2010.

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

### **ANNUAL OZONE COMPLIANCE VALUE, ppm**

**Measurement:** Ozone (O<sub>3</sub>) is not usually emitted directly into ambient air; rather it is created by a chemical reaction between oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC) in the presence of high temperatures and sunlight at ground level. It is measured in units of parts per million by volume (expressed as ppm). The unit ppm is used to describe very dilute concentrations. In quantifying the concentration of O<sub>3</sub>, the unit basically states that per one million liters of air there are the stated numbers of liters of O<sub>3</sub>. Eight-hour average ozone concentrations are used to determine the AQI. The annual ozone compliance values are shown in this report.

**Explanation:** Motor vehicle exhaust, some industrial emissions, gasoline vapors, and emissions of chemical solvents, as well as some natural sources, contribute NO<sub>x</sub> and VOCs to the atmosphere. These compounds along with the required ambient conditions (heat and sunlight) cause ozone formation. Ozone can irritate lung airways and cause inflammation much like sunburn. Repeated exposure to ozone pollution for several months may cause permanent lung damage. Ozone also damages the leaves of trees and other plants, reduces crop and forest yields, and increases plant vulnerability to disease.

**Trends:** Over the past ten years, the ozone concentrations have remained consistent. The major source of pollution in Broward County (including VOC and O<sub>3</sub>) is motor vehicles. While vehicle miles traveled has increased from the previous year, emissions from motor vehicles are expected to decrease due to cleaner-emitting new vehicles and turnover of the vehicle fleet. Ozone formation is also dependent on sunlight and high temperatures, thus it is very dependent not only on NO<sub>x</sub> and VOC emissions but on weather and climate. In 2007, the NAAQS for O<sub>3</sub> was changed from 0.08 ppm to 0.075ppm. Broward County has been in attainment with the ozone standard since 1997. Attainment is reached when the three year average of the annual fourth highest daily maximum eight hour average, which is the ozone compliance value, does not exceed the standard. Broward County's ozone compliance value for the three year period 2006-2008 is 0.068 ppm, and 2007-2009 is 0.063 ppm, 2008-2010 is 0.062 ppm, and 2009-2011 is 0.060 ppm. Broward County is part of the Southeast Florida Airshed, along with Miami-Dade and Palm Beach Counties. Compliance with the ozone standard is determined for the entire airshed, based on ozone concentrations monitored in Broward County as well as in Miami-Dade and Palm Beach Counties. For example with Broward County's ozone compliance value for 2008-2010 at 0.062 ppm, Miami-Dade County at 0.068 ppm and Palm Beach County at 0.065 ppm; the compliance value for the airshed would be 0.068 ppm. Our neighboring counties have significantly influenced on our ozone levels because we shared the same air shed.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention,

### **ANNUAL PARTICULATE COMPLIANCE VALUE, $\mu\text{g}/\text{m}^3$**

**Measurement:** Fine particulate Matter ( $\text{PM}_{2.5}$ ) is a complex mixture of small particles and liquid droplets (aerosols).  $\text{PM}_{2.5}$  refers to particles of aerodynamic diameter 2.5  $\mu\text{m}$  or smaller. Concentrations of these particles or aerosols are reported in micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ). Continuous 24-hour average concentrations are used to determine the Air Quality Index. Annual average concentrations are shown in this report.

**Explanation:** Any component of ambient air that is not a gas is considered a particle. Particle pollution includes acid aerosols (such as nitrates and sulfates), organic compounds, metals, and soil or dust particles. The smaller the particles, the easier those particles pass through the nose, throat, trachea, and primary bronchi, and enter the lungs. Once inhaled, these particles can affect the lungs and heart and may cause serious health effects. These particles can be directly emitted from sources or form in the atmosphere through photochemical reactions.

**Trends:** The last few years have reflected a relatively consistent  $\text{PM}_{2.5}$  annual average between 8.3 - 8.7  $\mu\text{g}/\text{m}^3$ . Broward County has been in attainment for  $\text{PM}_{2.5}$ . The NAAQS for  $\text{PM}_{2.5}$  is 15  $\mu\text{g}/\text{m}^3$  for the annual average and 35  $\mu\text{g}/\text{m}^3$  for the 24-hour average. Attainment for the annual standard is reached when the 3-year of the annual means is less than or equal to the annual standard. Broward County's  $\text{PM}_{2.5}$  compliance value for the annual standard for 2006- 2008 is 8.2  $\mu\text{g}/\text{m}^3$ , for 2007-2009 7.69  $\mu\text{g}/\text{m}^3$ , for 2008-2010 7.01  $\mu\text{g}/\text{m}^3$ , and for 2009-2011 is 6.7  $\mu\text{g}/\text{m}^3$ . Attainment for the 24-hr standard is obtained when the 3-year average of the annual 98<sup>th</sup> percentile values is less than or equal to the 24-hour standard. Broward County's  $\text{PM}_{2.5}$  compliance value for the 24-hour standard for 2006- 2008 is 20.7  $\mu\text{g}/\text{m}^3$  for 2007-2009 is 19.4  $\mu\text{g}/\text{m}^3$ , for 2008-2010 is 15.9  $\mu\text{g}/\text{m}^3$ , and for 2009-2011 is 14.5  $\mu\text{g}/\text{m}^3$ .

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

## **AIR RESOURCES - PRESSURES FROM MOBILE SOURCES**

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

**Measurement:** This performance measure tracks the amount of volatile organic compounds (VOC), oxides of nitrogen ( $\text{NO}_x$ ), and carbon monoxide (CO) emissions from mobile sources (automobiles and trucks). The Air Quality Program staff used the U.S. EPA MOBILE 6.2 model to obtain emission factors that were used to calculate the mobile source emissions. These emissions were calculated using the Vehicle Miles Traveled (VMT) data from the 2011 Florida Department of Transportation Public Roads Mileage and Miles Traveled Report.

**Explanation:** Emissions from mobile sources remain a major air quality concern in Broward County. VOC and  $\text{NO}_x$  emissions from mobile sources are precursors for ozone, the pollutant of concern in Broward County. Exceedances of the air quality standard for ozone not only result in poor air quality but can also trigger additional costly regulatory controls and loss of federal funding for construction/transportation development. Furthermore, benzene emissions from motor vehicles are the primary factor contributing to respiratory cancer risk to drivers in the U.S., including Broward County, according to the 1999 National Air Toxics Assessment (NATA, [www.epa.gov/ttn/atw/nata1999/](http://www.epa.gov/ttn/atw/nata1999/)). Through more stringent fleet performance and fuel quality standards, and voluntary initiatives, the U.S. EPA is implementing additional programs to offset the increase of mobile source emissions due to population growth and vehicle miles traveled. In addition, due to updates in federal vehicle emission standards, older vehicles built to less stringent emission standards are replaced in the fleet by newer vehicles built in compliance with more stringent standards.



**Trends:** The total level of pollution from mobile source emissions in Broward County, measured in tons per year (TPY), has been steadily decreasing since the year 2000. In 2011 the total level of pollution from mobile sources decreased by 6.75% (203,184.75 from 217,896.43) from the 2010. The level of CO emissions in Broward County also decreased by 5.8% and the levels of both NO<sub>x</sub> and VOC decreased by 12.3% and 8.9% respectively from 2011 to 2010. All of these reductions can be attributed to a combination of the mandatory phase-in of cleaner fuels, computerized onboard emissions diagnostic systems, reduction in vehicle miles traveled, and cleaner burning engines.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Maribel Feliciano, (954) 519 - 1260

#### **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." This performance measure supplements the information provided by the two "Vehicle miles traveled" performance measures. It provides a more comprehensive picture of how vehicular traffic and the adequacy of the roadway system can affect the environmental quality of life in a county experiencing continuing urbanization. More information is available at [www.browardmpo.org/](http://www.browardmpo.org/).

**Trends:** The percentage of overcapacity roadway segments in Broward for 2011 was 20% which is the same as it was for 2010.

**Data source:** Calendar year data. Metropolitan Planning Organization, Buffy Sanders, [sandersb@browardmpo.org](mailto:sandersb@browardmpo.org)

#### **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 Broward County for the indicated calendar year by 1,000 people, based upon population estimate figures provided by the Bureau of Census. The vehicles miles traveled data was obtained from the FDOT Public Road Mileage and Miles Traveled Report which includes the estimates include roads on the state highway system, roads off the state highways system (collectors and above) and local roads. The source of the data from previous benchmark reports was the MPO traffic counts report and did not include the same road types.

**Explanation:** This benchmark is different from the "Vehicle miles traveled" benchmark below; it is unbiased to population increase and reflects vehicle miles traveled trends that can be an indicator of improvements in the transportation sector, land use planning and technological improvements.

**Trends:** The VMT increased from 24,489 in 2010 to 24,768 in 2011. However, over the past five years the VMT per 1000 people has been on a steady decreasing trend.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Matthew R. Anderson, (954) 519-1482

#### **VEHICLE MILES TRAVELED/DAY, MILLIONS**

**Measurement:** This is a measure of vehicular traffic representing the total miles traveled (VMT) in Broward County for the indicated calendar year. The vehicles miles traveled data was obtained from the FDOT Public Road Mileage and Miles Traveled Report which includes the estimates include roads on the state highway system, roads off the state highways system (collectors and above) and local roads. The source of the data from previous benchmark reports was the MPO traffic counts report and did not include the same road types.

**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 air quality improvements, the 1990 Clean Air Act implemented additional programs to offset the increasing VMT, due to population increase.

**Trends:** In 2011 the vehicle miles traveled per day increased to 43,295,870 from 43,259,153 in 2010. However, the vehicle miles traveled per day in Broward County has been on a slight decreasing trend over the past three years.

**Data source:** Florida Department of Transportation website. [www.dot.state.fl.us/planning/statistics/mileage-rpts/](http://www.dot.state.fl.us/planning/statistics/mileage-rpts/)

## AIR RESOURCES – RESPONSES TO PRESSURES FROM MOBILE SOURCES

### NUMBER OF AIR QUALITY OUTREACH EVENTS

**Measurement:** The Pollution Prevention, Remediation and Air Quality Division is responsible for the development and implementation of numerous air quality educational outreach programs and events. This benchmark is a measurement of the number of educational programs coordinated throughout the fiscal year indicated ending on September 30<sup>th</sup>.

**Explanation:** Providing educational opportunities about Broward County's air quality issues and regulations to government officials, regulated facilities, business owners, students and residents will increase awareness about local issues and help educate our community about the importance of maintaining, protecting and improving overall air quality.

**Trends:** In 2011, the number of educational outreach programs and events remained consistent (110 to 109) as compared to 2010. The Division's annual goal is to participate in 100 outreach events and activities. In 2006, the Air Quality Program developed a Five-Year Outreach Plan to provide a clear strategy for conducting outreach in conformance with federal, state and local goals and objectives. The plan includes a description of activities to be conducted in a five-year period and incorporates measures of success to evaluate performance annually. A few of this year's outreach programs included two major tri-county educational campaigns: Air Awareness Month and Car Care Month; educational programs in support of the School Board Partnership Agreement such as the Character Education E-Newsletters, environmental contests; educational presentations for residents and civic groups; radio announcements and more.

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

### NUMBER OF PEOPLE REACHED THROUGH AIR QUALITY OUTREACH EVENTS

**Measurement:** The Pollution Prevention, Remediation and Air Quality Division is responsible for the development and implementation of numerous air quality educational outreach programs and events. This benchmark is a measurement of the number of individuals that are reached through educational programs coordinated throughout the fiscal year indicated ending on September 30<sup>th</sup>. The number of people reached through outreach events provides an account of the number of people that attends and participates in air quality outreach events and activities. It includes educational programs for schools; regulated facilities; residents; civic organizations; and community events. It does not include web site visitors, mass media social marketing or electronic newsletters.

**Explanation:** Providing educational opportunities about Broward County air quality issues and regulations to government officials, regulated facilities, business owners, students and residents will increase awareness about local issues and help educate our community about the importance of maintaining, protecting and improving overall air quality.

**Trends:** The benchmark tracking began in 2007. In 2011 the number of people reached through the Air Quality Program's outreach events increased to 20,430. This is a 40% increase as compared to the 14,544 people reached in 2010. This is due to a combination of the Air Quality Program's leveraging resources with other educational programs in the County and identifying large community events to promote environmental stewardship and air quality protection.

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

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

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

**Explanation:** Alternative means of transportation such as buses, shuttles, and trains, reduce road 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:** In fiscal year 2011, mass transit numbers decreased by 1% from 40,970,007 passengers to 40,548,555 compared to 2010.

**Data source:** County fiscal year data. Broward County Office of Transportation, Robert Fossa, (954) 357-8336, and South Florida Regional Transportation Authority, Marketing Department, Marcin Gadek, (954) 788-7950

#### **COMMUNITY SHUTTLE RIDERSHIP, THOUSANDS OF TRIPS/YEAR**

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

**Explanation:** The Broward County Mass Transit Division (BCT) in cooperation with the Community Transportation Initiative (CTI) of the Environmental Protection and Growth Management 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:** The community shuttles/bus system now stands at 19 cities down from 22 due to the contracts with Wilton Manors, Oakland Park, and Cooper City being terminated. BCT scheduling, marketing and outreach programs to assist and improve cities abilities in operating the community bus program are continuous. 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 which is always improving its service. Schedules are being posted in many public locations including neighborhood shops, parks, churches and libraries. Community Shuttle Ridership increased by 12% (2,084,898 in 2010 to 2,336,339 in 2011) More information is available at BCT's website at [www.broward.org/bct/Pages](http://www.broward.org/bct/Pages).

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

### NUMBER OF REGULATED STATIONARY SOURCES

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

**Trends:** The Air Quality Program began reporting the number of regulated stationary sources in 2006. The number of regulated facilities has been found to change very little from year to year. In 2011, the number of state permitted major industries increased by 1% (91 to 92) from 2010. In addition, the number of state and county permitted small operations increased by 3% respectively (307 to 316) and (131 to 135). Two factors affect the number of regulated facilities. First, as part of the county's air quality program, unpermitted facilities are inspected to determine whether a State of Florida air permit or a Broward County Air License may be required. Facilities found to need a permit or license are required to submit the appropriate application. Second, economic conditions affect the viability of new and existing businesses. The Air Quality Program has observed that some businesses have shut down due to the effects of the economic recession.

**Data:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Josie Cisneros, (954) 519-1260

### EMISSIONS FROM POWER PLANTS, TONS/YEAR

**Measurement:** The amount of criteria pollutants (carbon monoxide-CO, sulfur dioxide-SO<sub>2</sub>, nitrogen oxides-NO<sub>x</sub>, particulate matter-PM and volatile organic compounds-VOC) emitted by power plants in Broward County in a calendar year. The data is reported by Florida Power & Light Company, annually.

**Explanation:** Emissions from power plants contribute to air pollution in Broward County. Sulfur dioxide and nitrogen oxides are precursors for acid rain that in turn contribute to poor air and water quality. VOC and NO<sub>x</sub> are important emission categories because they are the primary contributors to the formation of ground-level ozone. Some VOCs fall into the category of Air Toxics. Some Air Toxics can (with prolonged exposure) lead to cancer and non-cancer respiratory health effects or neurological effects.

**Trends:** Total power plant emissions have fluctuated over the past few years. Emissions from power plants are influenced by the amount of electricity generated and, to a great extent, by the type of fuel that is burned. Natural gas is a cleaner burning fuel than oil so that emissions are generally lower during those periods when natural gas is fired. However, FPL's decision to burn oil or gas is principally an economic one depending on fuel prices and fuel availability. Therefore, year-to-year fluctuations can be generally explained by the variability in the type of fuel used. Other factors such as equipment outages and facility outages can also be significant. In the case of the Port Everglades Power Plant, FPL began a phased modification of the facility in 2005 to install low-NO<sub>x</sub> burners to control NO<sub>x</sub> emissions and electrostatic precipitators to control emissions of particulate matter (PM). The project was concluded in 2007. During the phased construction period, at least one of the

four boiler units was offline at any one time. Following is a summary of changes in reported emissions. In 2011, the overall emissions from power plants decreased by over 58% which included the CO emissions decreasing by 40%, NOx emissions decreasing by 40%, SO<sub>2</sub> emissions decreasing by 88%, and VOC emissions were reduced by 61% compared to 2010 levels. The only pollutant that increased in 2011 as compared to 2010 was PM which increased by 10%. The reduction of air pollutant emissions from the FPL Port Everglades Plant is due largely to load distribution to other FPL plants. FPL plans to demolish the Port Everglades plant in 2013 and replace it with a more efficient natural gas-fired combustion turbine generating facility

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

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

**Measurement:** This is a measure of the total annual electric power consumed in Broward County. Total electrical consumption includes residential and nonresidential users. 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:** Total Electrical Consumption has been increasing from 1997 to 2007 (only calendar year 2004 saw a decrease of 1.46% due in part to outages caused by tropical storms). However for the last three years the total electrical consumption has been on a decreasing trend.

The Per Capita Electrical Consumption has fluctuated overtime with a steady per capita consumption from 2004-2007. However data from 2007-2009 has reflected a significant decrease of 29% in the per capita electrical consumption for residential accounts in Broward County. The total energy consumption has decreased to 19,726,798,488 kWh in 2011 from 19,849,758,309 kWh in 2010. Also in 2010, the number of residential accounts decreased by 2% in 2011 from 2010 (9,598 to 9,789).

**Data source:** Calendar year data. Florida Power & Light Co., Lynn Shatas

## **AIR RESOURCES - RESPONSES TO PRESSURES FROM REGULATED STATIONARY SOURCES**

### **NUMBER OF COMPLIANCE INSPECTIONS OF REGULATED STATIONARY SOURCES**

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

**Explanation:** Natural Resource Specialists periodically conduct inspections of regulated facilities in Broward County to ensure that the operations are conducted within the regulatory parameters. This measure includes inspections of both major industries and small facilities operating in the County. Regulated Stationary Sources are any air pollutant sources at a fixed location that have been issued an air pollution license or permit by Broward County or the State of Florida.

