

BROWARD COUNTY
DEPARTMENT OF PLANNING AND ENVIRONMENTAL PROTECTION

ENVIRONMENTAL BENCHMARKS REPORT

Broward County Board of County Commissioners
October 2000

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I N T R O D U C T I O N

PROGRAM PURPOSE

A benchmark is a standard to judge or measure something. The Department of Planning and Environmental Protection's Environmental Benchmarks Program will strive to judge how the environmental quality of life in Broward County has changed over the years. It will also help measure how changes in natural resource management initiatives today and in the future translate into improvements in the environment. The program is an outgrowth of the County Commission's ***New Vision*** to review efforts to protect the environment and develop a comprehensive environmental strategy.

INDICATORS AND PERFORMANCE MEASURES

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

STATE-PRESSURE-RESPONSE CONCEPT

The example indicator above is useful for tracking the *state* or 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 knowing what are the pressures that influence the resource and how they are changing, the management agency can formulate *responses* to help mitigate adverse impacts on the resource. Continuing with the example, the indicator "number of vehicle miles traveled" would be an example of a pressure indicator; vehicle emissions are one of the most significant sources of air pollution. The management agency might strive to promote the use of mass transit or use of vehicles that run on cleaner fuels such as electricity or propane to mitigate this impact. This leads to response-type performance measures such as "the number of mass transit trips per year" or the "number of alternative-fueled vehicles" in use.

NATURAL RESOURCE CATEGORIES

In its present state of development, the Benchmarks Program concentrates on four primary natural resources; air, water, land and marine resources. For each of these resources, we have identified one or more state, pressure and response indicators. If historical data is available, we will chart it to show trends. For newly-formulated indicators, historical data may not be available. In these cases, we plot first year baseline data and trends will become evident in future reports.

DATA COLLECTION INTERVALS

When available we compile data annually. Some data, however, is not available on an annual basis. This is particularly evident when the data collection process is difficult. For instance, air emissions and domestic sewer service data are only collected in 3-5 year intervals. And the annual figure for population is based on the decennial census.

INDICATOR OVERLAP

Sometimes, an indicator may reflect upon more than one resource. For instance, waste management, tracked as the “tons of solid waste produced per capita,” might affect groundwater quality (through percolation or runoff) and ambient air quality (by odor production). When such overlap occurs, we use the indicator to evaluate the resource that it affects most.

REPORT FORMAT

This year's report differs from last year's primarily in format although we have included some new indicators and performance measures as well. We changed the data presentation format from tables to charts. The graphical presentation makes it easier to see the changes in the indicators over time. You may contact the director of the Environmental Monitoring Division at 519-1241 to obtain the data for any of the charts in this document.

Last year's report addressed the four resources included in this report plus an area termed “Waste Management.” In keeping with the idea of dealing with “resources,” we now group those indicators and performance measures under the resource most directly affected. For instance, the “waste production” indicators (tons/year produced and tons/year combusted), are found under the Air Resources section because odors are among the most common complaints associated with landfills. Similarly, the burning of solid waste at the resource recovery plants can have air quality impacts.

We did not identify state, pressure and response indicators as such in last year's report. The new report format includes a variety of these types of indicators for each of the four resources.

ENDNOTES

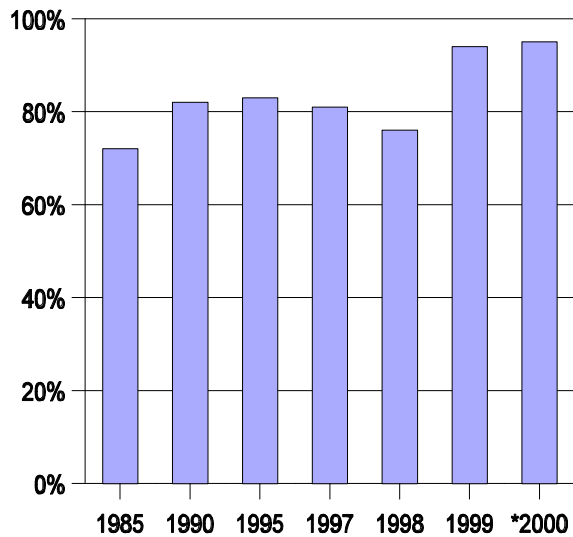
Near the end of the report you will find a section on *Endnotes*. Each indicator has an associated set of endnotes. Each endnote is comprised of three sections: ***explanation***, ***measurement*** and ***data source***. The *explanation* describes the significance of the indicator with respect to how it might impact the resource. The *measurement* provides some detail on how to calculate the specific performance measure. The *data source* provides identification of a contact with telephone number for readers wanting additional information on the performance measure. Identifying the data source will also simplify the update process.

We hope you find the report interesting and informative. The Benchmarks Program is clearly an ongoing process. As time goes on, we may see that some indicators we have selected are less useful than others and we will need to make changes. We solicit your ideas on how we can make the program and report more effective and useful.

STATE OF OUR AIR RESOURCES

Ambient Air Quality

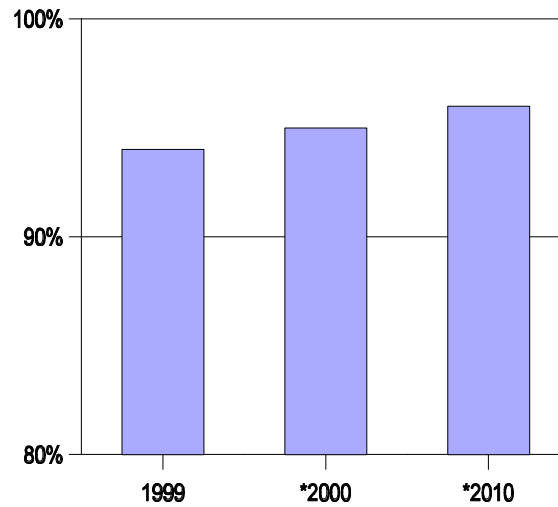
Percentage of days when the outdoor air quality was good, as calculated pre-1999 (Endnotes page 39)



*=Goal

Ambient air quality

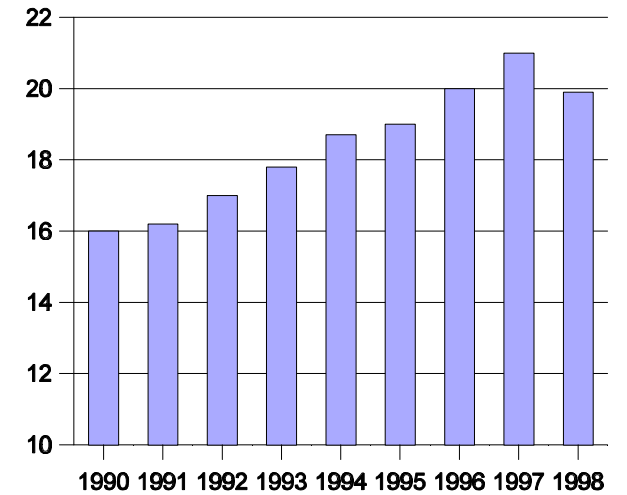
Percentage of days when the outdoor air quality was good, as calculated post-1999 (Endnotes page 39)



*=Goal

Roadway congestion

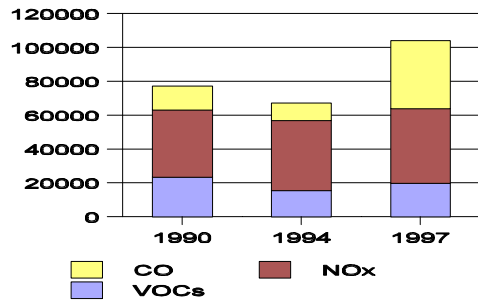
Number of over-capacity roadway segments (Endnotes page 39)



PRESSURES ON AIR RESOURCES

Air Pollutant Emissions

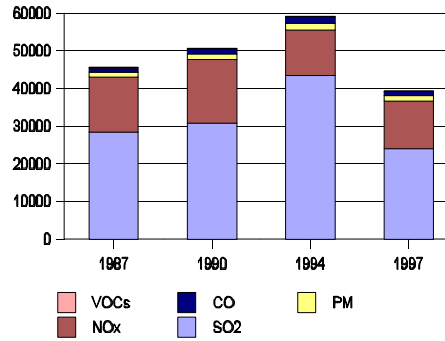
Emissions from stationary sources, other than power plants, tons/yr (Endnotes page 39)



CO=carbon monoxide
NOx=oxides of nitrogen
VOCs=volatile organic compounds

Air Pollutant Emissions

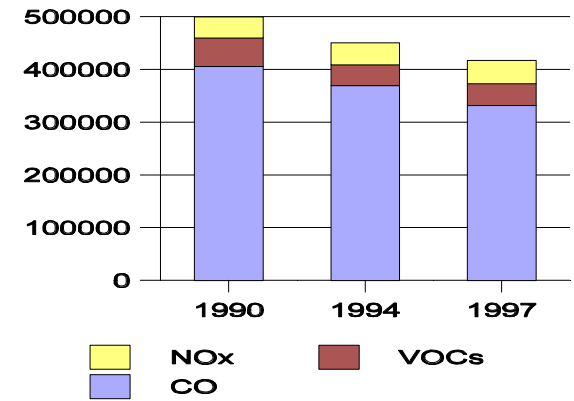
Emissions from power plants, tons/year (Endnotes page 40)



SO2=sulfur dioxide
PM=particulate matter

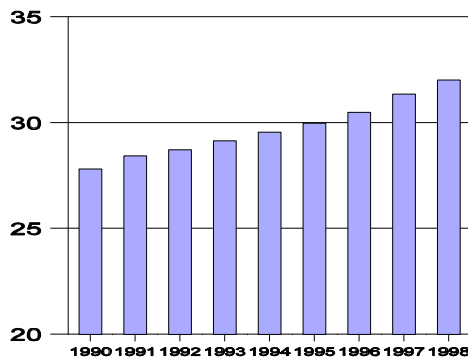
Air Pollutant Emissions

Mobile source emissions, tons/yr (Endnotes page 40)



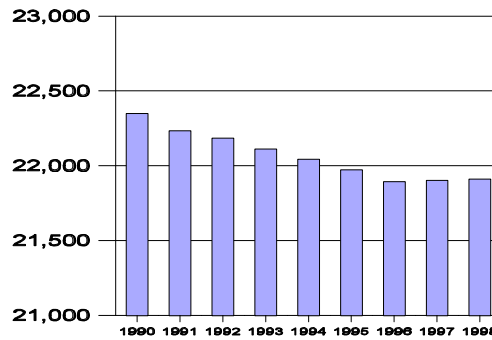
Vehicle Use

Vehicle miles traveled per yr, millions (Endnotes page 41)



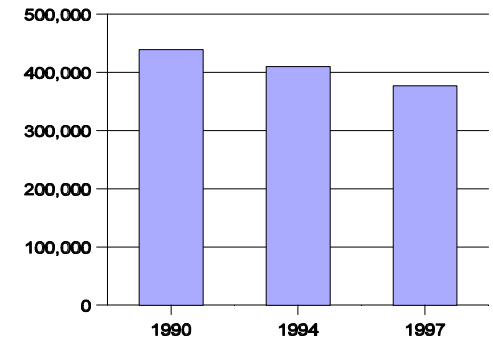
Vehicle use

Vehicle miles traveled/day/1000 people (Endnotes page 41)



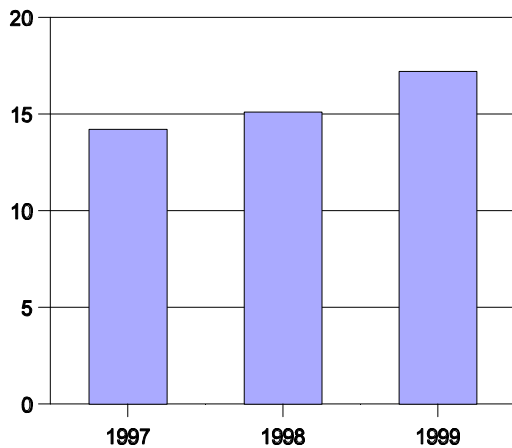
Airport emissions

Number of takeoff/landing cycles/yr (Endnotes page 41)



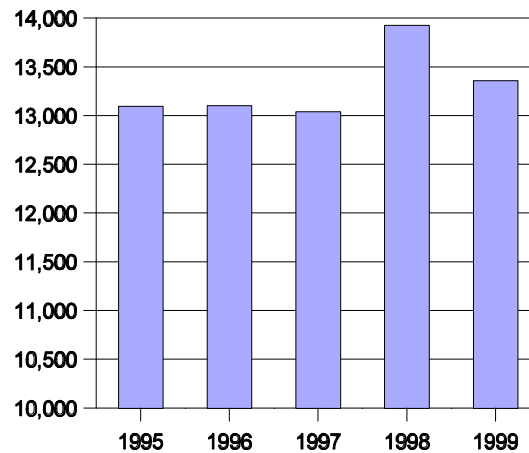
Energy consumption

Total electricity consumption, billions of KWH/yr (Endnotes page 42)



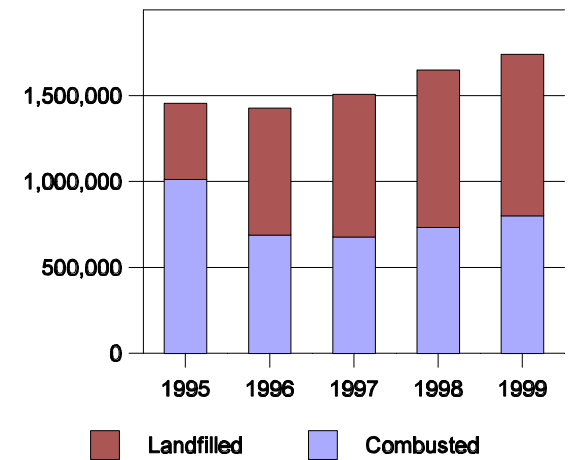
Energy consumption

Per capita electricity consumption, KWH/yr (Endnotes page 42)