**Trends:** The Air Quality Program implemented a Quality Assurance Program for tracking air compliance inspections starting with the 2006

calendar year. In 2011, the total number of inspections increased by 24% compared to 2010. The reason is that inspections for a number of county-licensed facilities had to be rescheduled from 2010 to 2011

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

### **PERCENT REGULATED STATIONARY SOURCES INSPECTED AND FOUND TO BE IN COMPLIANCE**

**Measurement:** The compliance rate is the percentage of inspected facilities found to be in compliance with the permit/license conditions issued by the Broward County Air Quality Program.

**Explanation:** The compliance rate is calculated by taking the total number of licensed and permitted facilities and comparing that to the number of license & permitted facilities with enforcement actions issued for the year.

**Trends:** The Air Quality Program began tracking the compliance rate during the 2007 Fiscal Year. The 2008 benchmark report marked the first year that the compliance rate was included. Data was included from the previous fiscal year. In 2011, the percentage of inspected facilities found to be in compliance was 96% which equaled the previous fiscal year.

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

### **CHANGES IN STATIONARY SOURCE REGULATIONS**

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

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

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

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

## **AIR RESOURCES - PRESSURES FROM OTHER SOURCES**

### **DAYS AIR QUALITY WAS IMPACTED BY AN UNUSUAL EVENT**

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

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

**Trends:** The Broward County Air Quality Program did not record any days during 2011 where the air quality was affected by Sahara Dust. However in 2011, there were four days where the air quality was affected by wildfires.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention,



## AIR RESOURCES - RESPONSES TO PRESSURES FROM OTHER SOURCES

### OPEN BURNING REGULATIONS

**Narrative:** In Broward County, open burning is regulated under Broward County Code Chapter 27, Article 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 the burning of certain materials. In the unusual event of a nearby large-scale fire (e.g., wildfires, forest fires, burning of sugar cane fields) that affects air quality in Broward County, the Broward County Air Quality Program issues public health advisories through the Air Quality Index, EnviroFlash, and local press releases.

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

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

## WATER RESOURCES - SURFACE WATER QUALITY

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

**Measurement:** This measure tracks the influence of urban stormwater discharges from the C-11 West Basin (Griffin Road Canal) in Broward County on water quality in the Everglades for the indicated water year (WY) 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 to reduce average phosphorus concentrations in stormwater and landscape runoff to consistently achieve this goal at this site. Water quality improvements are being sought through broad implementation of best management practices such as source controls on pollution, changes in water management operations and seepage control (S9-A pump station) and improvements in surface water quality treatment.

**Trends:** The phosphorus concentration in discharges leaving the C-11 West Basin via the S-9 pump station has trended downwards. Annual



concentrations averaged 16.7 between WY 01 and WY 05 and 13.2 ppb between WY 06 and WY 12. Average annual phosphorus concentrations measured during the last 6 years, with the exception of WY12 (15.6 ppb) have measured below the period of record average of 14.62 ppb.

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

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

**Measurement:** This performance measure is calculated based on four quarterly sampling events per calendar year obtained from Environmental Protection and Growth Management Department's surface water quality monitoring network along the fresh water portion of the C-13 (Middle River) canal (University Drive to Interstate 95) as measured at Environmental Protection and Growth Management Department station numbers 12, 13 and 14. Station 13 was dropped from the monitoring network in 2006. Percent improvement is measured by comparing the overall annual average water quality index of these three stations against their 1995 (baseline) overall annual average water quality index. The index is calculated using the Florida Department of Environmental Protection's Florida Stream Water Quality Index (WQI) to rate the quality of fresh water systems. The WQI is based on the measurement of six water quality categories: water clarity, dissolved oxygen, oxygen-demanding substances, bacteria (total and fecal coliform), nutrients and biological diversity with each category potentially having more than one parameter. Total coliform was dropped as a parameter in 2006. We converted annual average raw data for the six categories to index values from 0-99 and assigned a percentile value based on Florida stream water quality data. The Environmental Protection and Growth Management Department WQI is based on the five water chemistry parameters as biological diversity measurements are not available for Broward County surface waters.

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

**Trends:** Both natural and human events impact this measure causing variability. Rainfall and storm water runoff are particularly strong influences on water quality. Readers interested in this benchmark should look at long term trends not annual variability. In 2006, total nitrogen concentrations were 44% lower than the previous year resulting in the improved water quality index. In 2007, total nitrogen concentrations were higher but improvements in the concentrations of dissolved oxygen, total phosphorus and fecal coliform resulted in overall improved water quality. In 2008, a 21% increase in total nitrogen concentrations over 2007 levels, coupled with a decline in dissolved oxygen levels resulted in a decline in overall water quality. In 2009, total dissolved nitrogen concentrations decreased and dissolved oxygen levels increased slightly. However, these improvements were offset by over a 2 fold increase in the annual average of fecal coliform for these two sites resulting in an overall decline in water quality. The large increase in fecal coliform levels could be attributed to an extremely high fecal coliform count at site 14, second quarter. There was a decline in the 2009 WQI, but overall water quality remains good. In 2010, total nitrogen, and total phosphorus increased by a small amount, and dissolved oxygen levels declined slightly. The average fecal coliform level doubled due primarily to elevated levels at both sites 12 and 14 in the fourth quarter of 2010. As a result overall water quality declined compared to the previous year but was still higher than the 1995 baseline. Water quality is rated good, based on the WQI index.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention Remediation and Air Quality Division, Nancy Craig, PhD, (954) 519-1411

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

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

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

**Trends:** Both natural and human events impact this measure causing variability. Rainfall and storm water runoff are particularly strong influences on water quality. Readers interested in this benchmark should look at long term trends not annual variability. In 2006, the index was impacted by chlorophyll readings 2.8 times higher than the previous years. Total nitrogen values were actually 28% lower. In 2007, the average chlorophyll value was approximately four times less than 2006 and total nitrogen values fell resulting in an improvement in water quality over the 1995 baseline. In 2008, total nitrogen and chlorophyll concentrations increased over 2007 values by 48% and 18% respectively. The 2008 TSI indicates an increase in productivity compared to the 2007 TSI value, however, water quality remains good in this system. In 2009, there was a 28% increase in chlorophyll but TN and TP declined 10 and 21% respectively resulting in a slight improvement in overall water quality based on the Trophic State Index. In 2010, both chlorophyll a and TN concentrations decreased by 7% but TP increased by 36% compared to the previous year. The increase in TP was offset by decreases in chlorophyll a and TN leading to a less productive system and slight increase in water quality compared to the 1995 TSI baseline value. Water quality remains good in this basin. In 2011, TP concentrations continued to trend upward, with the average concentration 10% higher than the 2010 value. Chlorophyll also increased by 14 over 2010 levels. However, these increases were offset by a 38% decreases in TN concentrations compared to 2010. The overall TSI decreased slightly compared to the previous year indicating improved water quality and the 2011 TSI is 4.5% the 1995 baseline. Water quality in the basin is rated good.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention Remediation and Air Quality Division, Nancy Craig, PhD, (954) 519-1411

## PRESSURES ON SURFACE WATER QUALITY

### URBAN STORMWATER RUNOFF

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

**Explanation:** Nutrients are one of the major pollutants of concern since their input to waterways can stimulate high levels of algal growth, reductions in oxygen concentrations, and stresses on aquatic life. Where nutrients are present in discharges to the Everglades and coastal areas,

the impacts can be especially deleterious, resulting in significant shifts in the composition of aquatic plant communities. Fertilizers and pet waste are known to be significant sources of nitrogen and phosphorus (the most critical nutrients), but sediments can also pose a problem. Sediments can be introduced to surface waters when rainfall washes across roadways and during construction projects. Rainfall can pick up more than sediments. Other pollutants of concern are heavy metals, hydrocarbons, and certain trace elements. Many of the County's efforts to reduce urban stormwater runoff have included source controls. Development projects are now required to provide more on-site retention and pretreatment systems that help remove pollutants from runoff. The County encourages the integration of creative stormwater designs into permitted site plans through its green building goals, priorities and informative websites. "Green" infrastructural approaches to stormwater management serve to infiltrate, evapotranspire, or reuse stormwater. A number of outreach and training programs have also been implemented, with courses in construction and landscape best management practices. Other efforts include street sweeping programs, storm drain cleaning and community outreach.

**Trends:** As older properties undergo development and redevelopment, these sites are required to comply with current surface water management regulations. This means that fewer and fewer sites contain drainage systems that predate today's modern standards. Redevelopment accounts for the majority of construction projects underway in Broward County and it is expected to continue to be prominent during the next several decades. While the development process itself creates an opportunity for sediment erosion and loading, strict sediment controls and dewatering practices help to minimize the disturbance and potential impacts, and the new stormwater management system is generally a substantial improvement to the site. Local governments and communities throughout the State have been growing increasingly concerned with the management of nutrients with the advanced implementation of State-wide numeric water quality criteria and stormwater management. In 2008, the County launched a stormwater website at <http://www.broward.org/stormwater/Pages/Default.aspx> which provides information on new approaches, often referred to "green techniques," that mimic natural processes and integrate stormwater management within the landscape to create multi-functional site designs. In addition, in 2012 the Broward County passed a model landscape ordinance (Chapter 39-Zoning, Article VIII) to provide for functional landscaping and vegetative protections that will enhance stormwater management.

<http://www.broward.org/GoGreen/Municipalities/Documents/BrowardCountyCodeFunctionalLandscapingAndXeriscaping.pdf>

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

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

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

**Explanation:** A measure of pressures on our natural resources is the number of building permits issued by municipalities and Broward County for all new buildings and additions to non-residential buildings. All building permits require review and approval by DER. 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 economic down turn and surplus of available existing commercial and residential buildings has slowed new construction and has resulted in a decrease in the number of new buildings and additions to non residential buildings over previous years.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Monthly Reports and DER POSSE Construction Application System data base - Environmental Review Section, Elissa Taylor, (954) 519-1264

## PERCENTAGE OF DEVELOPED LAND NOT SUBJECT TO SURFACE WATER MANAGEMENT REGULATION

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

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

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

**Data source:** Calendar year data. The South Broward Drainage District, Kevin Hart (954) 680-3337 and the South Florida Water Management District, Tony Waterhouse (561) 686-8800. Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Elissa Taylor, (954) 519-1264

## RESPONSES TO PRESSURES ON SURFACE WATER QUALITY

### MILES OF STREETS SWEEPED

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

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

Regular sweeping of impervious roadways and parking areas is a best management practice (BMP) recommended by the United States Environmental Protection Agency as part of the NPDES program. Broward County, 26 local municipalities, and the Florida Department of Transportation are co-permittees under a shared NPDES permit requiring local implementation of pollution reduction activities to reduce pollutant loads to local water bodies. Street sweeping is just one of the BMPs implemented by co-permittees in the NPDES permit, but can provide an indication of the level of resources and effort being invested by local partners to achieve compliance with the NPDES permit, with the total number of miles swept serving as a proxy for the overall effectiveness of the NPDES program activities in achieving environmental/water quality improvements.

**Trends:** The overall trend shows an increase in the number of miles swept each year. The increase in miles swept beginning in 2008 reflects better tracking and reporting by select municipalities.

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

#### **TOTAL NUMBER OF CERTIFIED NATURSCAPE SITES**

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

**Explanation:** Landscape design and maintenance have the ability to exert tremendous influence on the quantity and quality of Broward's water resources. Landscape irrigation is estimated to account for as much as 50% household water consumption and landscape runoff is identified as a major source of water pollution. In 2002, NatureScape Broward program was created as an environmental initiative with the goals to conserve water quantity, protect water quality, and create wildlife habitat through environmentally-friendly landscape practices that include the use of native and other drought tolerant plants, and the prudent use of our water resources. NatureScape properties adhere to the principles of Right Plant, Right Place, Get the Water Right, and other landscape best management practices (including integrated pest management and the use of low and no phosphorus fertilizers). In 2005, Broward County achieved recognition by the National Wildlife Federation (NWF) as a Certified Wildlife Habitat based in large part on the number of certified NatureScapes registered by the County and the environmental standards by which landscapes are evaluated. The County's certification program serves to recognize those properties that exemplify the NatureScape principles and includes those properties certified under similar programs administered by the NWF and Florida Yards and Neighborhoods Program. NatureScapes include residential, commercial, public, and educational properties, and can range in size from several tens of feet to many acres in total area. In 2006, Broward County and the School Board of Broward County entered into an historical partnership agreement to NatureScape certify all school properties as an environmental goal. In 2012, the Broward County School District was recognized by the National Wildlife Federation as the Nation's first certified school district, setting the standard for the creation of outdoor learning and environmental programming. In 2012, the School Board Agreement was renewed for another 5 year term.

**Trends:** The total number of NatureScape certified sites reached 2,789 in 2012. The number of certified NatureScapes in Broward County has steadily increased since program inception, and an increase of 15% was achieved between 2009 and 2012. To date, 120 school properties have been certified as NatureScapes, with 33 of those re-landscaped under the 2006 School Board Agreement.

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

#### **NUMBER OF EDUCATIONAL PROGRAMS DELIVERED**

**Measurement:** This measure tracks the total number of water resources educational programs delivered on an annual basis beginning in County fiscal year 2005. The data reported is for the fiscal year indicated ending September 30th.

**Explanation:** The NatureScape Broward, Know the Flow and Water Matters Day components of the County's Integrated Water Resources Plan are part of an educational outreach campaign designed to produce long-term water demand reductions and water quality improvements. NatureScape Broward promotes "Florida-friendly" landscaping through classes, workshops, and presentations conducted by County staff, the NatureScape Broward website, and dissemination of printed materials. Participants are taught about the benefits of using native plants in landscapes, landscaping best management practices, and protecting water quality through prudent use of lawn chemicals. Under a partnership agreement with the School Board of Broward County, NatureScape Broward principles are being integrated into school landscapes and the educational curriculum at middle schools throughout the County. Through landscape make-overs, students, teachers and school maintenance staff learn the value of native landscaping and landscape best management practices that conserve water and reduce pollution. The Know the Flow



program is a water management course delivered monthly to residents and businesses by County staff in coordination with the South Florida Water Management District. This course provides a comprehensive overview of water management in Broward County and encourages participants to adopt environmentally sound landscaping and stormwater best management practices to help protect water resources while maintaining essential flood control. The County's premier environmental educational event is Water Matters Day, an annual community outreach event that educates homeowners about the role they play in managing water resources in their homes, yards and communities. Water Matters Day features water related educational booths, plant giveaways, workshops and family entertainment to help residents understand the importance of protecting our water resources and to learn how to maintain environmentally-friendly landscapes.

**Trends:** Since 2005, 634 water resource-related educational programs were delivered by County staff to 24,633 people, including residents, Master Gardeners, teachers, students, government employees, and civic and business groups. Through the NatureScape Broward and School Board partnership over the past 5 years, 37 District teachers and 213 custodial//maintenance staff were trained and program information was provided to an additional 765 teachers, administrators, custodial staff and other school board employees. 122 teachers are now National Wildlife Federation Habitat Stewards. Over 9,100 Broward County students have directly participated in educational lessons that raised their consciousness on the importance of environmental stewardship. Know the Flow seminars totaled 47, attended by 1097 participants. The Tenth Annual Water Matter Day event held in March, 2012 was attended by 3,204 participants, and in 2012 the NatureScape Broward and Water Resources websites had 35,373 visits.

**Data source:** County fiscal year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Robert Rudolph, (954) 519-0328

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

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

**Explanation:** The C-11 West Basin is the County's major source of stormwater discharge and urban pollution to the Everglades, so controlling polluted stormwater discharges to the Everglades from the C-11 West Basin is the primary goal of the BEWG. Stakeholder groups in the C-11 West Basin, including municipalities, drainage and water control districts, the agricultural industry and others, were invited to identify and implement specific strategies for reducing phosphorus pollution in urban landscape which contributes to the degradation of the Everglades. The result was the C-11 West Basin Pollution Reduction Action Plan, which stakeholders are currently working to implement. The BEWG meets regularly to review progress relative to water quality goals and pollution reduction commitments, and to identify strategies for enhancing efforts.

**Trends:** Since the first meeting was convened in May 2004, a total of sixteen BEWG meetings have been held. The collaborative, inclusive, and voluntary process by which the BEWG has operated serves as a model for similar local pollution reduction efforts. Participants representing drainage districts and municipalities approved the final draft of the C-11 West Basin Pollution Reduction Action Plan, which was subsequently



adopted as part of the LTP. In 2012, the BEWG met two times, and will continue to meet to report activities, assess progress, and modify pollution reduction actions as needed to meet water quality goals. Since January 2012, Broward County and the South Florida Water Management District have partnered to provide Know the Flow program delivery, nursery irrigation evaluations, and staff training and workshops in support of water quality protection and Everglades restoration within Broward County's Non-ECP basins. This agreement complements efforts to improve and protect water quality within the C-11 West Basin and provides for education to residents, property managers, business owners and the regulated community in Non-ECP basins on the relationship between the Everglades and our urban landscape and water management practices. Information on the Know the Flow program can be found at <http://www.broward.org/knowtheflow/Pages/Default.aspx>. Water quality data for these basins can be found at the SFWMD website for the Annual South Florida Environmental Reports, Vol. III, and Appendix 3.2: <http://my.sfwmd.gov/portal/page/portal/xweb%20about%20us/agency%20reports>.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Robert Rudolph, (954) 519-0328

### **CLEAN WATER ACT - TOTAL MAXIMUM DAILY LOADS**

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

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

**Trends:** In May, 2007 the County's first TMDL was established for nutrients in the Pompano Canal (WBID 3271). A Basin Management Action Plan (BMAP) is currently being developed to accomplish the goals of the TMDL. The measures the County and the effected stakeholders have implemented within the Pompano Canal basin since the time of the impairment listing along with the continued water quality monitoring will help ensure the removal of the water body from the impaired list for nutrients during the next FDEP assessment cycle in 2015. Since the commencement of the Pompano Canal BMAP development an additional 13 TMDLs have been established throughout Broward County for fecal coliforms. Information on the TMDL program can be found at <http://www.dep.state.fl.us/water/tmdl/index.htm>.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Dr. Jennifer Jurado, (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 can be sustained over several weeks if not quickly controlled. In addition, sediments that remain suspended are generally negatively charged and will therefore attract positively charged molecules such as phosphorus, heavy metals and pesticides that are then released slowly into the water column. The Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual contains BMPs for construction activities during and after construction to reduce erosion and sedimentation and to properly manage runoff for both stormwater quantity and quality.

**Trends:** The total number of open construction authorizations remains high, which may indicate that a growing number of projects are taking longer to complete due to recent changes in the real estate market. In addition, Senate Bill 503 from the 2009 legislative session and Senate Bill 1752 from the 2010 legislative session and House Bill 503 from the 2011 legislative session granted two-year extensions to a number of open construction projects.

**Data source:** Calendar year data. Surface Water Management licensing databases, FOXPRO and POSSE. Data summary, Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Elissa Taylor, (954) 519-1264

## **TOTAL SURFACE WATER MANAGEMENT CONSTRUCTION LICENSES ISSUED SINCE 1989**

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

**Explanation:** The Surface Water Management Program is responsible for licensing all construction of surface water management systems as required under Broward County Code of Ordinances, Chapter 27, Article V, renewal of operation licenses, and certain environmental resource, wetland resource and surface water management permitting, compliance and enforcement responsibilities under part IV, Ch 373, F.S. and the rules promulgated thereto as set forth in the Delegation Agreement Among the Florida Department of Environmental Protection, the South Florida Water Management District and the Broward County Board of County Commissioners. Please reference the [ERP Delegation Boundary Map](#) depicting the areas for which Broward County has delegated authority for the Environmental Resource Permit (ERP) program. Properly designed, constructed, operated, and maintained drainage systems remove pollutants from storm runoff prior to discharging into Broward County's surface waters and provide the required levels of flood protection in accordance with established criteria for proposed developments. There are currently 35,700 acres of existing pre-regulation developed land without a required surface water management license in the ERP delegated areas.

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

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

## WATER RESOURCES - GROUNDWATER QUALITY

### PERCENT OF POTABLE WATER WELLS MEETING DRINKING WATER STANDARDS

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

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

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

**Data source:** Calendar year data. Quarterly raw water sampling data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Ali H. Younes, (954) 519-1486

## PRESSURES ON GROUND WATER QUALITY

### PERCENT SALTWATER MONITORING WELLS WITH CHANGING CHLORIDE CONCENTRATION, 2000 BASELINE

**Measurement:** This performance measure reflects the potential for saltwater intrusion to impact potable water supplies. It is based upon data from monitoring of the Regional Saltwater Intrusion Monitoring Network in Broward County. The changes are classified as the percentage of all monitored wells in the Regional Network whose chloride concentration increased or decreased, expressed as a logarithm, by 0.5 or remained unchanged from the baseline year (2000). Individual well chloride concentrations are annual averages recorded for the well in the calendar year indicated with the exception of the current year which is as of June 30<sup>th</sup>.

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

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

**Explanation:** The presence of elevated levels of chloride in potable water supplies can cause treatment problems because it cannot be removed by certain types of treatment plants and the treated water is subject to the secondary water quality standard for chloride. We think that changes in chloride concentrations, expressed as the common logarithm of 0.5 tend to correlate with the degree of coastal saltwater intrusion, and low values indicate a lack of saltwater contamination at the monitoring point. As of 2002, Well G-2901 has been deleted from the network due to a leaky casing giving false readings. A data correction for well G-2693 (previously G-2694) resulted in a change in 2001 which previously caused a false indication of declining chlorides in that well. As of 2003, G-2894 was destroyed reducing the network to 16 wells. Due to funding shortfalls with the SFWMD wells G-2785 and G-2906 are no longer monitored bringing the network to 14 wells. Find additional technical information at [http://groundwaterwatch.usgs.gov/countymaps/FL\\_011.html](http://groundwaterwatch.usgs.gov/countymaps/FL_011.html).

**Trends:** Complete data for 2011 and 2012 show four wells where the increase in chloride concentrations exceeds a 0.5 logarithm change (G-2893, G-2896, G-2898, G-2899). This result suggests the saltwater intrusion front may be advancing in the areas monitored by these wells. Four other wells (G-2697, G-2897, G-2900, G-2904 and G-2906) show a lesser increase in chloride concentration compared to the 2000 baseline. However, the change in chloride concentration in these seven increasing wells does not exceed a 0.5 logarithm change. Wells G-2149, G-2445, G-2693, G-2752, G-2785, and G-2902, and G-2903 appear to be leveling off if not showing small decreases.

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

#### PERCENT BROWARD COUNTY WHERE CENTRAL DOMESTIC SEWER SERVICE IS NOT AVAILABLE

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

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

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

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Elissa Taylor, (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) provide data on waste production by Broward County to the Florida Department of Environmental Protection (FDEP). The FDEP, Bureau of Solid and Hazardous Waste, Division of Waste Management, publishes the data in the Solid Waste Management in Florida Annual Report ([http://www.dep.state.fl.us/waste/quick\\_topics/publications/default.htm](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 on annual BEBR statistics.

**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 has been decreasing since 2006 (3% between 2009 and 2010), perhaps associated with the downturn in the economy.

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

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

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

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

**Trends:** Overall, the historical data shows continued variability in the number of contaminated sites, with a 2.4% decrease in the number of contaminated sites since 2005.

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

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

**Measurement:** This is the number of hazardous materials and storage tank licenses issued by the Pollution Prevention, Remediation and Air Quality Division (PPRAQD). 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 PPRAQD issues before the end of the quarter and that expires on or after the end of the quarter. The number does not include un-issued new licenses in process or facilities facing enforcement action for non-renewal or operating without a license through September 30<sup>th</sup> of the year given.

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

**Trends:** Through efforts to license unlicensed facilities and the number of businesses closing leveling off, there has been a slight increase in the number of licenses in the last two years. This was after licenses were lost to closures of small businesses due to the economy a few years ago. We expect that the number of licensed facilities will continue to increase slightly as compliance efforts continue provided that the number of closures remains constant. Also, the number of storage tank facilities decreased concurrent with the economic downturn a few years ago and is anticipated to remain at the current levels for the short term.

**Data source:** County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention, Remediation and Air Quality Division, Connie Boden, (954) 519-1405

#### **AMOUNT OF HAZARDOUS MATERIALS HAULED, MILLION GALLONS**

**Measurement:** This measure tracks the amount of discarded hazardous material, sludge, and biomedical waste transported to, from and within Broward County. Environmental Protection and Growth Management Department licensed waste transporters submit a report to Environmental Protection and Growth Management Department of the total amount of waste they transport on a monthly basis.

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



**Trends:** The total amount of discarded hazardous material, sludge, and biomedical waste hauled increased approximately 14% during year 2011. Currently, PPRAQD cannot attribute this increase to any particular issue.

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

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

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

**Explanation:** Discharge Reporting Forms (DRFs) are required to be completed and submitted to the Pollution Prevention, Remediation and Air Quality Division within 24 hours of determination that a discharge has occurred. These reports are usually based on analytical results or visual observations of a spill of regulated substances that may have impacted the soil, groundwater or surface waters of the County. Upon receipt of DRFs, field staff performs discharge investigation inspections, verify that a discharge has actually occurred, complete their inspection reports electronically utilizing FDEP's database, and initiate cleanup tracking activities.

**Trends:** The number of reported discharges has historically correlated to storage tank systems' upgrade years. The latest and final upgrade requirement deadline had been on the books since 1998, and expired on December 31, 2009. Accordingly, by the end of FY07, the majority of the storage tank systems had met the upgrade requirements, and any associated discharges had been reported - this represents the traditional peak associated with upgrade years. In FY08, a 38.5% drop in reported discharges represented the post-peak downward trend associated with the mandatory upgrades. In FY09, the number of reported discharges again dropped by 22.5%, continuing the post-peak downward trend associated with the December 31, 2009 upgrade deadline. As of July 30<sup>th</sup>, 2011, some 99% of the storage tank systems within the County met the upgrade requirements. Further, the December 31, 2009 deadline was effectively extended by a 2010 Legislative Action and/or Consent Order(s) through September 30, 2011. Discharges, mostly discovered or associated with Tanks/Piping closures, have since essentially leveled off to an average of 32 discharges reported annually for FYs 2009 and 2010; 31 reported in FY 09 and 33 in FY 10. Following Storage Tank Systems upgrades to Double Wall Systems, discharge reporting began a downward drop to 25 in FY11 and 19 in FY12.

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

## **RESPONSES TO PRESSURES ON GROUND WATER QUALITY**

#### **LOCAL SURFACE WATER MANAGEMENT**

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

**Explanation:** Broward County consists of a diverse water management community with dozens of discrete water management entities, including municipalities, drainage/water control districts, water suppliers, and water managers. Water is a regional resource, however, with management implications that extend well beyond the jurisdictional boundaries of individual entities. The need for a coordinated approach among water managers to effectively meet the County's future water supply needs and water resource goals resulted in the establishment of the County-wide Integrated Water Resources Plan (IWRP). The IWRP is implemented by the Broward County Natural Resources Planning and Management Division, in partnership with local governments, water providers and water managers, to further efficient and effective water resource planning and management activities with a focus on coordination and cooperation. Elements of the IWRP include water resource assessments; development

of technical tools to aid in planning and management decisions; development and implementation of diverse traditional and nontraditional water management strategies; a comprehensive water conservation outreach and education program; and projects that are multi-jurisdictional in nature and that have multiple water resource benefits. A principle water management strategy of the IWRP has been to better utilize its existing canal infrastructure to move water to areas where it can be used for a number of beneficial uses, including recharge of our existing groundwater supplies, rehydrating urban wetlands, and preventing saltwater from intruding into our coastal wellfield areas. Information on the Integrated Water Resource Plan can be found at <http://www.broward.org/iwrp/welcome.htm>.

**Trends:** Since 2006, and through the IWRP, the County has provided interlocal partners with cost share funding for numerous projects to improve surface water management, enhance wellfield recharge and stormwater reuse, and to investigate ways to abate saltwater intrusion into coastal wellfields. Broward County has partnered with the United States Geological Survey and several municipalities to develop saltwater intrusion models for northern, central and southern Broward County. These models 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. The County has developed an advanced hydrologic model to assist local water managers in identifying and quantifying the benefits of various secondary canal improvement projects and it is being applied in the development of a County-wide Water Management Master Plan for surface water and groundwater resources.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Dr. Jennifer Jurado (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 (also known as on-site treatment) associated with certain building permit approvals granted for the subject period. The flow figures used are those identified for new septic tank installations minus those identified for septic to sewer conversions by calendar year.

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

**Trends:** Several central sewage system projects continue to be completed in phases and released for use resulting in a large influx of septic to sewer conversions. These projects are ongoing and we anticipate this trend of high septic to sewer conversions for the next few years.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Monthly Reports – Environmental Review Section, Elissa Taylor, (954) 519-1264

#### **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 increased 4% from 2009 to 2010.

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

#### **PERCENTAGE OF CONTAMINATED SITES CLEANED UP TO STATE STANDARDS**

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

**Explanation:** One of the greatest threats to our drinking water supply is contamination from leaking underground petroleum storage tanks

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

**Trends:** The historical data shows a continued increase in the percentage of sites cleaned up. However, new discharges make the cleanup of all sites a moving target. An increase in the percentage of sites cleaned up means that, overall, the number of sites being cleaned up is bigger than the number of new discharges.

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

## NUMBER OF LICENSED HAZMAT SITES INSPECTED

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

**Measurement:** This is a measure of the field activities of the Pollution Prevention, Remediation and Air Quality Division to inspect the holders of hazardous material management licenses in Broward County during the fiscal year indicated. The total number of inspections and their respective outcomes is compiled by using the Pollution Prevention, Remediation and Air Quality Division's Licensing and Inspection database, POSSE - Public One Stop Service. A POSSE query provides the number of inspections completed, the number of those inspections that resulted in an in-compliance or out-of-compliance status, and the number of licensed facilities inspected in any given time period, regardless of how often some facilities may have been visited in that same time period. For the purposes of this report, annual figures are compiled for the fiscal year indicated, beginning on October 1<sup>st</sup> and ending September 30<sup>th</sup>.

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

**Trends:** The decrease in the annual number of licensed hazardous material facilities inspected over the past few years had begun to level off at 3,205 in FY09 (down from 3,218 (0.4% drop) in FY08) and preceded by a 16.8% decrease between FY07 and FY08. These decreases had ended an upward trend that began in 2004 and were attributed, in part, to the economic downturn and the associated budget cuts that had resulted in a reduction of field staff. Furthermore, the number of times inspectors visited a given facility (frequency of facility inspection) increased in FY08, contributing to the decrease in the number of facilities visited. On average, in FY08, licensed facilities were inspected 1.8 times per year versus 1.45 times in FY07. In FY09, this facility inspection frequency held steady at 1.8. In FY10, this inspection frequency metric dropped to 1.6. The primary reasons for this frequency of facility inspections are: 1. On average, storage tank system installation activities may take up to eight (8) site visits to complete the installation inspection. 2. Closure inspections may also take up to three (3) site visits. 3. Out-of-compliance facilities are re-visited as needed to eventually achieve compliance, and 4. Response to complaints and reported discharges often result in additional site visits/inspections. The percentage of licensed facilities inspected determined to be in compliance averaged at 69.8% over FYs 07, 08 and 09, with 71.5% in FY07, 69% in FY08 and again 69% in FY09. However in FY10, this metric measured at 71%. That's a 2% increase over the previous two years. This increase is mostly attributed to the fact that all of the storage tank systems have upgraded to double-wall systems and an overall increase in Compliance Assistance Site Visits designed to help facilitate pollution prevention alternatives and maintain compliance. In FYs 2011 and 2012, the frequency of facility inspections dropped to 1.3 (for both FYs) and the compliance rates increased to 72% and 75%, respectively. That is a 4% increase since 2010. The drop in the frequency of inspections and the increase in compliance rates for FYs 2011 and 2012 are attributed to a slowdown in closures, installations, and reported discharges, as all Storage Tank Systems have either upgraded to double wall systems or closed/removed. Re-inspections are now mainly attributed to out-of-compliance facilities with non-paperwork type violations.

**Data source:** County fiscal year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention,

## WATER RESOURCES - GROUND WATER QUANTITY

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

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

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

**Trends:** In general, ground water levels have been relatively constant during the last twelve years. However, a notable increase has been measured in groundwater levels measured in the northern saltwater intruded area. In this region, the ground water levels during the last 4 out of 5 years have averaged more than 0.75 foot above the historical long-term average. This observation is likely explained by the topography and presence of various water control structures and interconnects that allow water to be moved effectively through the area to increase recharge and thus groundwater levels. Additionally, the City of Pompano Beach has transferred much of its water demand to more inland potable water wells located at the Palm Aire wellfield, allowing for some recovery in groundwater levels further east. Ground water levels in the southern saltwater intruded area, eastern C-11 basin, and western C-9 and western C-11 basins have increased by a quarter foot to half foot since 2000. Ground water levels in other parts of the County (western C-14 and central Broward County) have shown little change or a small decrease in water levels.

**Data source:** Calendar year data. Data sets maintained by the United States Geological Survey and the South Florida Water Management District. Data summary, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Michael Zygnerski, (954) 519-1450

## PRESSURES ON GROUND WATER QUANTITY

### INCHES OF ANNUAL RAINFALL

**Measurement:** This measure tracks the average annual rainfall measured across Broward County, in inches. This is provisional data based on

numerous rain gauges located throughout the County and monitored as part of a network by the South Florida Water Management District.

**Explanation:** Local rainfall significantly influences surface and ground water hydrology in Broward County. Annual rainfall in Broward County averages 57.67 inches per year (30-year average, 1981-2010, computed by the SFWMD), 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 seasonal abundance of rainfall, during drier months, reduced rates of rainfall and aquifer recharge can stress local water supplies and wetland systems by causing reductions in ground water levels. This is particularly true during the winter and spring months when irrigation demands increase and the region's population expands with winter residents. Such strains are greatest during prolonged periods of drought when surface water recharge of potable water wellfields can leave eastern wellfields vulnerable to saltwater intrusion. With such close connection between local rainfall, 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 measured over a 30-year period of record averages 57.67 inches. Annual Broward County rainfall has exceeded this long-term average in two of the last ten years (2003 and 2012). Rainfall has been lowest during this ten-year period in 2004, 2006, 2007, 2008, and 2011 when total rainfall ranged from 45 to 53 inches, much less than the historical average. In 2009 and 2012, the annual average rainfall was 63 inches.

**Data source:** Calendar year data. Data provided by the SFWMD and are considered provisional, summarized by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Dr. Jennifer Jurado, (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 has been 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 58 inches per year in Broward County) and ground water seepage and surface water deliveries from the Everglades. In recent years, concern has grown about reliance upon the Everglades as a water source for aquifer recharge, and in the carrying capacity of the Biscayne Aquifer for potable water demands. With the establishment of the regional water availability rule by the South Florida Water Management District and the Broward County's urban population expected to reach 2.2million by 2030, planning efforts have focused on the development of alternative water supplies in order to ensure an adequate and reliable water supply is available. This would protect against changing climatologic conditions, while working to ensure regional water is reserved for restoration of the Everglades, consistent with the intent of the federal Comprehensive Everglades Restoration Plan. Wellfield withdrawals by public and private water suppliers provide a measure of the degree to which utilities are maintaining or reducing wellfield withdrawals through conservation programs and the development of alternative water supplies.

**Trends:** Wellfield pumpages in 2010-2012 declined from the recent years and in 2012 are at 238 MDG. Pumpage was highest in 2004 at 270.4



MGD when annual rainfall measured 45 inches, or 13 inches less than the 30-year long-term average of 58 inches for Broward County. While previous declines of 10% was measured between 2000 and 2001 when restrictions on landscape irrigation were imposed and again in 2008 (237.5 MGDs), these levels are generally not maintained once the restrictions are lifted. In fact, withdrawals increased to 258.6 MGD in 2009 when rainfall recovered and drought conditions were relieved, despite the fact that water restrictions remained in place. The recent declines in withdrawals may have been the result of the economic impacts of the recession and the associated high vacancy rates in the residential housing stocks. As the economy recovers, the pressures on the public water supplies will likely increase in the absence of meaningful and long-term conservation practices.

**Data source:** Calendar year data. Data provided by the SFWMD and summarized by Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Dr. Jennifer Jurado, (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 distributed annually in each Broward County Water and Wastewater Services (WWS) district divided by our best estimate of population derived from the 2010 census and projected forward for each WWS district.