Waste management

*Total waste landfilled & combusted, tons/yr (Endnotes page 42)



*See also "Recycling" under Land Resource Responses

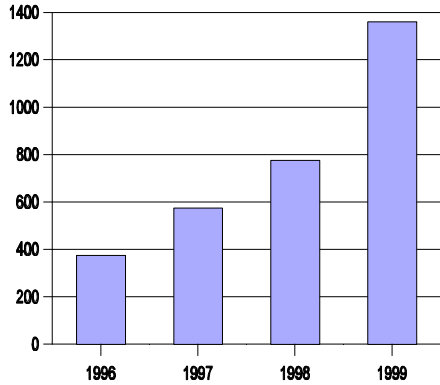
RESPONSES TO AIR RESOURCE PRESSURES

Alternative Fueled Vehicle Use

Air pollutant reductions

Promotion of bicycle use as transport

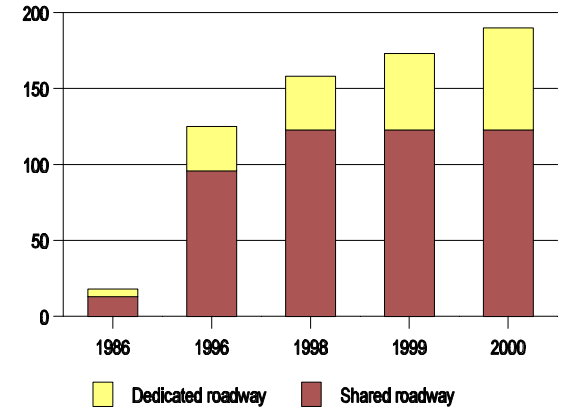
Number of alternative fueled vehicles in government & commercial fleets (Endnotes page 42)



Reduction in emissions of hazardous air pollutants, tons/yr. (Endnotes page 43)

Coming in 2001!

Bicycle-friendly roadways, miles (Endnotes page 43)

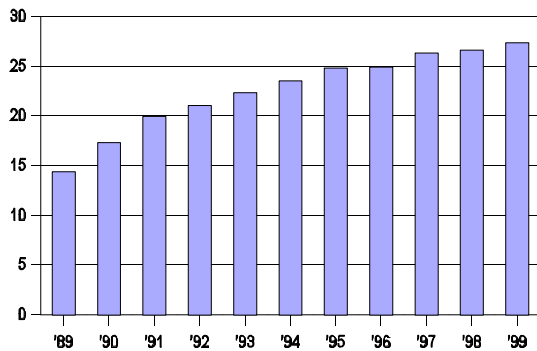


Mass Transit Use

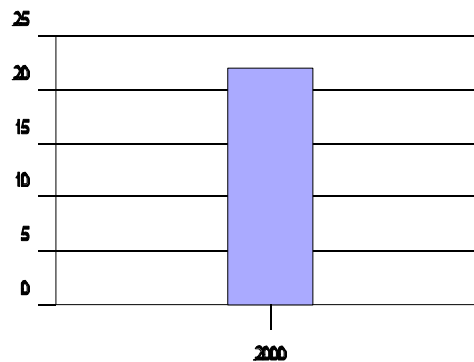
Community Bus Service

Community Bus Service

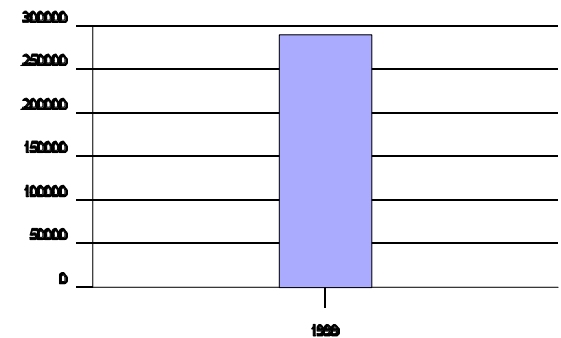
No. of mass transit passenger trips/yr; millions (Endnotes page 44)



Number of community shuttles (Endnotes page 44)

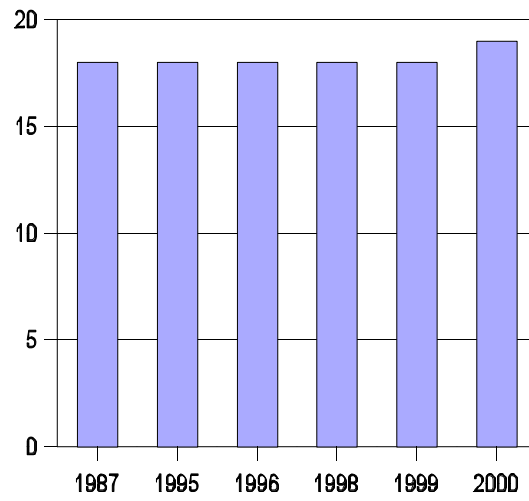


Community shuttle ridership (Endnotes page 44)



Recreational transportation access

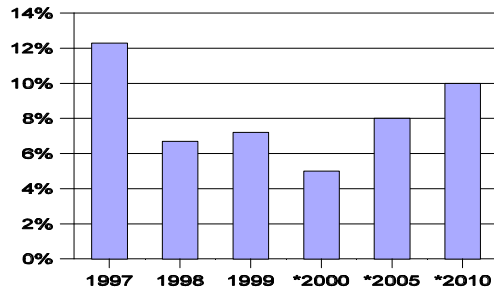
Miles of Greenways (Endnotes page 44)



STATE OF OUR WATER RESOURCES

Surface water quality

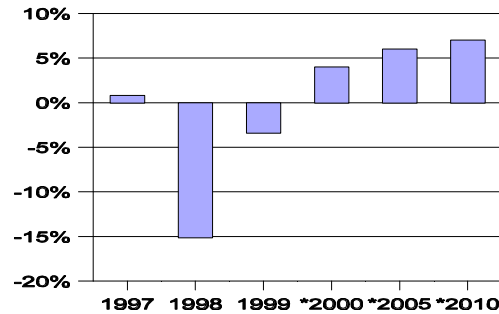
% improvement in fresh water quality in C-13 canal, compared to 1995 baseline (Endnotes page 45)



*=Goal

Surface water quality

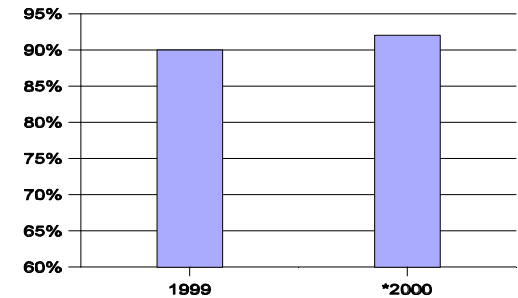
% improvement in marine water quality, C-13 & C-14 canals, compared to 1995 baseline (Endnotes page 45)