**Explanation:** The actual per capita water consumption in gallons per day per person differs from service area to service area because this statistic includes commercial and industrial (non-residential) water usage which also varies from service area to service area. However, the change in this descriptive statistic from year to year can reflect changes in residents' attitudes regarding water use and conservation as indicated by customers within all WWS water service districts.

**Trends:** Overall per capita consumption continues to drop (2010 and 2011 Per Capita Consumption decreased about 5% per year from 2009) and this downward trend may be attributed in part to the following.

1. The WWS Neighborhood Improvement Program, which is 93% complete, has replaced over 26% of our underground infrastructure, thereby reducing leaks and per capita consumption.
2. All new construction is required by Broward County Ordinance to use more efficient, low-flow plumbing fixtures.
3. We project that WWS's ongoing Water Conservation Program, including the 2012-2013 credit program for low-flow fixtures, will continue to reduce per capita consumption.
4. 2011 was the sixth consecutive year with drought conditions and/or mandatory Stage II or Stage III water restrictions imposed by the SFWMD or by Broward County Ordinance for the entire year.

**Data source:** Calendar year data. Broward County Public Works, Water and Wastewater Services, John Crouse, (954) 831-0765

### **REGIONAL SURFACE WATER MANAGEMENT**

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

**Explanation:** Surface water deliveries from the regional, or the Everglades system, are an important component of Broward's hydrologic system. While local rainfall provides the vast majority of water needed to meet Broward's urban water supply needs, rainfall is seasonally variable 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. Maintenance of adequate water levels is critical in maintaining the hydration and viability of urban wetlands, preventing saltwater intrusion into potable wellfields, and for protecting water management infrastructure from erosion. When Water Conservation Areas located in western Broward County lack the water necessary to provide for urban water deliveries, recharge of the County's canal network can be temporarily suspended (as occurred during spring 2007). Furthermore, the regional water availability rule adopted by the South Florida Water Management District limits urban demands on the regional system by

restricting pumpage from the Biscayne Aquifer to levels measured prior to April 2006. Regional policies and climatologic variability necessitates efficiencies in surface water management and the development of alternative source waters to meet consumptive use demand and for canal and aquifer recharge.

**Trends:** The relationship between urban water management and the Everglades Biscayne Aquifer systems remains in transition. As part of the Comprehensive Everglades Restoration Plan, the pilot Central Everglades Planning Project (CEPP), and pursuant to adoption of the Regional Water Availability Rule, regional water management practices and policies are being modified to retain a greater volume of water within the Everglades system and Biscayne Aquifer for Everglades restoration and to reduce overall urban reliance upon the Everglades and the Biscayne Aquifer as sources of water. Local governments have worked to identify and develop alternative water supplies to meet future water demands, and to offset some portion of current water demands. These efforts include development of the Floridan Aquifer, aquifer storage and recovery wells, wastewater reuse, stormwater reuse, and conservation. Broward County continues to pursue regional alternative water supply solutions in partnership with local water providers, neighboring counties, and the South Florida Water Management District. Hydrologic modeling efforts are underway to identify local alternative water supply projects and the potential for utilizing more regional sources of fresh water, points of distribution, and secondary canal routing needed to provide for the County's long-term water demands and in compliance with regional policies and management constraints. The Broward Water Resources Task Force, established in 2008 has finalized its final report of 40 recommendations to advance conservation, regional water supply projects, the development of reuse, and the continuation of technical assessment and research to provide for sustainable water supplies. The Task Force continues to provide a forum in which to discuss effective alternative water supply strategies to meet current and future regional water demands including regional environmental/water supply partnerships and to advance the recommendations such as the regional C-51 water source option.

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

## RESPONSES TO PRESSURES ON GROUND WATER QUANTITY

### MAINTENANCE OF URBAN GROUND WATER LEVELS

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

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

**Explanation:** A direct connection exists among urban 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 dehydrate, urban wellfields can become impacted by saltwater intrusion, the operation of drainage infrastructure can become compromised due to erosion, and induced rates of ground water seepage from the Everglades can increase. The County has committed many resources to the development of technical tools to better manage surface water resources for the purposes of aquifer, wetland, and wellfield recharge and has supported numerous surface water management projects designed to improve the retention of stormwater and landscape runoff and enhance aquifer recharge. In FY '12 and as part of the IWRP, the County is extending the ILA partnering with the City of Fort Lauderdale on a secondary canal interconnection to improve recharge to the C-12 canal. Current designs of a secondary canal interconnection between in the C1 and C2 canals in

northern Broward County to enhance surface water management and recharge is expected to advance as well. The County is also participating in efforts to identify regional and sub-regional alternative water supply projects that will help reduce urban demands on the Biscayne Aquifer and the Everglades. For example, the City of Miramar is designing a reuse feasibility to provide for irrigation demands to areas that are currently outside its service area. The City of Coconut Creek is also proposing to extend its current reuse lines north to the Palm Beach County boundary. The City of Sunrise is exploring a partnering with the Town of Davie for the transfer of water supplies between the two entities. 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 continued to support the construction of secondary canal projects to make more efficient use of existing water resources. And while the County's secondary canal system will likely continue to constitute a fundamental part of our local water management system, efforts are underway to identify and pursue other sub-regional alternative water supply projects to replace and augment existing water resources as part of the activities of the Broward Water Resources Task Force and recommendations in the Final Report. For example, continued exploration of the C-51 storage option is advancing with the Palm Beach County Water Resources Task Force early in 2013. Also, a Broward Regional Reuse Master Plan was approved in July, 2012 to establish a 20-year plan to promote the cost-effective and long-term use of beneficial reuse county-wide.

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

## **ALTERNATIVE WATER SUPPLY DEVELOPMENT**

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

**Explanation:** Broward County is estimated to need an additional 20 to 47 million gallons of water each day (mgd) to meet water demands projected for 2030. 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 required to develop alternative water supplies, independent of the Biscayne Aquifer and water deliveries from the Everglades system. Potential alternative water supplies are the Floridan Aquifer, aquifer storage and recovery wells, wastewater reuse, stormwater reuse, and desalination. Chapter 373, Florida Statutes, requires that local governments provide for the planning, design, construction, operation, and maintenance of alternative water supply development projects; the formulation and implementation of alternative water supply development strategies and programs; and encourages multi-jurisdictional water supply projects. The Water Resources Policy and Planning Program has implemented the County-wide Integrated Water Resources Plan (IWRP) which provides for water resources technical assessments, water management strategies, and water conservation activities that will help the County and all of its water providers to comply with this mandate in a coordinated and cost-effective approach. IWRP implementation has included development of technical tools and a County-wide Integrated Water Resource Management Master Plan, with municipal, water utility and drainage/water control district partners, to help guide these efforts and to effectively meet the County's water supply needs and water resource goals for the benefit of all water users. This latter project includes modeling of proposed Floridan Aquifer water supply projects, analysis of a regional surface water reservoir project concept, and assessment of proposed sub-regional alternative water supply concepts developed by the Broward Water Resources Task Force.

**Trends:** A number of efforts are underway in the County to identify alternative water supply options. Broward County is partnering with the United States Geological Survey to conduct a geotechnical study of the Upper Floridan Aquifer to benefit the development of alternative water supplies. Modeling is being conducted in support of developing the C-51 Reservoir as an alternative water supply. IWRP cost share grants

continue to be offered to support the development of alternative water supplies, further water conservation, and improve water management efficiencies. Regional collaborations have been enhanced through the efforts of the Broward Water Resources Task Force which was convened in 2008 to identify and evaluate opportunities for regional and subregional alternative water supply projects and water conservation strategies. Their final report of recommendations was completed in June 2010. For more information on the activities of the Task Force, visit <http://www.broward.org/intergovernmental/pages/waterresourcetaskforce.aspx>. At the same time, local water utilities are making significant progress in their alternative water supply planning efforts, including 2030 plans for development/expansion of Floridan Aquifer systems to 37 MGD (withdrawals in 2012 were 2.5 MGD) and plans to develop beneficial reuse projects to 96.56 MGD (currently producing 10.68 MGD) in compliance with the 60% reuse requirements of the 2008 ocean outfall legislation. The 2012 Draft Lower East Coast Water Supply Plan, these proposed Alternative Water Supply projects are detailed in Appendix G:

[http://my.sfwmd.gov/portal/page/portal/xrepository/sfwmd\\_repository\\_pdf/lec\\_app\\_g\\_wsd\\_projects\\_draft%20ext\\_12-13-12.pdf](http://my.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/lec_app_g_wsd_projects_draft%20ext_12-13-12.pdf)

The individual water and wastewater facility information can be found in Appendix D

[http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd\\_repository\\_pdf/lec\\_app\\_d\\_draft%20ext%2012-20-12.pdf](http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/lec_app_d_draft%20ext%2012-20-12.pdf)

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Dr. Jennifer Jurado, (954) 519-1464, South Florida Water Management District, Water Supply Planning Division, Mark Elsner, (561) 682-6156.

## 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 2.2 million by 2030, water demands are expected to increase at least 20% during the next 20 years, equating to an additional water demand of 55 million gallons per day. At the same time, constraints are increasing on our ability to use current water resources to meet future water demands. These constraints are closely linked to the health of the Everglades and the integrity of the Biscayne Aquifer. One way we are working to ensure the sustainability of the Broward's urban and natural systems is through coordinated water management efforts, community outreach and educational initiatives, and the pursuit and promotion of sub-regional projects that meet multiple water resource needs. The success of these efforts can be measured, in part, by the level of participation and support of other governmental entities, including municipalities and drainage/water control districts in these efforts and planning committees. Our goal is to achieve 95% participation by our local partners in one or more of these IWRP initiatives, whether that includes staff attendance at Know the Flow courses, participation in the Broward

Everglades Working Group, membership in the Water Advisory Board or its Technical Advisory Committee, or one of the many other initiatives 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 95% in 2012. Thirteen IWRP-related activities and programs were provided support in 2012 with many entities participating in multiple IWRP initiatives.

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

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

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

**Explanation:** The NatureScape Irrigation Service (NIS) is a water conservation service offered by the County in cooperation with 18 municipal and water utility partners, the County's Water and Wastewater Services, and the School Board of Broward County. Goals of the NIS are to reduce urban water consumption and improve the quality of surface waters through more efficient irrigation operations and environmentally-friendly landscape practices. The NIS partners are dedicated to protecting water as a valuable resource and are focusing their efforts on large properties, such as parks, schools, residential and large commercial complexes, where water conservation efforts can produce the greatest water savings. The NIS provides water users with irrigation system evaluations and recommendations for improving irrigation system efficiency and operation, through basic site assessment, inspection of existing irrigation systems and operational schedules, measurement of current water usage, and a general landscape analysis. Property managers are provided with a detailed 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 defective and/or mismatched 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 a sensible irrigation watering schedule, minor repairs and a basic irrigation system tune-up. Water savings are documented based on these initial recommendations and follow-up evaluations. Property managers are also provided with information on the NatureScape Broward program and are encouraged to pursue NatureScape certification of their landscapes, if appropriate. Since the NIS is focused on delivering only the amount of water that can be effectively used by plants in the landscape plus typical losses to evaporation, many of the problems associated with inefficient and excessive irrigation are reduced, including the growth of dollar weed, presence of fungus, and proliferation of pests. Improvements implemented based on NIS recommendations result in water, energy, time and money savings, and the improved health of turf grass and landscape plants. Such improvements translate into a reduced demand for fertilizers and other lawn care products, producing additional environmental benefits and cost savings.

**Trends:** Since beginning operations in 2005, the County's NIS has saved over 912 million gallons of water. In 2011, 282 evaluations were completed and a total water savings of 165 million gallons was achieved. This recent increase in actual water savings has been attributed to the NIS focus on larger properties that are in need of renovation and/or overhaul. For example, four evaluations and three follow-up evaluations at a 600 unit condominium complex yielded an annual water savings of over 4.8 million gallons. Water savings were highest in 2006 before the imposition of regional water restrictions in 2007 and the later adoption of permanent water conservation measures relating to landscape irrigation in 2010.



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

### **WATER MATTERS DAY ATTENDANCE**

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

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

**Trends:** The first Water Matters Day event in 2003 was attended by 1,300 individuals. Attendance increased by 46% in 2004 with an estimated 1,900 attendees and continued to increase in the years that followed. The total number of attendees was estimate to be 4,000 in 2007 and 2008. More precise tracking was employed in 2009, and in 2010 the event attracted 3,409 attendees and the support of more than 100 volunteers. In 2011 and 2012 attendance was 3,209 and 3,204 respectively.

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

## OUR LAND RESOURCES - NATURAL LAND QUANTITY

### ACRES OF PROTECTED LAND, THOUSANDS ACRES OF UNPROTECTED DEVELOPABLE LAND o Protected Natural Land Inventory o Designated Natural Lands

**Measurement:** The Land Stewardship Section maintains an inventory of Protected Natural Lands that were acquired through the 1978, 1989 and 2000 Land Preservation Bond referenda (through municipal acquisition, or through regulatory mechanisms. The unprotected lands include areas designated as Local Areas of Particular Concern (LAPC) and/or Natural Resource Areas (NRA) in the County Comprehensive Plan; or Natural Forest Communities (NFC) in the Tree Preservation Code. Platting and proposed development of these lands are reviewed by the Tree Preservation Program staff and attempts are made to preserve all or part of these lands through regulatory means. **Protected Natural Land** This category consists of environmentally sensitive lands (LAPC, NFC and NRA), mitigation sites and other public or private lands managed for conservation and included in the Protected Natural Land Inventory. **Water Preserve Area:** These sites have been acquired by the South Florida Water Management District and maintained for the prevention of urban flooding and the supply of water to the Biscayne Aquifer.

#### Designated Natural Land

The County Comprehensive Plan and the Tree Preservation Code designate natural lands in the following categories. These designated lands are reviewed during the platting and proposed development phases for potential preservation.

*Local Area of Particular Concern (Native Vegetative Communities Category) is an area which shows a predominance of native vegetation associated with one or more of the following ecological communities: Beach and Dune Community; Coastal Strand Forest Community; Mangrove Community (Saltwater Swamp); Scrub Community; Pine Flatwoods Community; High Hammock Community; Low Hammock Community; Cypress Wetland Community (Freshwater Swamp); Everglades Community (Freshwater Marsh).*

*Natural Forest Community* means a vegetated area generally comprised of a canopy, subcanopy and groundcover, and which meets the criteria for the classification of an area as a Natural Forest Community under [Chapter 27](#), Article XIV, Section 411 of the Code.

*Natural Resource Area* means a land designation as defined in Article IX, [Section 5-280](#) of the Broward County Land Development Code, as amended.

**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:** Over 1,000 acres of land was acquired through the 2000 Safe Parks and Land Preservation Bond program.

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

#### 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.

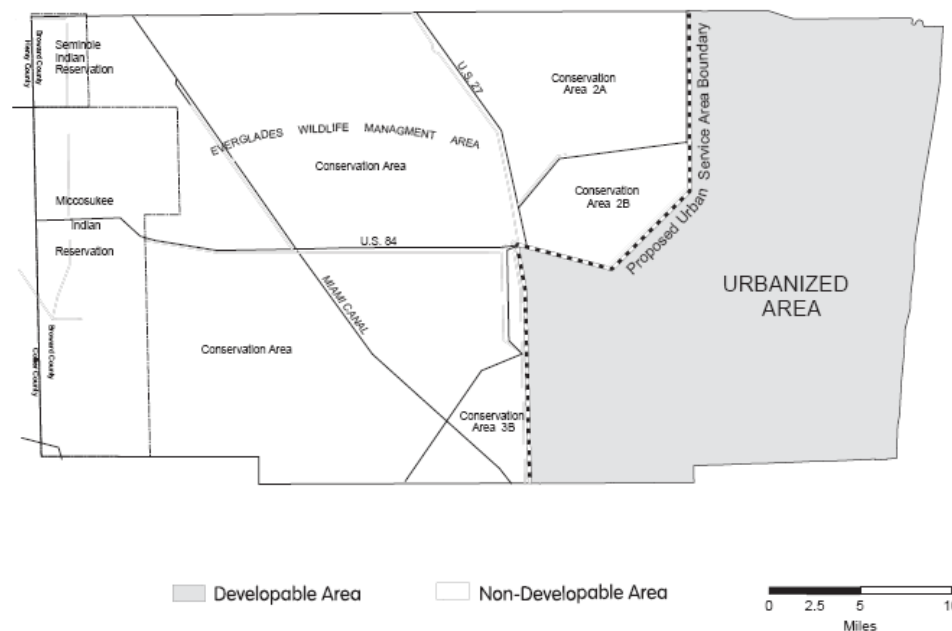
**Measurement:** WCA 2A has an area of approximately 164.7 square miles, a portion of which is located in north-central Broward County (99.2

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:** The foremost functions of the WCA include the prevention of urban flooding, the conveyance of Lake Okeechobee water to the Atlantic Ocean, and the supply of water to recharge the Biscayne aquifer. Water supplied to the aquifer is important to maintaining ground water levels in coastal areas, which, in turn, sustains municipal water supplies. The WCA also protect the urban and agricultural lands in Broward and Miami-Dade Counties from flooding and supply water to Everglades National Park.

**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.

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



## PRESSURES ON NATURAL LAND QUANTITY

### BROWARD COUNTY POPULATION, MILLIONS

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

**Explanation:** Population increases are a direct impact on our land resources. The temperate weather of South Florida is a powerful lure to the area and will result in continued land resource impacts. More information on population statistics may be found at Broward-by-the-Numbers at <http://www.broward.org/PLANNINGANDREDEVELOPMENT/DEMOGRAPHICSANDECONOMICS/Pages/BrowardByTheNumbers.aspx>. In addition, current and historic county populations going back to 1972 can be found at [http://www.edr.state.fl.us/Content/population-demographics/data/FLcopops\\_2011.xls](http://www.edr.state.fl.us/Content/population-demographics/data/FLcopops_2011.xls).

**Trends:** Broward County reached a peak of population in 2007 with 1,765,707 estimated residents. Population estimates declined in 2008 and 2009. The 2010 Census shows slight growth (1,748,066) over last year. The lull in population growth was attributed to more people moving out of Broward than into the County. The short-term trend was related to escalation of housing costs. According to U.S. Census estimates of

population, most of Broward's in-migrant growth is international indicating that Broward's demographic is changing as well as growing.