*=Goal

Surface water quality

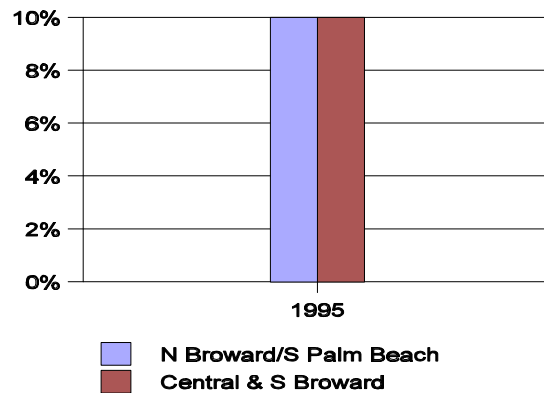
% of beach water quality test results rated as satisfactory (Endnotes page 46)



*=Goal

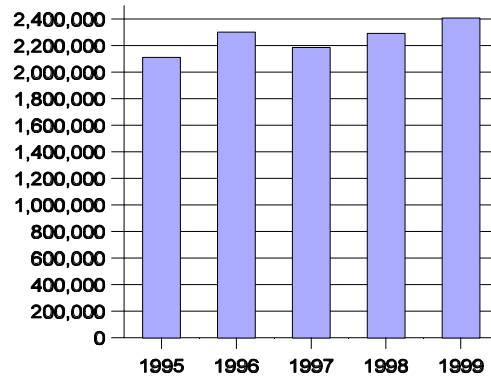
Ground water quantity

% of time under water use restriction, previous 5 yrs. (Endnotes page 46)



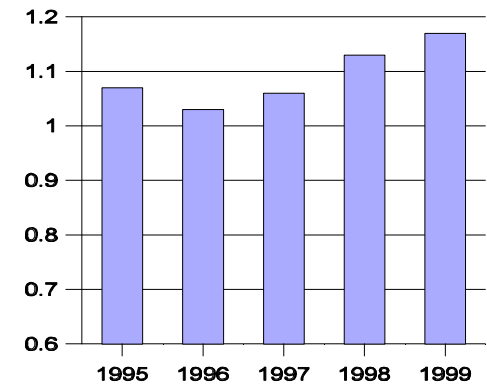
Waste production

Total solid waste produced, tons/yr (Endnotes page 47)



Waste Management

Per capita solid waste produced, tons/yr (Endnotes page 47)



Surface/ground water quality

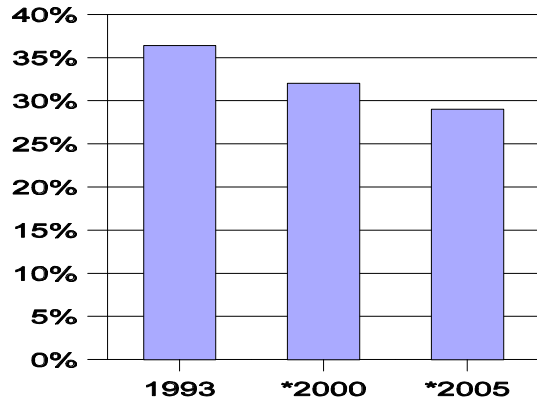
Percent of available waste water
treatment disposal capacity (Endnotes
page 47)

Coming in 2001!

PRESSURES ON WATER RESOURCES

Ground water quality

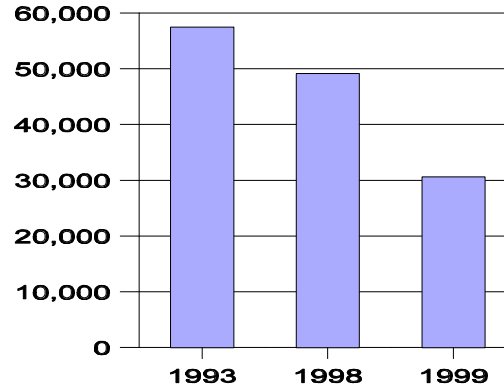
% of county where central domestic sewer service is not available (Endnotes page 47)



*=Goal

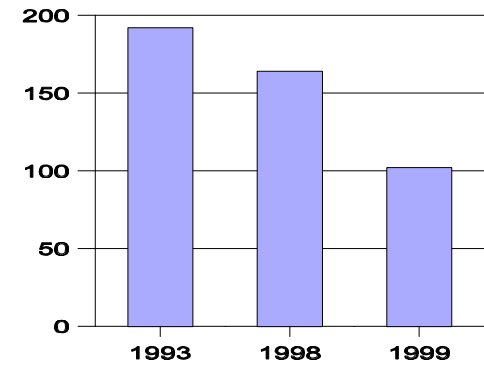
Ground water quality

Net gain/loss in septic system wastewater flow, gallons/day (Endnotes page 48)



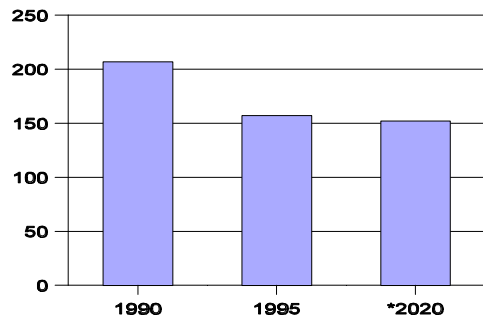
Ground water quality

Net gain/loss in septic system wastewater flow, equivalent residential connections (Endnotes page 48)



Ground water quantity

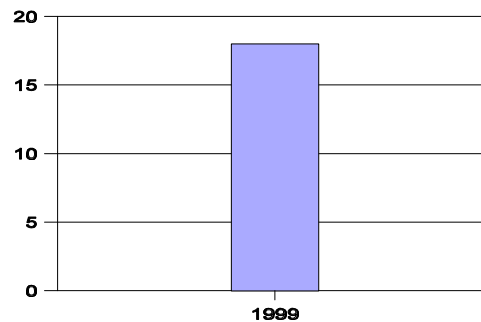
Municipal water consumption, per capita, gallons/day (Endnotes page 48)



*Goal

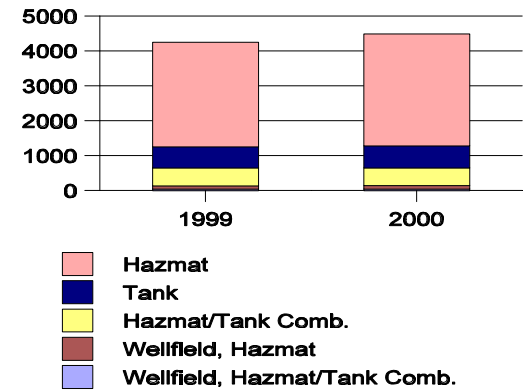
Ground water quality

Cumulative no. of wells lost to salt water intrusion (Endnotes page 48)



Ground water quality

Number of hazmat & storage tank licenses (Endnotes page 49)



Construction Activity

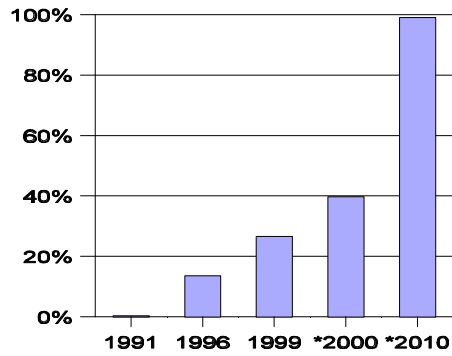
Percent of developed land subject to surface water management (endnotes page 49)

Coming in 2001!

RESPONSES TO WATER RESOURCE PRESSURES

Ground water quality

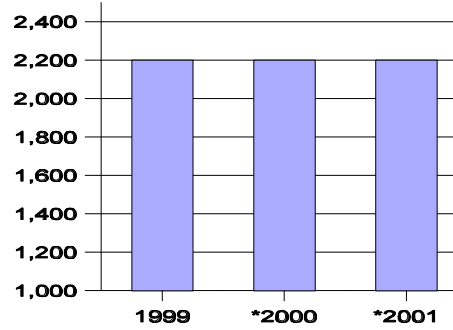
% of contaminated sites cleaned up to state standards (Endnotes page 49)



*=Goal

Pollution prevention

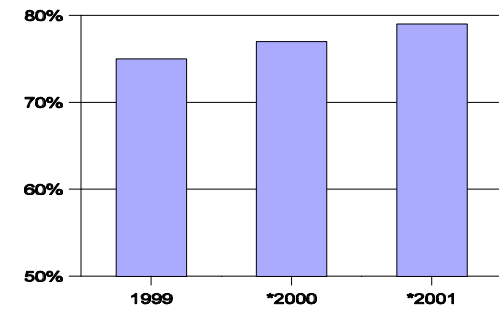
Number of licensed hazardous material facilities inspected/yr (Endnotes page 50)



*=Goal

Pollution Prevention

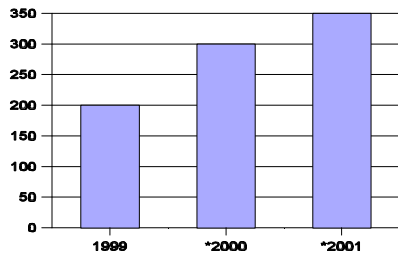
% of licensed hazmat sites inspected & found to be in compliance (Endnotes page 50)



*=Goal

Pollution Prevention

of facilities receiving a direct 1-on-1 pollution prevention initiative (Endnotes page 50)

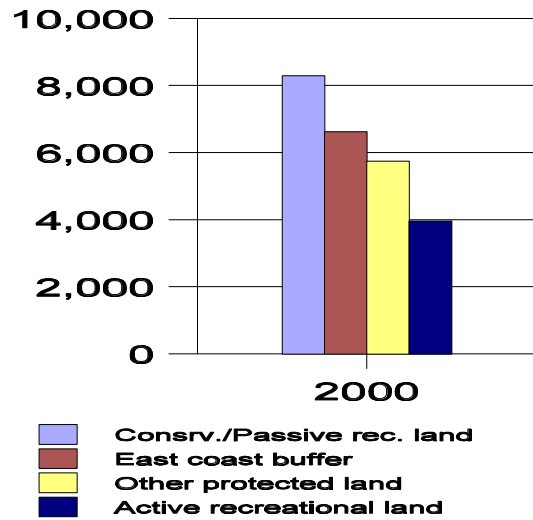


*=Goal

STATE OF OUR LAND RESOURCES

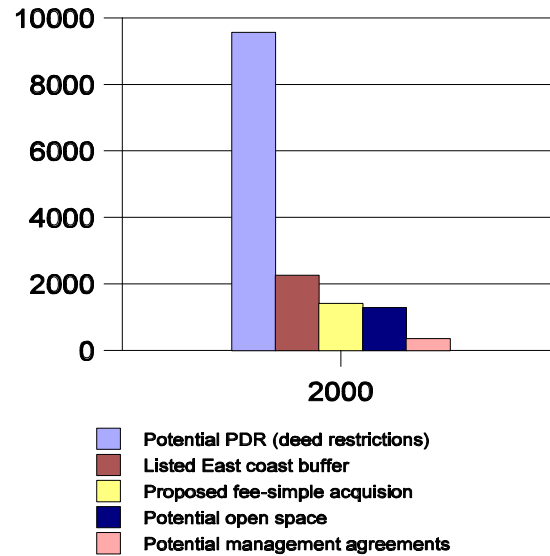
Existing protected land

Protected land, acres (Endnotes page 50)



Unprotected land (developable)

Unprotected (developable) land, acres (Endnotes page 51)



Tree canopy

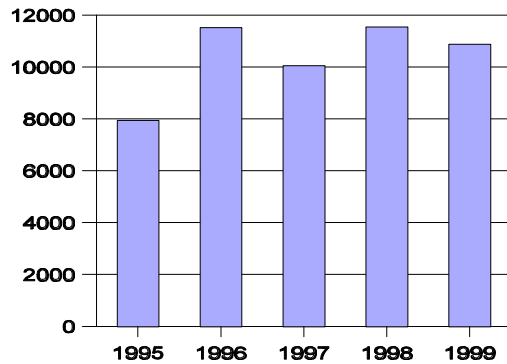
% tree canopy coverage in Broward County, E of conservation areas (Endnotes page 52)

Coming in 2001!

PRESSURES ON LAND RESOURCES

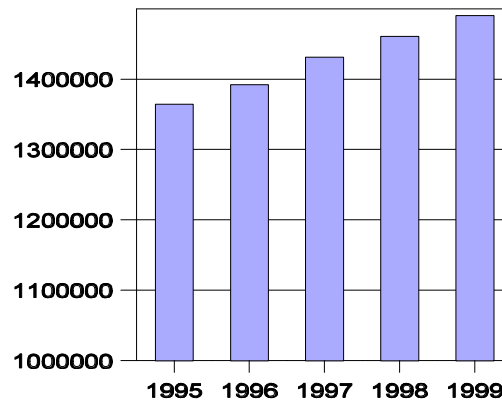
Construction activity

Number of new commercial structure/addition approvals issued (Endnotes page 52)



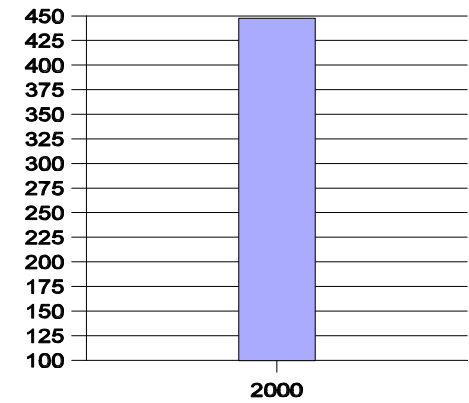
Population growth

Broward County population (Endnotes page 52)