**Data source:** Calendar year data. 2010 data provided as reported by the South Florida Regional Planning Council

(<http://www.sfrpc.com/census/2010PLProfiles.htm>)

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

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

**Explanation:** A measure of pressures on our natural resources is the number of building permits issued by municipalities and Broward County for all new buildings and additions to non-residential buildings. All building permits require review and approval by DER. 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 economic down turn and surplus of available existing commercial and residential buildings has slowed new construction and has resulted in a decrease in the number of new buildings and additions to non-residential buildings over previous years.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Planning and Environmental Regulation Division, Monthly Reports and DER POSSE Construction Application System data base - Environmental Review Section, Elissa Taylor, (954) 519-1264

#### **WETLANDS LICENSED FOR 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. The current economic climate has also impacted the rate of development and the number of applications being submitted for review.

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

#### **MITIGATION LEAVING BROWARD COUNTY, ACRES**

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

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

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

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

## RESPONSES TO PRESSURES ON NATURAL LAND QUANTITY

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

**Measurement:**

With the conclusion of the 2000 Safe Parks and Land Preservation Bond Referendum, no further land acquisition is proposed. Any additional land preservation in the near future will likely be through regulatory mechanisms for tree preservation or wetland mitigation.

**Explanation:** Over 1,000 acres of land was acquired through the Land Preservation Bond Program. Efforts will be made to enhance the ecological value of the acquired natural lands.

**Trends:** As this program has concluded no additional land acquisition projects are proposed at this time.

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

### ENVIRONMENTAL REVIEW

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

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

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

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

### ACRES OF MITIGATION LICENSED IN BROWARD COUNTY

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

**Explanation:** Wetland impacts are evaluated using the Florida Unified Wetland Mitigation Assessment Method (UMAM). Step one of this methodology looks at the wetland function provided by the area based on hydrology, vegetation and community structure. Numeric values are assigned and the "function loss value" of wetlands for impacts to that wetland area is determined. Step two evaluates the proposed mitigation



area, as it currently exists and how it is expected to function after the mitigation is complete, using the same criteria. Step three then determines the "functional gain value" the mitigation area will provide. The "functional loss" should be equal to the "functional gain". *This is not an acre for acre replacement calculation.*

**Trends:** Land available for large-scale developments has continued to decrease. Applications are trending toward redevelopment (i.e., several single family home sites merged for townhouse development) or single family home tracts that are now being constructed.

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

#### **ACRES OF MITIGATION ON PUBLIC LANDS IN BROWARD COUNTY**

**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 partnerships with municipalities to help to allow development while retaining wetland values in Broward County.

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

## **OUR LAND RESOURCES - NATURAL LAND QUALITY**

#### **NATURAL LAND QUALITY**

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

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

**Trends:** The management of protected natural lands is handled through the various managing entities as time and funds are available. The wetland mitigation areas are to be maintained by the property owner which generally is a homeowners association with limited or no knowledge of natural area management. An Urban Forest Management Plan for the County and the various municipalities is under development. This will provide

a regional approach to land management.

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

## PRESSURES ON NATURAL LAND QUALITY

### INVASIVE EXOTIC VEGETATION

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

**Explanation:** Non-native, invasive tree species have a high potential to crowd out indigenous vegetation that native Florida wildlife relies on for food and shelter. In addition to County-led efforts, reduction of invasive plant species also includes efforts by the SFWMD within the Water Conservation Areas, Broward County's largest area of natural land, as well as the efforts by County and city governments within the eastern, urban portion of Broward County.

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

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

### NATURAL LANDS UNDER HYDROLOGIC STRESS

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

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

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

**Trends:** The Broward County Environmental Protection and Growth Management Department, in conjunction with Parks & Recreation and Highway Construction & Engineering Divisions, has undertaken efforts to hydrologically restore some of the damaged wetlands. See **RESTORING HYDROLOGIC FUNCTION TO NATURAL LANDS** section below.

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

## **FIRE SUPPRESSION ON NATURAL LAND**

**Narrative:** Florida plant communities have evolved with fire due to the State's peninsular geography and weather patterns. As a result, communities such as pinelands and scrub require fire to maintain ecosystem health, biodiversity and longevity. In these communities fire directly encourages native plant seed dispersal and germination, provides forage for wildlife, and limits competing fire-sensitive tree species such as oaks. Fire is also necessary to reduce excess understory litter (fuel loading) and to control plant and insect pest species.

**Explanation:** Due to land development and landscape segregation natural fire in much of Florida is no longer a viable mechanism and unattended wildfires can threaten life and personal property.

**Trends:** Broward County should seek opportunities to conduct prescribed fire or mechanical management on acquired natural lands to ensure the integrity of the resource is retained.

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

## **RESPONSES TO PRESSURES ON NATURAL LAND QUALITY**

### **PERCENT OF MUNICIPAL NATURAL LAND SITES WITH MANAGEMENT PLANS**

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

**Explanation:** For all acquired natural lands, Resource Management Plans are created to direct present and future staff in ensuring 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. The Land Stewardship section and staff are currently involved in a County-wide monitoring program for all sites acquired with 2000 Safe Parks and Land Preservation Bond Funds. This monitoring is in addition to the municipal management and helps to ensure all approved aspects of the management plan are being carried out. If shortfalls exist, municipalities will be notified of corrective actions to be taken.

**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. To date 100% of the acquired sites have approved final management plans.

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

### **LAND STEWARDSHIP PROGRAM**

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

**Explanation:** The "Partners in Preservation" grants fund the ecological restoration of natural public lands within Broward County through the removal of invasive non-native vegetation and replacement with appropriate native plantings. To date, the program has funded 60 projects totaling \$2,059,675 and over 400 acres for both municipalities and County Parks which are located throughout Broward County.

**Trends:** These programs assist Broward County cities to implement conservation measures on protected natural lands.

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

### **COMPREHENSIVE EVERGLADES RESTORATION PLAN**

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

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

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

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

**Data source:** Official website for the Comprehensive Everglades Restoration Plan, <http://www.evergladesplan.org>, Fact Sheet for Broward County Water Preserve Area, [http://www.evergladesplan.org/docs/fs\\_bcwpa\\_sept\\_2007.pdf](http://www.evergladesplan.org/docs/fs_bcwpa_sept_2007.pdf), Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

### **RESTORING HYDROLOGIC FUNCTION TO NATURAL LANDS**

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

**Explanation:** In developing an Integrated Water Resources Plan, 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. Water use permits have been obtained for all projects. Environmental Resource Permits are still required. Negotiations are underway with most cities for permitting requirements.

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

### **CONTROLLED BURN OR ALTERNATIVE MANAGEMENT METHODS**

**Narrative:** To counteract the absence of periodic natural fire, land managers must utilize prescribed fire and or mechanical management to reapply this natural process, ensure ecosystem health and reduce wildfire risk for neighboring properties. Prescribed fire is such a vital essential to Florida

ecology that the State Legislature recognizes and protects certified burners from liability and the right to conduct prescribed burning through an authorization process provided by the Florida Forest Service (formerly the Division of Forestry, see FS 590.125).

**Explanation:** The following are three appropriate management options to mimic or reintroduce fire in fire dependent plant community: (1) prescribed fire alone, (2) mechanical management - followed with prescribed fire (forestry-mowing or roller chopping), and (3) mechanical management only. The first option of prescribed fire only 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, mechanical management and followed with prescribed fire, provides a desirable level of ecological benefit, reduces the height of fuel loads and reduces flame lengths/heights during prescribed fire, thus making a planned fire easier to control. This option expands the range of conditions in which burning may be conducted and reduces the intensity in an area far exceeding its' typical burn regime, however it still carries some risks and difficulties of burning in an urban setting. The third option of mechanical management only has a greatly reduced and perhaps questionable ecological value but is the 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 fire on acquired natural lands to ensure the integrity of the resource is retained.

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

## OUR LAND RESOURCES - URBAN LANDSCAPE

### URBAN LANDSCAPE

**Narrative:** The urban landscape of Broward County is influenced by a wide combination of natural and anthropomorphic inputs including natural lands left undeveloped, groups of trees preserved through development, trees planted by residents, trees that were dispersed and matured naturally, and landscape trees planted pursuant to site plan requirements. This includes native and non-native species. Changes to the urban landscape can occur from natural causes, such as hurricanes or tropical storms, and human causes, such as additional development or unauthorized tree removal. Improving the urban landscape by planting trees appropriate for this area can help mitigate effects from storms, as they are better-equipped to withstand storm impacts. Broward County code related to tree trimmer and removal licensing, and protection of trees from construction helps to mitigate effects of human-caused impacts.

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

**Trends:** The Citrus Canker Eradication Program and hurricanes in 2004 and 2005 caused considerable damage to the urban landscape. A number of programs including NatureScape Broward and Partners in Preservation can help mitigate some of the impacts. An Urban Forest Management Plan for the County and the various municipalities is under development. This will provide a regional approach to land management.

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



## PRESSURES ON URBAN LANDSCAPE

### NUMBER OF TROPICAL STORMS

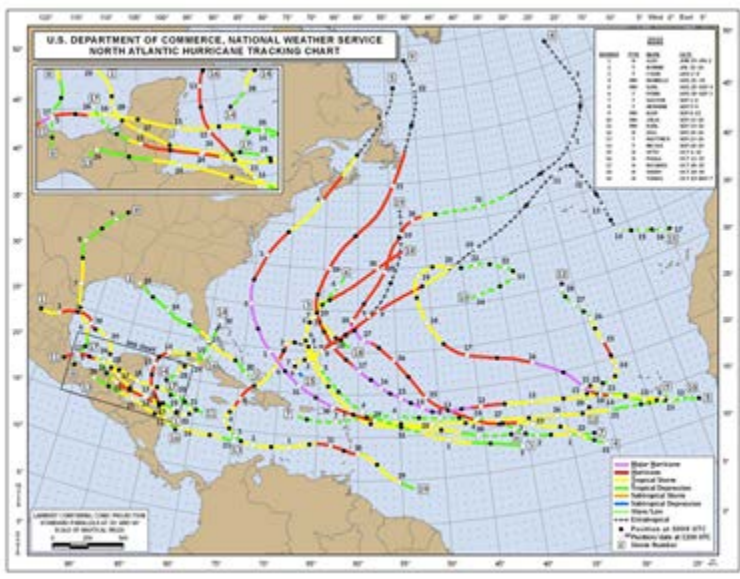
**Measurement:** The number of all tropical cyclones (hurricanes and tropical storms) whose centers passed within 65 nautical miles of Broward County in 2010 and 2011.

**Explanation:** As a peninsula of land projecting out between the Atlantic Ocean and Gulf of Mexico, Florida is in the potential path of tropical storms and hurricanes as history has recorded. The destruction to the urban landscape of Broward County caused by Hurricane Wilma in October 2005 highlighted the need to plant the right trees in the right places and to maintain them properly. To date, Broward County Parks has spent 6 million dollars to replant the "right" trees in Park areas severely damaged by hurricanes. This represents the planting of approximately 13,000 trees. Additionally, the Land Stewardship Program is promoting the planting of native trees and plants best suited for the location and habitat of the desired site. This is a primary function of the Partners In Preservation Grant Program.

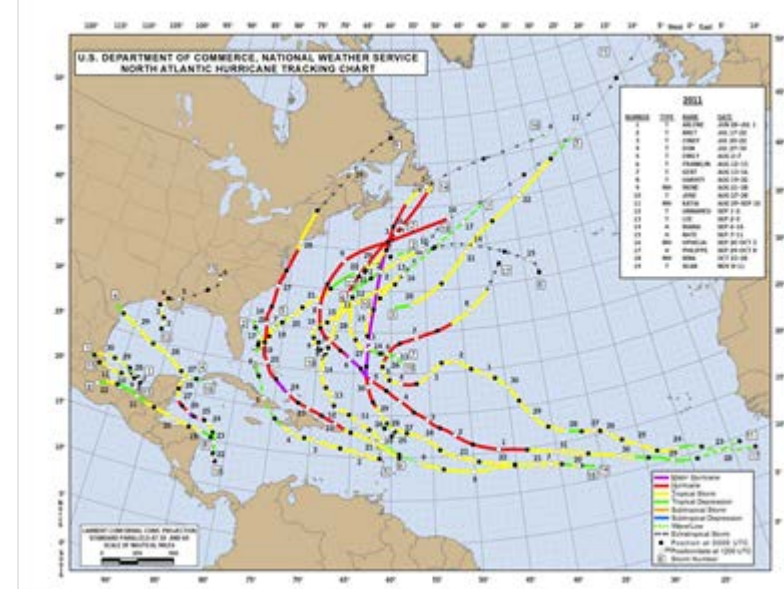
**Trends:** Climate scientists suggest that the Atlantic Ocean Basin will experience increased hurricane and tropical storm activity during the next several decades.

**Data source:** Calendar year data. National Oceanic and Atmospheric Administration 2010, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Donald Burgess, (954) 519-0305

2010 Map



2011 Map



## REDUCTION OF WILDLIFE HABITAT

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

**Explanation:** Habitat can be destroyed or degraded in two basic ways: quantitative and qualitative losses. Quantitative losses involve a reduction in the amount of habitat area. For example, if a wetland is paved over, then there has been a quantitative loss of wetland. Qualitative changes involve a change or degradation in the structure, function, or composition of the habitat. For example, a paper company discharging chemicals into a waterway and poisoning the water creates a qualitative loss. Sometimes a combination of quantitative and qualitative loss occurs as when a forest is fragmented or divided into many patches (from conversion to agricultural or residential land) providing less benefits to species than an intact forest.

If species are unable to tolerate extensive habitat modifications they may become threatened or endangered, even extinct. The loss of species reduces biological diversity and can also have economic, recreational, and aesthetic impacts.

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

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

## EMERGING PEST PROBLEMS

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

**Explanation:** Broward County has been inundated over the past few years with blights, plagues and pest infestations with notable impacts to our landscapes. The detrimental effects have perhaps been compounded by diminished vegetative coverage and loss mature tree canopy following the 2005 hurricane season. An additional factor contributing to the extent of pest impacts is the lack of plant diversity often present in our landscapes, such that when a specific plant species or type is targeted by a pest population, observed impacts can be widespread. Selection of inappropriate plant material in landscape design poses another problem. Choosing the wrong place for a plant can stress it and make it susceptible to disease and less resilient to pests. In response, landscape managers and homeowners frequently intervene with control measures, most often, pesticides. However, pesticides kill more than the targeted pest, contributing to the demise of beneficial insects and the natural system of balance which can exacerbate the problem and allow pest populations to further increase. There is also concern about the casual use of incorrect or ineffective pesticides, which when applied may not fully eradicate the pest population and can actually allow pests to develop pesticide resistance, further compounding the problem.

**Trends:** Broward County landscapes bear the impacts of a growing number of plant pests and plagues. Specific ornamental, turf and landscapes pests and diseases that have impacted Broward landscapes in the past 3 years include, but are not limited to, the following:

### Pests

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

### Diseases

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

**Data source:** Florida Department of Agriculture and Consumer Services and its agricultural regulatory unit, Division of Plant Industry, keep track of insects and diseases that have recently arrived in Florida and those that are projected to make an appearance. Information on pests and appropriate treatment measures are available through their materials and website at <http://www.fl-dpi.com/enpp/pi-pest-alert.html>. Additional Florida pest information is available on the University of Florida's (UF/IFAS) Pest Alert website: <http://entnemdept.ufl.edu/pestalert/>. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Diana Guidry (954) 519-0317

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

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

**Explanation:** The two complaints that the Tree Preservation Section routinely responds to are tree abuse or unlicensed tree removal. Tree abuse is basically improper tree trimming; unlicensed tree removal is removing trees without a Tree Removal License. A search was done of the licensing database to determine the number of complaints received per year.

**Trends:** The number of complaints in 2011 was up from the previous year. This could be attributed to increased citizen activism and greater awareness of environmental regulations.

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

### **NUMBER OF TREES LICENSED FOR REMOVAL**

**Measurement:** This measurement tracks the number of trees licensed for removal each year. Tree removal is good indicator of development pressure.

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

**Trends:** The number of trees licensed for removal was down slightly in 2011. This again was a result of a sluggish economy and less development projects.

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

## RESPONSES TO PRESSURES ON URBAN LANDSCAPE

### PUBLIC EDUCATION

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

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

**Trends:** Broward County's tree canopy continues to recover from Hurricane Wilma and future storm activity is likely in the next decade. Right Tree Right Place public education will continue to be a priority. As a result of the NatureScape Program, over 3249 backyards, along with schoolyards, workplaces, public properties and homeowner communities have been certified as NatureScapes in Broward County.

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

### TREES PLANTED IN BROWARD COUNTY PARKS AFTER STORM EVENTS

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

**Explanation:** The Broward County Parks and Recreation Division has undertaken an aggressive tree planting program to replace trees lost due to tropical storms. The trees planted will provide more tree canopy at maturity than what was lost. The tree species utilized should also be able to better withstand future storms, providing a more viable long lasting resource.

**Data source:** Broward County Environmental Protection and Growth Management Department, Development and Environmental Regulation

#### **TOTAL NUMBER OF CERTIFIED NATURSCAPE SITES**

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

**Explanation:** Landscape design and maintenance have the ability to exert tremendous influence on the quantity and quality of Broward's water resources. Landscape irrigation is estimated to account for as much as 50% household water consumption and landscape runoff is identified as a major source of water pollution. In 2002, NatureScape Broward program was created as an environmental initiative with the goals to conserve water quantity, protect water quality, and create wildlife habitat through environmentally-friendly landscape practices that include the use of native and other drought tolerant plants, and the prudent use of our water resources. NatureScape properties adhere to the principles of Right Plant, Right Place, Get the Water Right, and other landscape best management practices (including integrated pest management and the use of low and no phosphorus fertilizers). In 2005, Broward County achieved recognition by the National Wildlife Federation (NWF) as a Certified Wildlife Habitat based in large part on the number of certified NatureScapes registered by the County and the environmental standards by which landscapes are evaluated. The County's certification program serves to recognize those properties that exemplify the NatureScape principles and includes those properties certified under similar programs administered by the NWF and Florida Yards and Neighborhoods Program. NatureScapes include residential, commercial, public, and educational properties, and can range in size from several tens of feet to many acres in total area. In 2006, Broward County and the School Board of Broward County entered into an historical partnership agreement to NatureScape certify all school properties as an environmental goal. In July 2012, for its comprehensive approach to environmental education and the creation and use of outdoor learning spaces through a partnership with Broward County's NatureScape program, the Broward County School District is the first in the country to be certified by the National Wildlife Federation.

**Trends:** The total number of NatureScape certified sites reached 3,249 in 2012. The number of certified NatureScapes in Broward County has steadily increased since program inception. To date, 124 school properties (both public and private) have been certified as NatureScapes, with 37 of those relandscaped under the 2006 School Board Agreement.

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

#### **GREATER FT. LAUDERDALE FLYWAYS CITIES COALITION**

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

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

The two major goals of the Flyway Cities Coalitions are:

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



of migratory and resident wildlife.

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

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

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

**Trends:** Population growth and urban development present challenges in the preservation of natural areas and wildlife habitat. The effects of global climate change are expected to create additional challenges for resident and migratory wildlife as ecological zones shift and critical habitat is further diminished. Such stressors contribute to the fragmentation of natural ecosystems, isolated populations of plants and animals, and the lack of connectivity of green space and wildlife habitat along critical migratory paths. Through the Flyway Cities Coalition, governments, environmental groups, volunteers, schools, and others are now joining in coordinated efforts to ensure the preservation of wildlife habitat that contributes to healthier communities and is essential in maintaining the continued presence of resident and migratory wildlife. In 2011, NatureScape began a 2 year study to collect local survey data for the National Audubon Habitat Oases for Migratory Songbirds Program. Information collected from this study will be used to identify and promote the plant species used by migratory birds.

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

#### **EDUCATIONAL EVENTS TO REDUCE PEST PROBLEMS**

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

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

- Use of native plants and removal or management of exotic species;
- Targeted use of plants not subject to pest populations;
- Introduction of biological control agents such as predatory insects, including native and non-native species;
- Implementation of integrated pest management practices to reduce the need for pesticides;
- Accurate identification of the problem to determine the correct treatment. Some diseases can be controlled through mechanical or cultural methods rather than pesticides; and
- Education and understanding of beneficial insects and a more natural control of pests and weeds.

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

**Trends:** Audiences for NatureScape programs in fiscal year 2012 included residents and homeowners, licensed landscaping professionals, teachers and students, business groups, civic groups, Master Gardeners in training, and state and county employees.

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

#### **ACTIVE TREE TRIMMER LICENSES**

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

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

**Trends:** There were 396 active Tree Trimmer Licenses at the end of the 2011 as reported by the Permitting, Licensing and Consumer Protection Division.

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

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

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

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

**Trends:** The number of enforcement related actions increased in 2011. This was likely due to the fact there were more tree related complaints received.

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

#### **REPLACEMENT TREES REQUIRED BY LICENSING**

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

the response to the loss of tree canopy.

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

**Trends:** The number of replacement trees required decreased in 2011. This was due to the fact that there were less major construction projects meaning less trees installed.

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

#### **TREES FUNDED FOR PLANTING THRU THE TREE TRUST FUND**

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

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

**Trends:** The number of trees funded by the Tree Trust Fund increased slightly in 2011. This was due to increased funding for a tree giveaway which resulted in a larger number of trees given to homeowners for planting.

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

## **OUR MARINE RESOURCES - REEF RESOURCES**

### **Reef Quality**

#### **PERCENT HEALTHY CORALS**

**Measurement:** Selected areas in each of Broward's three reef terraces are visited annually to determine the percentage of stony corals affected by disease or bleaching. Coral health is reported for ten sites on the first reef, eight sites on the second reef and seven sites on the third reef. Using SCUBA, divers assess a 20 meter x 1.5 meter transect established at each site sequentially along one side of the transect and then the other side with a 0.75m<sup>2</sup> quadrat. All stony corals are censused and those with disease or that show bleaching 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. A 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 equally warranted for Broward's reef communities.

**Trends:** Relative health of stony coral colonies was high for all years with an insignificant decrease in 2003. The percent of healthy colonies at all 25 sites examined decreased slightly from 100% to 97.2% from 2007 to 2008. Due to contract expiration this metric was not recorded

during 2009 but was measured at 99.7% during 2010 and at 99.07% in 2011.

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

#### **NUMBER OF FISH SPECIES OBSERVED ON THE REEF**

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

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

**Trends:** The number of individual fish counted varies from year to year and from reef tract to reef tract and may be dependent on the time of year that the fish counts are conducted. The fish count transects are conducted from September through December or January each year and may vary significantly in species composition and number of individuals throughout this time period showing a possible seasonal trend. Comparison among the reef tracts consistently shows a greater number of individuals and species on both the second and third reef tract compared to the first reef tract. In 2011 1,395 individuals (of 73 species) were counted on the 1<sup>st</sup> reef, 2,959 (87 species) on the 2<sup>nd</sup> reef, and 2,335 (84 species) on the 3<sup>rd</sup> reef.

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

### **Reef Quantity**

#### **PERCENT LIVE CORAL COVERAGE**

**Measurement:** Selected sites on 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 a 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 starting 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 land-based sources of pollution and harmful algae blooms are impacting the reef communities.

**Trends:** Average live coral cover on the first reef and on the second reef decreased slightly but insignificantly during the 2008 survey compared to 2007, while the percent cover on the third reef increased slightly. During the 2011 surveys percent live coral coverage on the 1<sup>st</sup> reef was 5.51 while the percent cover on the 2<sup>nd</sup> and 3<sup>rd</sup> reefs were 1.91 and 2.85 respectively. The higher first reef number reflects the inclusion of 3 first reef sites that have significantly higher than average live coral coverage compared to the average of the either the remaining 1<sup>st</sup> reef sites or all of the other 22 sites combined.

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

## **OCTOCORAL AND SPONGE DENSITY**

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

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

**Trends:** Octocoral and sponge density both increased between 2007 and 2008. Octocoral density (8.42 compared to 7.43) increased slightly in 2011 compared to 2008.

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

## **NUMBER OF FISH SURVEYED ON THE REEF (ABUNDANCE)**

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

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

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

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

## **PRESSURES ON REEF RESOURCES**

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

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

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



both coasts. Also, residents fishing from shore do not have to purchase this license as well as others who qualify under the other types of exemptions to the Florida Saltwater Fishing License. In FY2010, the number of shoreline licenses was included in this count.

**Trends:** Residential licenses in the categories of residential saltwater license and residential shoreline fishing license account for most of the variability in this benchmark over the last three years.

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

### NUMBER OF DAYS WHEN WATER TEMPERATURE WAS NOT OPTIMAL FOR CORALS

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

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

**Trends:** Data collection at 12 sites (see table below) began on July 13<sup>th</sup>, 2000. We report the number of days when the mean daily water temperature for each reef tract was equal to or greater than 29°C or less than 16°C. Non-optimal temps were a result of high temperatures, rather than cold. The outer reef tends to have more moderate temperatures than the nearer shore sites.

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

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

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

NSU Thermographs (HOBO Water Temp Pro, Onset Corporation, Accuracy:  $\pm 0.2^{\circ}\text{C}$  at 0 to  $50^{\circ}\text{C}$  [ $\pm 0.36^{\circ}\text{F}$  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)
BC1	Ft Lauderdale 1st reef	-15	26° 08.872'	-80° 05.758'
BC2	Ft Lauderdale 2nd reef	-40	26° 09.597'	-80° 04.950'
BC3	Ft Lauderdale 3rd reef	-50	26° 09.518'	-80° 04.641'
BCA	Fort Lauderdale ridge complex	-20	26° 08.985'	-80° 05.810'

#### PERCENT OF 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:** Percent of sites was relatively high this year, although not the highest value seen. Reasons for this are unknown.

**Data source:** Annual survey in September and October. 2007 data provided by Nova based on reef mapping sites. Nova Southeastern University Oceanographic Center *Lyngbya* presence/absence survey at Broward County Environmental Protection and Growth Management Department biological monitoring sites:

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

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

**NUMBER OF TIMES SHIP DAMAGE IMPACTED BROWARD'S REEFS**

**Measurement:** The number of groundings or ships anchored outside of the officially designated commercial ship anchorages that have been reported to 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 resulted, until 2008, in numerous ship groundings ships disregarding the anchorage and anchoring outside of its bounds, thus damaging reef resources. Many groundings required intervention by the United States Coast Guard (USCG) for removal and were, therefore, reported to the Florida Fish and Wildlife Conservation Commission (FWCC) or the Department of Environmental Protection (FDEP). Many anchor incidents, in which ships anchor outside of the anchorages, are reported to USCG, 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. The offshore anchorage configuration was changed in 2008 to eliminate the shallow anchorage which should minimize groundings, and no large ship groundings have occurred since that time. Two small vessels, however, grounded or sank on Broward's nearshore hardbottom causing damage to biota and substrate.

**Trends:** No vessel groundings were reported during this period. Many incidents of anchoring on reef outside of anchorage likely occur that aren't reported.

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

### **ACRES OF REEF DIRECTLY PHYSICALLY IMPACTED BY COASTAL CONSTRUCTION ACTIVITIES**

**Measurement:** The acreage of reefs directly impacted by coastal construction-related activities, including mitigation and habit creation for other reasons.

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

**Trends:** Trends are episodic due to the occurrence of coastal construction projects or vessel impacts. Groundings have resulted in a net impact because no mitigation has been completed for any event. No coastal construction projects were carried out or groundings reported in 2012.

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

### **CUMULATIVE ACRES OF REEF IMPACTED BY DESTRUCTIVE ACTIVITIES**

**Measurement:** The acreage of reefs directly impacted by coastal construction-related activities, including mitigation and habitat creation for other reasons.

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

**Trends:** Trends are episodic due to the occurrence of coastal construction projects or vessel impacts. No coastal construction projects were carried out nor groundings reported in 2012.

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

## **RESPONSES TO PRESSURES ON REEF RESOURCES**

### **MARINE PROTECTED AREAS (MPAs)**

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

**Explanation:** MPAs are used as a management tools to protect, maintain, or restore natural and cultural resources in coastal and marine waters. As used herein, MPA is defined to mean an area of coastal shelf designated as permanently closed to all fishing and other extractive uses with

limited exceptions for research. They have been used effectively both nationally and internationally to conserve biodiversity, manage natural resources, protect endangered species, reduce user conflicts, provide educational and research opportunities, and enhance commercial and recreational activities. In 2001, an area of 566km<sup>2</sup> in the Dry Tortugas, Florida, was designated as a no-take marine reserve. Subsequent monitoring of this area showed that the number of fish species remained stable in the first 4 years after formation. The abundance of several exploited and non-exploited species increased, and there was a shift to more, larger individuals of exploited species (Ault et al 2006). Preliminary results of monitoring the Dry Tortugas reserve in 2008 indicate that stocks have slowly begun to recuperate since the implementation of no-take status. In particular, there were improvements in numbers of snapper, grouper, and coral recruits (Ault, personal comm.). Preliminary evidence found by Burton et al (2005) indicated that spawning aggregations of mutton snapper were reforming at Riley's Hump in the protected Dry Tortugas and a spawning aggregation was observed by staff from Florida Wildlife Research Institute at the Dry Tortugas in 2009.

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

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Kenneth Banks, Ph.D., (954) 519-1207

**References:**

Ault JS, Smith SG, Bohnsack JA, Luo J, Harper DE, McClellan DB, 2006. Building sustainable fisheries in Florida's coral reef ecosystem: positive signs in the Dry Tortugas. *Bulletin of Marine Science*, 78(3): 633-654.

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

**COASTAL WATER QUALITY MONITORING - TOTAL NITROGEN, ug/l AND CHLOROPHYLL mg/l**

**Measurement:** Four coastal water quality sample stations were established in December 2005. Samples are collected at the three offshore sites and the Port Everglades sites on a monthly basis, weather permitting. The average annual total nitrogen and chlorophyll concentration is presented for the offshore sites and Port Everglades.

**Explanation:** 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. The reef system along the southeast coast of Florida is ecologically dynamic and economically important. The reefs provide habitat for a diverse biological community, attract tourism and support substantial commercial and recreational fisheries estimated in 2001 to generate \$2.1 billion in revenue in Broward (<http://www.broward.org/EnvironmentAndGrowth/EnvironmentalProgramsResources/Publications/Documents/SocioeconomicStudy2001.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, especially nitrogen, 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. The study area centered around Port Everglades inlet as a potential conduit through which land based sources of pollution are entering the coastal ocean.

**Trends:** As of the 2010, these four sites have been sampled 42 times. Assessment of data suggests surface water exiting through Port Everglades Inlet, has higher nutrient concentrations compared to offshore stations. In 2010, the average TN concentration in waters exiting the Port was 268 ± 98 compared to 180 ± 61 ug/l in offshore surface waters. While there is a strong seasonal component to the data and high inter-annual variability but this appears to be a consistent trend over time. Chlorophyll a follows a similar pattern. Chlorophyll concentrations were 2 to 3 times higher in Port Everglades Inlet compared to surface water offshore values, 1.69 mg/l and 0.57 mg/l respectively in 2010. Data from this project is presently being used by the Florida Department of Environmental Protection to help develop numeric nutrient criteria for Florida's



coastal ocean. Monitoring up to twelve times per year at these sites will continue.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Pollution Prevention Remediation and Air Quality Division, Nancy Craig PhD, (954) 519-1411

#### **ALGAL BLOOM MONITORING EFFORTS**

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

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

**Trends:** The biological monitoring agreement with Nova Southeastern University was interrupted during this time period due to amendment negotiations. Therefore, no data is available.

**Data source:** Annual survey in September and October. Nova Southeastern University Oceanographic Center *Lyngbya* presence/absence survey at Broward County Environmental Protection and Growth Management Department's 25 biological monitoring sites in 2005 and 2006. 2007 data provided by Maureen Trnka of NSU is a study of spatial distribution of cyanobacterial cover. Natural Resources Planning and Management Division, Kenneth Banks, Ph.D., (954) 519-1207

#### **CONSTRUCTED HABITAT: ACRES OF BOULDER AND MODULAR REEFS, NUMBER OF SHIPWRECK REEFS**

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

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

**Trends:** No artificial reefs were deployed in this time period.

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

#### **ACRES OF REEF MITIGATION FOR COASTAL CONSTRUCTION ACTIVITIES**

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

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

**Trends:** The construction of mitigative artificial reefs is episodic depending on incidents, such as vessel groundings, or the issuance of coastal construction permits for projects, such as dredging, natural gas pipeline construction, or fiber optic cable installation. No mitigation projects were completed in this time period.

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

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

**Measurement:** This measure tracks the pounds of debris and trash removed from the reefs and beaches during the Ocean Watch Foundation's 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:** The Ocean Watch Foundation closed its office in 2009. Since then, the annual Reef Sweep event has not occurred. In 2010 The Southeast Florida Coral Reef Initiative (SEFCRI) established the Southeast Florida Marine Debris Reporting and Removal Program. This program encourages local divers to report marine debris and organize reef cleanup dives to remove the debris from the reef. To report marine debris call the SEAFAN hotline at 1-866-770-SEFL (7335), or complete the online SEAFAN Marine Incident Report form at

<http://www.dep.state.fl.us/coastal/programs/coral/debris1.htm>.

**Trends:** The amount of debris collected and the number of volunteers that participated in Reef Sweep varied each year. On average, the cleanup removed 5000 pounds of debris from the reef annually. From 2004 through 2008, it appeared that the amount of trash collected each year decreased. In July 2012, the Florida Department of Environmental Protection Coral Reef Conservation Program (FDEP CRCP) and the Southeast Florida Coral Reef Initiative (SEFCRI) conducted the 2<sup>nd</sup> Annual Southeast Florida Reef Cleanup. In Broward County 2 dive operators, American Dream Dive Charters and South Florida Diving Headquarters participated in this event. During 2 dives 16 volunteers removed 129 pounds of trash from the reef. This pilot project was conducted to encourage SCUBA divers to remove debris from the reef on every dive they make and to develop a framework to conduct larger annual reef cleanup events in the future.

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

#### **NUMBER OF MOORING BUOYS**

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

**Explanation:** Coral reefs and their associated benthic communities are an important natural resource for the fishing and diving industries. The mooring buoys were installed to reduce the impacts associated with anchoring of boats on the reefs. One hundred twenty-two buoy installations are available to boaters when visiting the reef. For information on the location and proper use of the buoy network, please go to <http://www.broward.org/NaturalResources/BeachAndMarine/Pages/Default.aspx>.

**Trends:** Broward Country continues to fund and manage a mooring buoy maintenance program. Each month a commercial diving firm inspects and maintains the buoys. The annual maintenance contract costs \$59,784 and is renewable through December 2, 2013.

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

#### **NUMBER OF TIRES REMOVED FROM THE REEF ZONE**

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

**Explanation:** An artificial reef made of one to two million tires was built in the 1970s and early 1980s off the coast of Broward County. Instability of the tires during storms resulted in substantial damage to adjacent natural reefs. A small tire retrieval program (1600 tires) was conducted by researcher at NOVA Southeastern University in 2001 using a grant from the National Oceanic and Atmospheric Administration (NOAA). More recently, a joint project to remove these tires has been initiated among the US military, Florida Department of Environmental

Protection and Broward County Environmental Protection and Growth Management Department. In the summer of 2006, 30 sample tires were retrieved to various issues with removal, transportation and disposal. Military salvage divers worked for 3 weeks in June 2007 to develop the most effective means of removing these tires removing over 10,000 tires. The removal project began in earnest in 2008 with the removal of approximately 45,000 tires. The project was shortened in 2009 because of re-prioritization of military equipment. 15,000 tires were removed in 2009 for a cumulative 60,000 tires removed.

*Trends:* No tires were removed in this time frame due to unavailability of military dive personnel.

*Data source:* Calendar year data. Natural Resources Planning and Management Division, Kenneth Banks, Ph.D., (954) 519-1207

## OUR MARINE RESOURCES - BEACH RESOURCES

### Beach Quality

#### PERCENT OF BEACH WATER QUALITY RESULTS RATED "GOOD"

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

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

*Trends:* Over the past four years the percentage of satisfactory/good beach water samples is averaging 98.65% with a range from 98.2% to 99.4%. This year's result, 99.4%, is 0.75% above the four year average. There were 1545 samples taken with 9 samples indicating poor water quality.