Construction activity

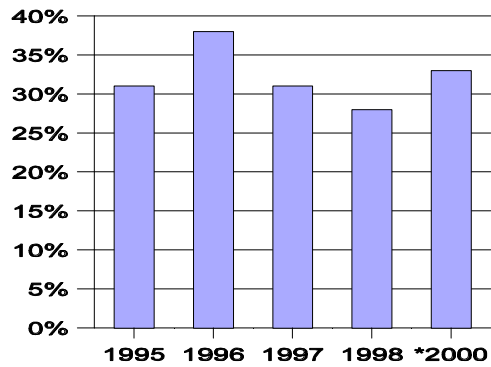
Wetlands impacted by development, acres (Endnotes page 53)



RESPONSES TO LAND RESOURCE PRESSURES

Waste management

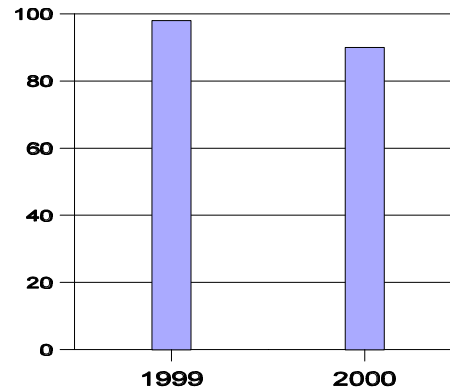
Percent of solid waste recycled
(Endnotes page 53)



*Goal

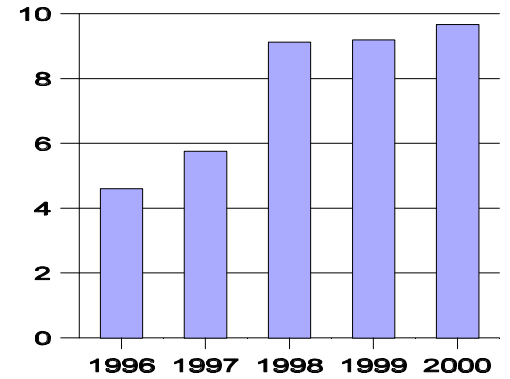
Waste Management

Miles of adopted highway (Endnotes page 53)



Waste Management

Litter cleanup campaigns, shoreline litter collected, lbs/event/volunteer
(Endnotes page 53)



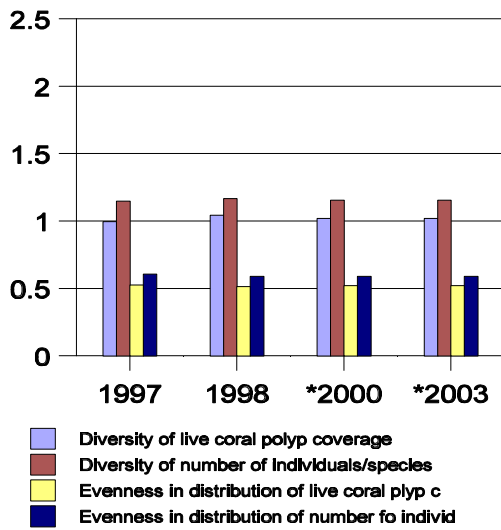
STATE OF OUR MARINE RESOURCES

Coral reef health

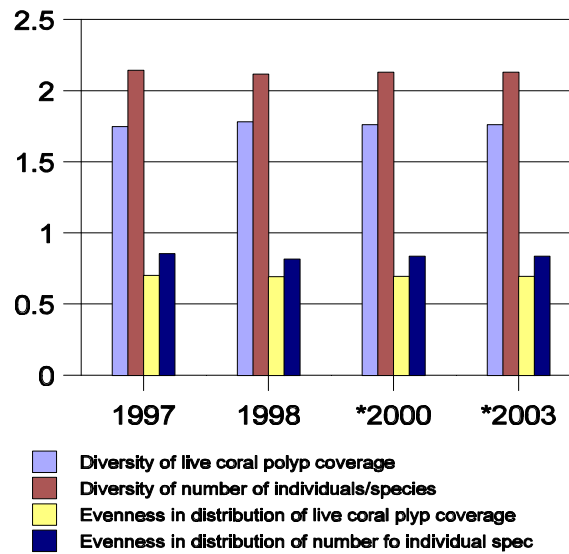
Coral reef health

Coral reef health

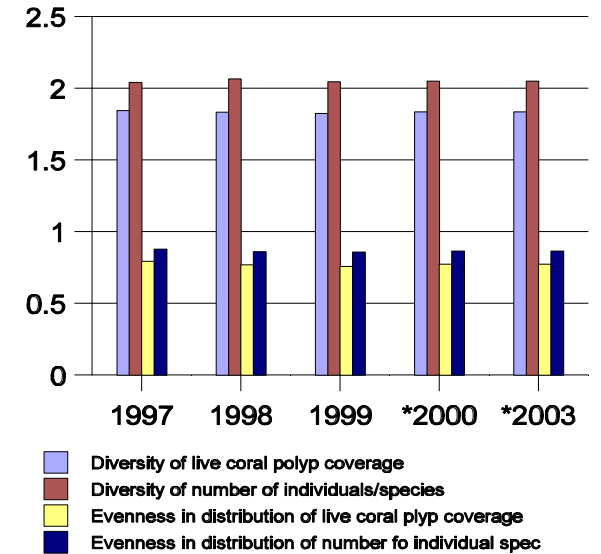
Coral reef health indices, 1st reef
(Endnotes page 54)



Coral reef health indices, 2nd reef
(Endnotes page 54)



Coral reef health indices, 3rd reef
(Endnotes page 54)



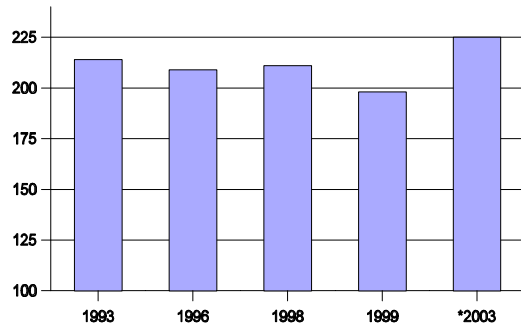
*=Goal

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Beach adequacy

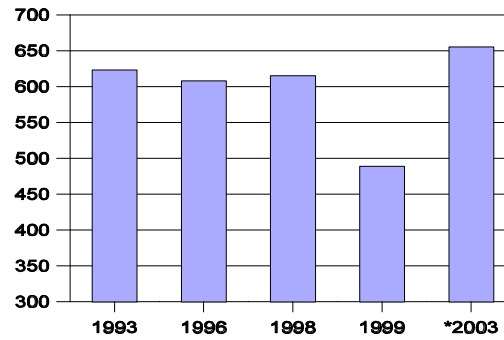
Average beach width at high tide, feet (Endnotes page 55)



*Goal

Beach adequacy

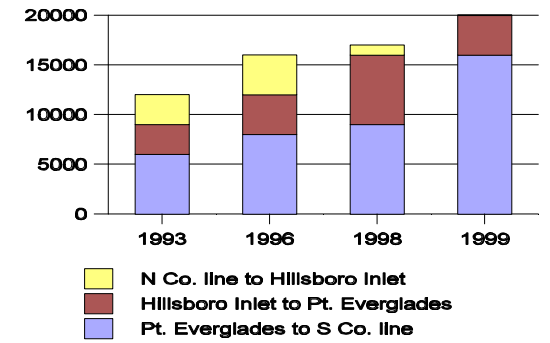
Total beach acreage, acres (Endnotes page 55)



*Goal

Beach adequacy

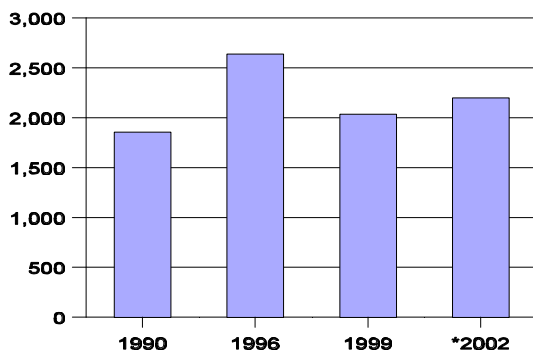
Critically-eroded beach, linear feet (Endnotes page 55)



Protected Wildlife

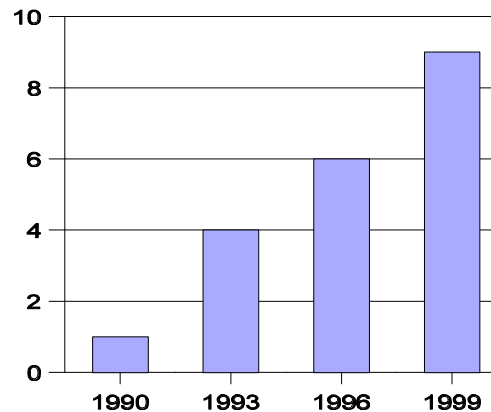
Florida West Indian manatee population (Endnotes page 56)

*Goal



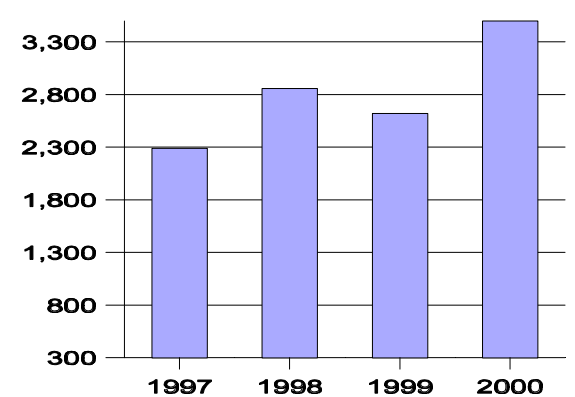
Protected Wildlife

W. Indian manatee mortality in Broward County (Endnotes page 56)



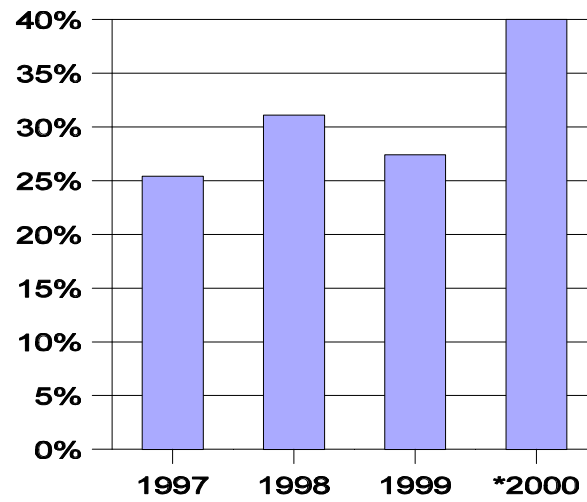
Protected Wildlife

of sea turtle nests (Endnotes page 56)



Protected wildlife

% of sea turtle nests left in-situ (Endnotes page 56)

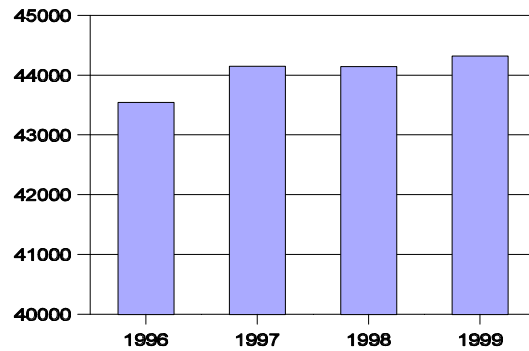


*=Goal

PRESSURES ON MARINE RESOURCES

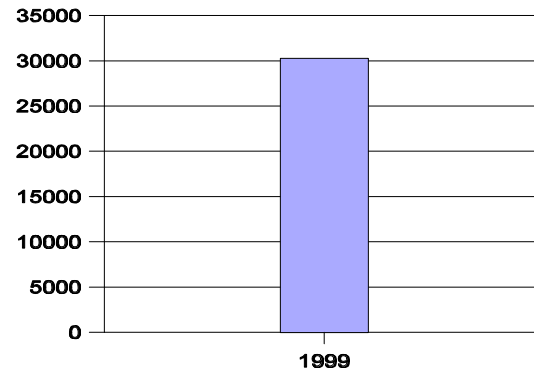
Boating activity

Number of registered vessels in Broward County (Endnotes page 57)



Recreational fishing effort

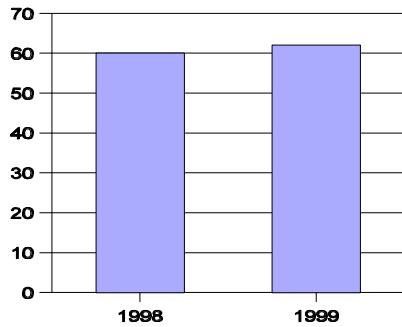
Number of saltwater fishing licenses in Broward County (Endnotes page 57)



RESPONSES TO MARINE RESOURCE PRESSURES

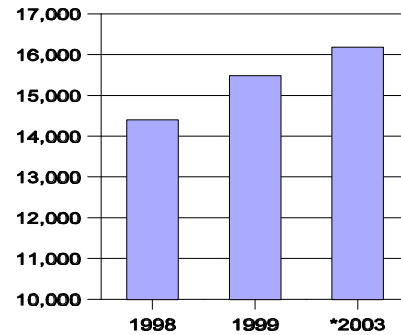
Artificial reefs

Number of shipwreck reefs (Endnotes page 58)