*Data source:* State fiscal year data. Broward County Health Department and Florida Department of Health, Anthony Vomero (954) 467-5932

### Beach Quantity

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

#### PERCENT OF NON-CRITICALLY-ERODED BEACHES

*Measurement:* This is a measure of the ability of Broward County's beaches to provide storm protection and recreational beach area. Critically-eroded beaches are those beaches where the width at high tide is deemed inadequate to provide storm wave damage protection and/or acceptable recreational opportunities. For the purposes of this survey, the threshold width which defines a critically-eroded beach is 75 feet. This definition is different from that used by the State of Florida in determining critically-eroded beaches. Florida Department of Environmental Protection survey monuments are used for beach measurement locations. These monuments are sometimes located in roads or yards, or on sidewalks or seawalls, but for comparison purposes "beach width" includes the width of the sandy or vegetated beach. 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 three critical functions: to provide storm wave protection for upland property, structures, and

infrastructure, to serve as habitat for many species of plants and animals, 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 width 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 at the 128 shorefront reference monument (established by the State of Florida) inclusive of the vegetated and sandy beach. More information about the Broward County Beach Management Program may be found at <http://www.broward.org/bio/beaches.htm>.

**Trends:** The long-term trend in beach adequacy is typically downward over the years because of chronic beach erosion; however for 2011 time period average beach width remained stable, due primarily to small beach renourishment projects in Deerfield Beach/Hillsboro Beach and Hollywood, although in late 2012 a decrease in average beach width was observed related to storm events. 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; storms or high wave events, which can move large quantities of sand offshore and alongshore; and an overall deficit of sand in the beach system. Most beaches in Broward County are either stable or erosive. South of Port Everglades, the beaches are sand-starved due to the impoundment of sand by the north jetty of the Port. These beaches are restored periodically by infusions of sand dredged from offshore. Such a project was completed in spring of 2006. Approximately 2 million cubic yards of sand were placed onto the beaches of Hallandale Beach, Hollywood, Dania Beach, and John U. Lloyd Beach State Park (JUL). 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. Since the completion of the 2005-06 project in Hallandale Beach, Hollywood, Dania Beach and John U. Lloyd Beach State Park, those beaches have been narrowing through equilibration of the newly placed fill and due to background erosion rates. A small amount of sand will be placed on the beaches of JUL in 2013 as part of the Port Everglades channel maintenance project. 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 some beaches along the central portion of the segment are too narrow to provide optimum protection or recreational space. Approximately five miles of these Segment II beaches are scheduled for restoration beginning in 2013. The beaches from the Broward/Palm Beach County line to Hillsboro Inlet likewise are stable throughout most of the City of Deerfield Beach to increasingly eroded in southern Deerfield Beach and northern and central Hillsboro Beach. The City of Deerfield Beach's shoreline benefits from a groin field constructed during the 1960's and occasionally from sand bypassing at Boca Raton Inlet, and by sand drifting southward from beach restoration projects at south Boca Raton.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

## PRESSURES ON BEACH RESOURCES

### PRESENCE OF INLETS

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

with erosion and recession on the downdrift (south) side of the channel.

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

**Trends:** Broward County has two stabilized inlets, Hillsboro Inlet and Port Everglades. At Hillsboro Inlet, sand bypassing has been ongoing since the 1950's, mainly to keep the channel clear of sand, but since the material is placed on the downdrift beaches at Pompano Beach, that shoreline benefits for several miles south. Since a beach nourishment project in 1983 restored the beaches of Pompano Beach and Lauderdale-By-The-Sea, the bypassing operation at Hillsboro Inlet has contributed to the stability of those beaches. A renourishment of certain areas of Pompano Beach, Lauderdale-By-The Sea, and Fort Lauderdale is planned for 2013. No sand bypassing operation currently exists at Port Everglades, so the primary mitigative measure to offset the erosion downdrift has been by nourishment of the beaches to the south. A 1.9 million cubic yard beach nourishment project along JUL, Dania Beach, Hollywood, and Hallandale Beach was completed in spring of 2006, along with the construction of several erosion control structures just south of the Port Everglades channel. The County is currently in the engineering/design and permitting stages of constructing a sand bypassing operation at Port Everglades. Pending approval of the concept and the acquisition of project permits, construction is scheduled for 2014. A beach management plan for Segment III, south of Port Everglades Inlet is being developed which will provide a transition from large episodic nourishment events to smaller hot spot projects.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

#### **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 25 miles per hour (22 knots) as the standard, thus falling within the range of force 6 on the Beaufort scale. Monthly wind records were reviewed for Fort Lauderdale-Hollywood International Airport. Days which experienced wind velocities of 23 mph or more were considered to be days when Small Craft Advisories were issued by the National Weather Service.

**Explanation:** High waves are a major cause of sand movement along beaches. The sand moves alongshore in the direction of wave travel, moves offshore, and to a lesser extent, onshore during high wave events. This movement of sand generally results in loss of beach sand, both alongshore and offshore. Small craft advisories are a measure of high wave events, however, since regular records of these advisories apparently are not kept by the National Weather Service, the metric of wind speed of 25 mph or greater was chosen for these benchmarks.

**Trends:** Recent (2006, 2007, 2008, 2010, 2011, and 2012) data appear to point to an increase in the number of days when a small craft advisory is issued, although the data are highly variable. This trend implies a general increase in the frequency of windy (greater than 25 mph) days, and consequent high waves and increased beach erosion.

**Data source:** Calendar year data. National Weather Service (<http://www.nws.noaa.gov/climate/>), Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

#### **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, tourists 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 was seen through 2008 when the number of visitors rose to 10.84 million. In 2009, the number of visitors fell by 2.5% reflecting an equal reduction of both foreign and domestic visitors. These numbers rebounded in recent years with a steady increase in foreign visitors.

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

## OVERDEVELOPMENT

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

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

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

**Data source:** Annual aerial photography by the Broward County Property Appraisers Office. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

## 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, a sizable amount of trash remains that is not disposed of properly. Natural areas are often the final resting place for trash, as it becomes lodged in vegetation. Trash cleanup events, such as the Ocean Conservancy's International Coastal Cleanup sponsored and coordinated locally by Broward County, assist in gathering the remaining trash and specifically target areas where trash collection is infrequent. Cleanup events also serve as superb public awareness campaigns whereby residents are educated on the problems trash cause to the environment.

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

**Trends:** Data are not available on the amount of trash regularly deposited or collected from our beaches by Broward County or local municipalities, however, the International Coastal Cleanup trash/volunteer statistics can serve as a metric for the amount of trash on Broward beaches at a specific point (3<sup>rd</sup> Saturday in September) during each year. Ocean conditions prior to the event can also have a great influence. Rough wave conditions in 2004 may have delivered more debris to the beach. Additionally, weight of debris collected in 2004 (4855 lbs.) was increased due to collection of fishing lead around Anglin's Pier in Lauderdale-by-the-Sea. During the 2005 Coastal Cleanup event, 4575 lbs. of trash was collected by 2506 volunteers. The 2006 Coastal Cleanup suffered from a lack of promotional materials normally supplied by Ocean Conservancy resulting in a diminished turnout of 1091 volunteers. However, these volunteers collected 4021 lbs. of trash without the addition of an underwater site. This amount was nearly equivalent to 2005, yielding a much higher trash/volunteer ratio. The Cleanup in 2007 took place at 13 sites along the coast and resulted in 4503 lbs. of trash being removed by 1420 volunteers. Due to logistical issues, a site was removed for the 2008 Cleanup and 4465 lbs. of trash were collected by 1308 volunteers at the 12 remaining sites. During 2009, 2385 volunteers removed 7383 lbs. of trash. The increase in pounds of trash collected that year may indicate 1) more trash is along the shoreline than previously thought, 2) the normal trash collection procedures are inadequate, 3) other circumstance(s) may have resulted in more trash available for removal, or 4) a combination of the previous 3 scenarios. In 2010, volunteer turnout was lower (1694) than the previous year, probably due to inclement weather the morning of the event, although the amount of trash collected (4697 lbs.) was consistent with most previous years. 2001 saw a resurgence in the number of volunteers (2344) without an increase in the amount of trash collected (4545 lbs.); however 2012 experienced similar weather as 2010, but 2458 volunteers participated and collected 7171 lbs. of trash. The amount of trash collected in 2012 may have been influenced by Tropical Storm Isaac which passed over the south Florida area a few weeks before the event.

Additional information can be found on Broward County's Coastal Cleanup web page at:

<http://www.broward.org/NaturalResources/BeachAndMarine/Pages/BeachCleanup.aspx> and the Ocean Conservancy's International Coastal Cleanup web page at [http://www.oceanconservancy.org/site/PageServer?pagename=press\\_icc](http://www.oceanconservancy.org/site/PageServer?pagename=press_icc).

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

## RESPONSES TO PRESSURES ON BEACH RESOURCES

### SAND BYPASS

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

**Explanation:** Sand bypassing is one of a suite of sand management strategies useful for employing 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 annually moves approximately 100,000 cubic yards of sand from the inlet channel and deposition basin to the beach at the City of Pompano Beach. There is no such operation at Port Everglades, where an annual average of approximately 40,000 to 60,000 cubic yards of sand per year is deposited on the beaches of Fort Lauderdale and into the port channel. Broward County is currently in the

engineering, design, and permitting stages of construction of a sand bypassing operation at Port Everglades. The operation will consist of excavation of a sand deposition basin at the north jetty of Port Everglades entrance channel, removal of the shoreward portion of the spoil shoal north of the channel, and ancillary structures to protect infrastructure. Sand bypassing at Port Everglades is expected to move an annual average of 40,000 to 60,000 cubic yards per year to the beaches of John U. Lloyd Beach State Park, where the material could resume its southward journey and ultimately benefit the beaches of Dania Beach, Hollywood, and Hallandale Beach.

**Trends:** The quantity of material bypassed at Hillsboro Inlet increased following the Hillsboro Inlet's purchase of a larger dredge in 1984. In 2002, the channel at Hillsboro Inlet was deepened and widened to increase boater safety. One outcome of the project was a change in the bypassing frequency which also correlates with beach renourishment at Hillsboro Beach. We anticipate that over a period of years, annual average quantities of material bypassed will follow this trend.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

## **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, has historically been 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 protection to upland structures and infrastructure, to provide increased recreational opportunities for residents and visitors, and to restore diminishing dunes and 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 egg burial, and successful sea-finding behavior by emerging hatchlings. Areas of beach that have become critically eroded will result in a measurable increase of the number of unsuccessful emergences of nesting females (false crawls) and an overall reduction in the number of nests deposited. Successful nourishment of these critically eroded beaches replaces nesting habitat with sand that is of similar quality (grain size, percent carbonate, etc.) as the native sand that eroded away.

**Explanation:** In Broward County, ten major beach nourishment projects have been performed since 1970, totaling almost 11 million cubic yards placed. In each case, sand was obtained from offshore of the County and pumped ashore through pipelines. The material was then spread and graded on the beach. The most recent project in 2005 and 2006 placed 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. In addition, the municipalities of Deerfield Beach, Hillsboro Beach, Hollywood, and Fort Lauderdale have in recent years conducted small-scale truck-haul beach nourishment projects to address local "hot spot" erosion areas. These recent nourishments are a good illustration of marine turtle nesting habitat replacement. For example, the Hallandale Beach-Hollywood-Dania Beach-John U. Lloyd Park beaches were restored during the 2005 sea turtle nesting season between May, 2005 and February 2006. In 2004 on Hollywood and Hallandale Beach, there were 76 nests and 191 false crawls surveyed on that beach. During the 2005 marine turtle season (ongoing construction of the beach) there were 110 nests and 154 false crawls surveyed. The increase in nests and decrease in false crawls is attributed, in part, to augmentation of available nesting habitat. The 2006 nesting season resulted in 97 nests and 184 false crawls. This decrease in nests and increase in false crawls as compared to the previous year may be cyclical or may be due to equilibration and scarping of the newly placed beach fill. In 2008, 115 nests were laid and 186 false crawls were noted, and in 2009, 117 nests were laid and 138 false crawls were surveyed.

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

2013 Segment II beach nourishment project is proposed to use an upland source of sand.

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231 and Louis Fisher, (954) 519-1255

### **MONITORING THE CONDITION OF THE BEACH**

**Narrative:** Monitoring the condition of the beach is essential to acquire an understanding of how the beach behaves over the long term. Some beaches appear to be eroding or accreting, but longer-term monitoring can 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 and remote sensing techniques. Comparing periodic surveys can illustrate the long-term prognosis for a stretch of beach.

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

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

**Data source:** Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231

### **REGULATORY COMMENT ON BEACH RESOURCES**

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

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

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

**Data source:** FDEP, Bureau of Beaches and Coastal Systems (<http://www.dep.state.fl.us/beaches/>), Broward County Environmental Protection and

Growth Management Department, Natural Resources Planning and Management Division, Eric Myers, (954) 519-1231 and Louis Fisher, (954) 519-1255

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

**Measurement:** The pounds/participant/event is a measure of the quantity of litter collected per person during annual coastal cleanup campaigns. The Ocean Conservancy (formerly the Center for Marine Conservation), a nonprofit organization committed to protecting ocean environments, sponsors the International Coastal Cleanup annually on the third Saturday of September. There are currently 12 beach cleanup locations along the 24 miles of Broward County shoreline. The information gathered provides a snapshot in time of the types of debris being found on beaches and waterways around the world. The Ocean Conservancy then tailors their education campaigns to address reducing the most abundant types of litter found in each region.

**Explanation:** This is a measure of the effectiveness and public involvement in litter cleanup campaigns within the County. In the past, inclement weather (e.g. morning thunderstorms or an approaching tropical storm) had impeded the participation and efforts of volunteers 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. Additionally, in 2004, the Coastal Cleanup included one underwater site located at the base of a fishing pier. This site significantly increased the annual pounds collected per event per volunteer due to the removal of lead weights found near the pier.

**Trends:** Total weight of debris collected can vary during different years for various reasons. Ocean conditions prior to the event can have a great influence with rough wave conditions delivering more debris to the beach. Additionally, weight of debris collected can be increased due to changes in locations such as fishing piers along the coastline. The amount of debris collected per volunteer per event from 2004 through the 2008 event was 3.5 lbs. Although 2004 had the lowest volunteer turnout, the Cleanup had the greatest amount/volunteer of debris collected of 5.6 lbs. due to lost/discarded fishing lead collected at an underwater site around a pier. 2004 was the only year with an underwater site. The 2005 Cleanup had the highest number of volunteers (2506), but the lowest amount/volunteer of debris collected (1.8 lbs.). The 2006 Coastal Cleanup suffered from a lack of advertising material normally supplied by the Ocean Conservancy, which may have resulted in fewer volunteers coming to the event and collecting less debris, although the amount of debris collected/volunteer was above the average at 3.7 lbs. The 2007 and 2008 Coastal Cleanups had more wide-spread advertising than the previous years and targeted high school environmental groups along with Girl Scout and Boy Scout Troops. This appears to have resulted in a more consistent number of volunteers and amount of debris collected/volunteer of 3.3 lbs. The increase in volunteers for 2009 is most likely due to increased awareness of the Cleanup event by the local schools, and with the exception of 2010, the number of volunteers since 2009 appears to be relatively consistent. Many school ecology clubs are attending the same sites each year and high school age volunteers use the Cleanup as an opportunity to earn community service hours. Even with the additional volunteers, the amount of trash per volunteer remained consistent with most previous years. The two exceptions (2009 and 2012) showed an average increase of 2397 lbs. over previous years, but more data would be needed to determine the cause or identify trends.

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

### **OUR MARINE RESOURCES - MARINE WILDLIFE - SEA TURTLES**

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

**Measurement:** Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March 1 through October 31. We record the number of nests deposited and the Global Positioning System location of each. Those nests found at sites not amenable to successful hatchling entry into the surf are relocated to adjacent sections of beach where the ordinances designed to provide light management and



thereby darker beaches are in effect and successfully enforced. Open-beach hatcheries and chain-link hatcheries are no longer allowed by permit and are not in use.

**Explanation:** The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to Environmental Protection and Growth Management Department for beach renourishment projects. The goal of the program is to reduce the number of sea turtle nests that require relocation and maximize the survivability of nests left on the beach. We conduct the Conservation Program during non-renourishment years to allow for continuity of collection and analysis of data. The number of sea turtle nests requiring relocation in the year 2012 continued to decrease due to the enactment of sea turtle lighting ordinances in the Cities of Pompano Beach, Deerfield Beach, Lauderdale-By-The-Sea, Fort Lauderdale, Hallandale Beach, Hillsboro Beach, and Dania 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 surveyed increases by 48% from 2392 nests in 2011 to 3539 nests in 2012. The percent of nests left in-situ increased again from 2011 to 2012 (90.9% to 95.6%).

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

#### PERCENT OF SEA TURTLE NESTING SUCCESS

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

**Explanation:** Increases or decreases of the nesting success percent from year to year may be used as an indicator of the level of disturbance to nesting females on a particular stretch of beach. The nesting success in the following survey regions was calculated for 2012. In Fort Lauderdale, the NS is 51.9%. In Pompano Beach and Lauderdale-by-the-Sea, the average is 46.6%. In Hollywood and Hallandale Beach, the average is 40.4%, while in Hillsboro and Deerfield Beaches the average is 50.2%. The average nesting success countywide in 2012 was 49.3%.

**Trends:** As long as the nesting habitat remains suitable in terms of an appropriate amount of nesting beach, we can expect that the nesting success percent will remain between 45-55%, on average. If the habitat is reduced (the beach erodes) then the number of false crawls will increase and the nesting success percent will decrease. Overall, average nesting success increased from 48.0% in 2011 to 49.3% in 2012.

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

### MARINE RESOURCES - MARINE WILDLIFE - MANATEES

#### FLORIDA WEST INDIAN MANATEE POPULATION

**Measurement:** Manatees are counted statewide to determine manatee distribution, abundance and use of habitat. The Environmental Protection and Growth Management Department participates in a statewide interagency team conducting winter aerial surveys during the months of December through March. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute coordinates these surveys. 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. Counts from Broward sites are shown with total Florida count.

**Explanation:** The manatee is an endangered species whose existence is threatened by several human activities. The goal of the state and federal

government is to increase the manatee population to a point where the U.S. Fish and Wildlife Service "Multi-Species Recovery Plan for South Florida" reclassifies them as "threatened" and eventually removes them from the endangered species list. The annual statewide count is important in identifying population trends. The Florida Fish and Wildlife Conservation Commission (FWC) did not conduct the annual statewide manatee synoptic survey in the winter of 2008, due to much warmer than average weather.

**Trends:** Aerial surveys are not an accurate representation of the Florida West Indian manatee population and statewide numbers obtained through aerial surveys reflect the transient nature of manatees. Although, during periods of cold weather, manatees congregate in warm water refuges (e.g. natural springs and power plant effluents), these surveys are affected by water clarity and weather conditions which may facilitate or obstruct surveys success. As a result, counts vary by hundreds between surveys, but may be used to demonstrate large scale trends in the population. Due to warmer than average weather, the annual statewide manatee synoptic survey was not conducted in 2008 while the 2009 count was nearly 1000 manatees greater than 2007. Additionally, the synoptic survey is used to determine manatee distribution state-wide, but it is not necessarily an indication of manatee use in Broward County. During the week of the 2009 synoptic survey, 555 manatees were counting in Broward; however, a survey later in 2009 recorded 927 manatees in the County. Similarly, the synoptic survey for 2010 included 813 animals in Broward, while over 1022 manatees, the highest recorded number in the County at that time, were counted on another survey that year. This may not have indicated an increased use of Broward's waterways by manatees, but rather the results of: 1) standardized surveys implemented as a conservation measure of the Manatee Protection Plan and/or 2) record low temperatures and long periods of cold weather in southeast Florida in general, and Broward County in particular during the winters of 2009 and 2010. Although, due to a mild winter in 2011-2012, no state-wide synoptic survey was conducted, 1192 manatees were counted on one survey flight.

**Data source:** Calendar year data. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute, Information and Education Office (727) 896-8626 and on the web at <http://myfwc.com/research/manatee/projects/population-monitoring/synoptic-surveys/>. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, PhD (954) 519-1218

## PRESSURES ON MARINE WILDLIFE - SEA TURTLES

### BEACHES WITHOUT TURTLE-FRIENDLY LIGHTING

**Narrative:** Although all eight coastal municipalities in Broward County have passed marine turtle-friendly lighting ordinances, most of the beaches within those cities (Deerfield Beach, Pompano Beach, Lauderdale-By-The-Sea, Fort Lauderdale, Dania Beach, Hollywood, Hallandale, and Hillsboro) have not yet complied enough to allow 100% successful, ocean-orientated emergence of hatchling turtles. Progress towards darkening the beaches in most of the County continues, however, and much of the County remains without turtle-friendly lighting conditions as of the nesting and hatching season in 2011. Complete compliance with local lighting ordinances will contribute to continued reduction in the disorientation of adult nesting female turtles. A measure of this might be revealed if the nesting success percent were to increase beyond the average range of 45-55%.

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

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

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

#### **NUMBER OF SEA TURTLE NESTS DESTROYED BY PREDATORS**

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

**Explanation:** Eggs and hatchlings of marine turtle nests are preyed upon by several species here on south Florida's beaches. Predator prevention measures that are employed to reduce the number of nests taken by raccoons (*Procyon lotor*) can include placing mesh cages and/or 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 problem at the state park will be to trap and remove the entire raccoon population from the park through a cooperative effort between Broward County, the Florida Park Service and the US Department of Agriculture Wildlife Services. Additional predators contributing to the take of marine turtle hatchling and eggs include night herons (*Nycticorax nycticorax*), ghosts crabs (*Ocypode quadrata*), foxes (*Vulpes vulpes*), feral dogs and cats, fire ants, and people.

**Trends:** The average number of nests taken by predators in Broward County is 194 each season. The 2012 season revealed only 24 nests taken by predators representing an 82% decrease in predation from 2011 to 2012.

**Data source:** Calendar year data. 2011 Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

#### **OBSTRUCTED NESTING ATTEMPTS**

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

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

**Trends:** This was measured and recorded and reported to the Florida Fish and Wildlife Conservation Commission for the first time during the 2008 nesting season. The 2012 season revealed 247 ONAs representing a 56.3% increase in ONAs from 2011.

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

#### **NUMBER OF SEA TURTLE HATCHLING DISORIENTATION EVENTS**

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

relocated to "darker, safer" beaches. This change in conservation strategy and implementation resulted in 385 disorientation events reported during 2006 and 356 hatchling disorientation events during the 2007 season. Additional enforcement and compliance with required lighting conditions resulted in a significant reduction in the number of disorientation events during the 2008 season. The number of events reported in 2008 was 170, less than half of those reported in 2007. The service of additional volunteers trained to discover, rescue, and release disoriented hatchlings during the 2010 season resulted in a decrease in the number of reported disorientation events from 233 to 138, however this number does not include disorientation events reported by outside volunteers. This outside group reported over 340 events but unfortunately it cannot be determined how many of those reported events were actually duplicate reports of the 138 events reported by Broward County.

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

**Trends:** The trend will be for a significant increase in the number of disorientation events reported in the future because State and Federal agencies (Florida Fish and Wildlife Conservation Commission and United States Fish and Wildlife Service) that issue marine turtle activity permits for the in nesting and hatching season are requiring a substantial reduction in the number of nests relocated because of lighting issues. Because of the increased effort by volunteer hatchling rescuers to find and report disoriented hatchling turtles the trend for increased numbers of hatchling disorientations will likely continue until compliance with lighting ordinances in the coastal areas significantly increases.

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

#### **NUMBER OF JUVENILE AND ADULT SEA TURTLES FOUND INJURED OR DEAD**

**Measurement:** Dead or injured marine turtles, either juvenile or adult, mostly wash up on the beaches here in Broward County. The conservation program operators are charged with responding to each of these events. If the animal is found alive, it is measured, photographed, and transported to a rescue or rehab facility within reasonable driving distance (Miami Seaquarium or the Gumbo Limbo Nature Center in Boca Raton) and all reasonable and humane efforts are used to save the turtle. If the turtle is found dead, then the respondent takes appropriate measurements, records the location of the stranding using Global Positioning Systems (GPS), the possible cause of death if apparent, and whether the turtle is tagged. The discovery of fresh dead green or leatherback turtles is immediately reported to Florida Fish and Wildlife Conservation Commission (FFWCC) and arrangements for deep freeze storage of the turtle are made until it can be transported to the state facilities where a complete necropsy will be conducted. All stranding information in Broward County is submitted to the Florida Sea Turtle Stranding and Salvage Network (FSTSSN).

**Explanation:** The Endangered Species Act requires that an official recovery plan for each threatened and endangered marine turtle species be published and updated on a regular basis. These recovery plans include tracking the fate of dead or injured specimens and determining possible preventative action to reduce the number of stranded marine turtles throughout their range. Here in Broward County, the primary cause of dead or injured adult and juvenile marine turtles is collisions with boat hulls and propellers.

**Trends:** The average number of stranded juvenile and adult marine turtles over the previous five years in Broward County is 62 per calendar year. The number of strandings in 2012 was 62.

**Data source:** Calendar year data. 2012 Broward County Sea Turtle Conservation Program, Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Louis Fisher, (954) 519-1255

## RESPONSES TO PRESSURES ON MARINE WILDLIFE - SEA TURTLES

### PERCENT OF SEA TURTLE NESTS RELOCATED / PERCENT OF SURVEYED NESTS LEFT IN PLACE

**Measurement:** Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March 1 through September 30. 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 or to open-beach hatcheries. Starting in 2006, hatchery use was no longer allowed by FFWCC.

**Explanation:** The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to Environmental Protection and Growth Management Department for beach renourishment projects. The goal of the program is to reduce the number of sea turtle nests that required relocation and maximize the survivability of nests left on the beach in their original egg chambers. We conduct the Conservation Program during non-renourishment years to allow for continuity of data collection and analysis.

**Trends:** in 2005 only 35.8% of the nests were left in-situ. In 2006 this percentage changed to 63% and has steadily increased to 95.6% left in-situ in 2012.

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

## MARINE WILDLIFE - PRESSURES ON MANATEES

### NUMBER OF VESSELS REGISTERED IN BROWARD COUNTY

**Measurement:** This information was obtained for the Florida Department of Highway Safety and Motor Vehicles (HSMV) annual revenue report which is posted annually on the web at [http://www.flhsmv.gov/html/revpub/revpub\\_july08\\_june09.pdf](http://www.flhsmv.gov/html/revpub/revpub_july08_june09.pdf). The DMV provides total number of registered vessels including dealer registrations, pleasure craft and commercial vessels. This information is tracked on the State's fiscal year (e.g. July 1, 2007 through June 30, 2008).

**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 2011, the number of registered vessels continued to decline mainly in the number of registered pleasure vessels. This appears to reflect continued impacts of the economic downturn in the area.

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

### MANATEE MORTALITY IN BROWARD COUNTY

**Measurement:** West Indian manatee mortality statewide is monitored by the Florida Fish and Wildlife Conservation Commission's Marine Research Institute. The number of manatees is compiled across the state annually.

**Explanation:** The manatee is an endangered species whose existence is threatened by several human-related activities including boat and ship impacts, water control structures, habitat reduction, and water pollution. This summary database of individual manatee mortality allows users to search for information by county, cause of death, and date. Manatee deaths are broken down into eight categories based on gross, histological, and microbiological findings.

Descriptions of Manatee Death Categories:

- **Watercraft:** Manatees hit by boats, barges or any type of watercraft. Death may result from propeller wounds, impact, crushing, or any combination of the three.



- Crushed/Drowned in Flood Gate or Canal Lock: Manatees killed by crushing or asphyxiation in flood gates and canal locks.
- Other Human-Related: Manatee deaths caused by vandalism, poaching, entrapment in pipes and culverts, complications due to entanglement in ropes, lines, and nets, or ingestion of fishing gear or debris.
- Perinatal: Manatee less than 150 cm (5 ft.) in total length which were not determined to have died due to human-related causes.
- Cold Stress: Manatees which die as a result of exposure to prolonged cold weather. Animals are usually emaciated and in a general state of malnutrition.
- Other Natural: Manatee deaths resulting from infectious and non-infectious diseases, birth complications, natural accidents, and natural catastrophes (such as red tide poisoning).
- Undetermined: Manatee deaths in which the cause of death could not be determined.

**Trends:** The number of manatee deaths hit a twenty-year peak in 2010 when a cold event caused 8 manatees deaths and the causes of 10 deaths were undetermined (10 deaths) categories. In 2012, the number of deaths has been reduced from the peak but remain higher than the ten year average.

**Data source:** Calendar year data. The Florida Fish and Wildlife Conservation Commission, Marine Research Institute, Information and Education Office (727) 896-8626 and on the web at <http://myfwc.com/research/> under manatees

## NUMBER OF BOAT SLIPS IN BROWARD COUNTY

**Measurement:** The number of boat slips in Broward County was determined through aerial surveys, site inspections, and historical use records. In the Boat Facility Siting Plan (BFSP) element of the Broward County Manatee Protection Plan (MPP), a **slip** is defined as *a space designed for the mooring or storage of a single watercraft, which includes wet or dry slips, anchorage, beached or blocked, hoist, seawall, floating platforms, davits, boat lifts, or the number of parking spaces for boat ramps. Piers, authorized only for fishing or observation, are not considered wet slips.* The BFSP addresses public or private structures or operations where boats are moored and/or launched, including commercial, recreational, private, governmental, residential marinas, and boat ramps. While considered in the cumulative impact analysis for the BFSP, single-family slips are not regulated by this Plan. The only feasible means to enumerate single-family slips was by summing the number of parcels zoned for single-family use. Each single-family parcel adjacent to a navigable waterway is allotted one boat slip per 100 ft. of shoreline. Therefore, the number of single-family slips should remain relatively constant unless parcels are re-zoned for higher resident density. Docks utilized for transitory purposes were also counted as part of the existing slip count. Transitory uses include restaurants, shopping, fuel service, transportation services, parks and tourism.

**Explanation:** Boat slips represent a direct and indirect pressure on Broward County marine resources. Directly, slips impact the shoreline and benthic resources, such as mangrove and seagrass habitat. Slips are also associated with various pollutants including chemicals, fuel, lubricants, and municipal waste that may wind up in County waterways and adversely impact living resources. Indirectly, slips equate to boats, which may impact and kill manatees. The number and siting of boat slips is important to ensuring the sustainability of the federally endangered Florida population of the West Indian Manatee.

**Trends:** Broward County had been under a marine facility licensing moratorium from 2004. However, with the Florida Fish and Wildlife Conservation Commission's approval in 2007 of Broward's BFSP component included in the Manatee Protection Plan (MPP), marine development of commercial and private facilities are again being licensed. The table below shows the existing slips and the approved increase listed in the MPP; a complete breakdown of slips of each type in each zone is presented in the MPP which can be downloaded at <http://www.broward.org/Manatees/Pages/ManateeProtection.aspx>. The main focus for new marina facilities is located in the southern half of the County which entails the South Waterway Zone and the Areas of Special Concern: South Fork of the New River, Dania Cutoff Canal Middle/C-10 Canal, and Dania Cutoff Canal West. Five hundred and thirteen of the 4,392 proposed slips will be reserved for municipal development into public boat facilities. The breakdown of this reserve is: North - 200; Center - 0; South - 248; South Fork New River - 5; Dania Cutoff Canal

BFSP Zone	Existing slips	Proposed slip Increase
North	5,597	1,353
Center	6,381	619
South	10,242	1,033
Port Everglades	2	0
South Fork New River	4,653	471
Dania Cutoff Canal/C-10	3,415	806
Dania Cutoff Canal West	449	110
<b>Total slips</b>	<b>30,739</b>	<b>4,392</b>

While initial predictions of marina development were that the total South Waterway Zone and Areas of Special Concern slip allocations would be licensed within the first year after approval of the MPP, the economic downturn has resulted in little change in the total number of slips.

**Data source:** Calendar year data. Broward County Manatee Protection Plan, November 2007. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, PhD (954) 519-1218

**RESPONSES TO PRESSURES ON MARINE WILDLIFE - MANATEES**

**MANATEE PROTECTION**

**Narrative:** In November 2007, Broward County completed drafting Broward County's Boat Facility Siting Plan (BFSP), which is the third and final element of the Broward County Manatee Protection Plan (MPP). The Boating Safety and Manatee Education and Awareness elements of the Plan were approved by the Broward County Commission in 1992 and were adopted into the Broward County Comprehensive Plan in 2001.

**Explanation:** The Boating Safety element of the Broward County MPP resulted in the installation of numerous speed zones throughout the County. Boater compliance to these zones is high, presumably resulting in decreased watercraft-related manatee mortality. The Manatee Education and Awareness component of the Broward MPP is also in place. Broward County maintains numerous education and awareness efforts alone and in conjunction with other government and non-profit environmental agencies. The efforts include regular distribution of educational materials, public forums, informational kiosks, educator toolboxes, and a manatee webpage on the Broward County website <http://www.broward.org/Manatees/Pages/Default.aspx>.

The BFSP element of the MPP was prepared to meet the requirements of Section 370.12(2)(t), Florida Statutes, which requires the counties identified in the Governor and Cabinet's October 1989 Policy Directive (Broward County was one of the counties identified) to develop Manatee Protection Plans (MPPs) consistent with Florida Fish & Wildlife Conservation Commission (FWC) criteria based upon Attachment K of the directive, and to submit such protection plans for review and approval by the FWC. The statute further states that each MPP include a BFSP as a required element.

The BFSP identifies appropriate dock densities for particular areas of the County while providing protection for State of Florida and federally protected manatees. A series of factors, including both manatee and human uses of waterways, were examined to create a map of proposed dock

densities. This element will be used for boat facility development applications and modifications to existing boat facilities so that watercraft-related impacts to manatees and their habitats are addressed when applications are reviewed.

To offset the potential increased risk to manatees resulting from an increased number of boat slips and a greater number of boats on our waterways the BFSP provides for certain conservation measures. Conservation measures, as established in the element, provide for:

§ One full-time marine law enforcement officer dedicated primarily to the South Fork 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 entails weekly surveys during winter months (mid-November - March) and quarterly surveys during the remainder of the year.

§ Development of an active signage system to let boaters know when high numbers of manatees are near the power plant discharges.

§ Expanded manatee education and awareness efforts.

**Trends:** Traditionally, manatee mortality in Broward County is low relative to other Florida counties. However, the fraction attributed to watercraft-related impacts is high thus deeming Broward one of the 13 key counties required to develop a MPP. This situation has not changed and mortality levels, with the exception of 2006, have remained relatively consistent (2003 = 5, 2004 = 1, 2005 = 2, 2006 = 6, 2007 = 1, 2008 = 3, 2009 = 3, 2010 = 5, and 2011 = 2). From January-March 2006 six watercraft-related mortalities occurred in Broward. This is likely a random spike considering that neither boating activity nor manatee abundance had increased appreciably in Broward County. A longer term trend is necessary to attribute increased mortality to one of these factors. Although five watercraft-related mortalities occurred in 2010, two were early in the year (March-April) with the remaining three late in the year (November-December), essentially two different "manatee seasons" in Broward County. The low mortality with large numbers of manatees present may be due to restricted movement of manatees due to the extended cold periods and possibly less boaters on the waterways for the same reason during that time. Finally, on September 7, 2011 the FWC adopted amendments to the Broward County Manatee Protection Rule extending manatees zones along specific stretches of the Intracoastal Waterway.

**Data source:** Calendar year data. Broward County Environmental Protection and Growth Management Department, Natural Resources Planning and Management Division, Pat Quinn, PhD (954) 519-1218 and Mote Marine Laboratory Boating Traffic and Safety Study 2005, Jay Gorzelany

Recommended citation: Broward County Natural Resources Planning and Management. March 2013. The Broward County Florida, Environmental Benchmarks Report 2012. pp 136.

<http://www.broward.org/EnvironmentAndGrowth/EnvironmentalProgramsResources/Publications/Pages/Publications.aspx>