Artificial reefs

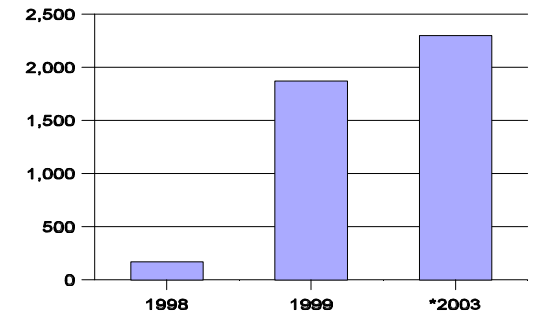
Number of square feet of modular reefs (Endnotes page 58)



*=Goal

Artificial reefs

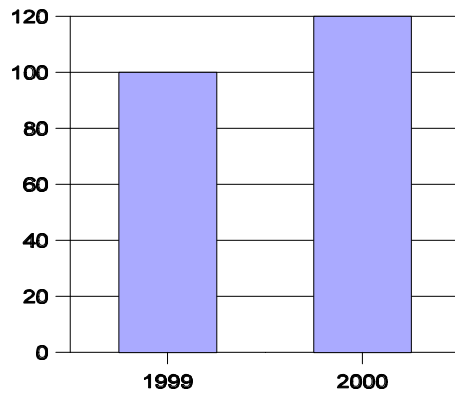
Number of square feet of boulder reefs (Endnotes page 58)



*=Goal

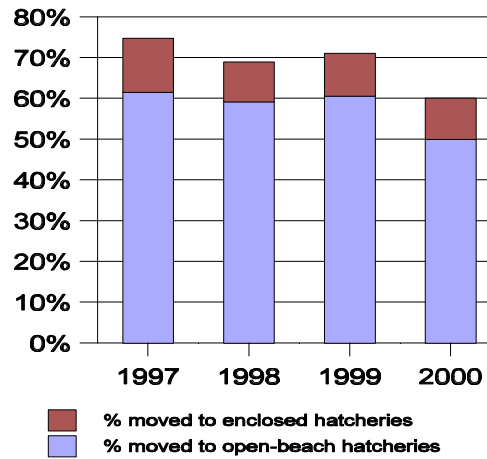
Reef Protection

Number of mooring buoys (Endnotes page 58)



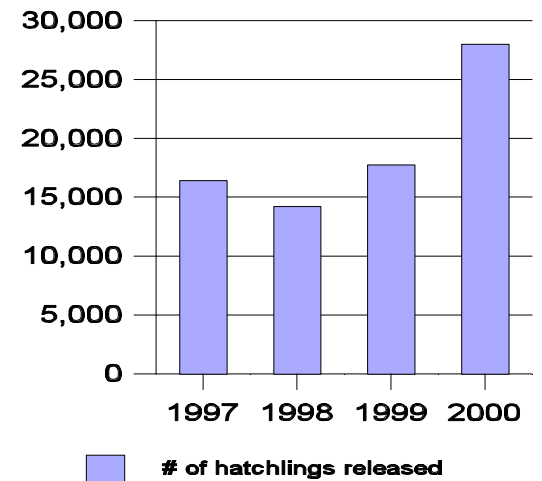
Protected wildlife

Sea turtle nest management (Endnotes page 58)



Protected wildlife

Sea turtle management (Endnotes page 58)



ENDNOTES

STATE OF OUR AIR RESOURCES

Percentage of days when outdoor air quality was rated as good.

Measurement: This benchmark shows the percentage of monitored days when the air quality is rated good based on the highest pollutant concentration of that day.

Effective in 1999, the measurement of the ozone concentration has changed. As a result, the Air Quality Index reported for 1999 is not comparable to the AQI reported for the previous years.

Explanation: Poor air quality affects public health, especially children and the elderly. The EPA has established National Ambient Air Quality Standards for ozone, particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide and lead to ensure adequate public health and environmental protection. The EPA developed a national Air Quality Index to reflect air quality on any given day. Broward County provides the Air Quality Index information to the public daily.

Data source: Broward County DPEP, Air Quality Division, Rosalia Bunge, (954) 519-1262

Number of over-capacity roadway segments

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

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 benchmark supplements the information provided by the two "Vehicle miles traveled" benchmarks. It provides a more comprehensive picture of how vehicular traffic and the adequacy of the roadway system that serves it can affect the environmental quality of life in a county experiencing continuing urbanization.

Data source: Broward County DPEP, Transportation Planning Division, Ossama Al Aschkar (954) 357-6653.

PRESSURES ON OUR AIR RESOURCES

Emissions from stationary sources other than power plants; tons/year:

Measurement: This measure tracks the amount of criteria pollutant (volatile organic compounds, oxides of nitrogen, particulate matter, sulfur dioxide, carbon monoxide) emissions from point and area sources. We obtain data from the Broward County Emissions Inventory prepared every three years.

Explanation: Emissions from stationary sources contribute to air pollution in Broward County. Power plants, industrial, commercial and residential operations and activities generate such emissions and together affect the quality of air. Emissions

from major industrial sources and select commercial sources are subject to federal, state and local regulations. Volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) are precursors for ozone, the pollutant of concern in Broward County. Ozone exceedances result not only in poor air quality but can also trigger costly, regulatory controls and loss of federal funding for construction/transportation development. Sulfur dioxide and oxides of nitrogen are precursors for acid rain that in turn contribute to poor air and water quality.

Data Source: Broward County DPEP, Air Quality Division, Rosalia Bunge, (954) 519-1262

Emissions from Power Plants; tons/year:

Measurement: The amount of criteria pollutants (volatile organic compounds, nitrogen oxides, particulate matter, sulfur dioxide, carbon monoxide) emissions from point and area sources. We obtained the data from the Broward County Emissions Inventory prepared every three years.

Explanation: Emissions from stationary sources contribute to air pollution in Broward County. Power plants, industrial, commercial and residential operations/activities generate such emissions and together affect the quality of air. Emissions from major industrial sources and select commercial sources are subject to federal, state and local regulations. VOCs and NO_x are precursors for ozone, the pollutant of concern in Broward. Ozone exceedances result not only in poor air quality but can also trigger costly, regulatory controls and loss of federal funding for construction/transportation development. Sulfur dioxide and oxides of nitrogen are precursors for acid rain that in turn contribute to poor air and water quality.

Data Source: Broward County DPEP, Air Quality Division, Rosalia Bunge, (954) 519-1262

Mobile Source Emissions, tons/year:

Measurement: This measure tracks the amount of volatile organic compounds and nitrogen oxides emissions from mobile sources (automobiles, trucks, lawn movers, airplanes, vessels). We obtain the data from the Broward County Emissions Inventory prepared every three years.

Explanation: Emissions from mobile sources remain a major air quality concern in Broward County. VOCs and NO_x emissions from mobile sources are precursors for ozone, the pollutant of concern in Broward. Ozone exceedances result not only in poor air quality but can also trigger additional costly, regulatory controls and loss of federal funding for construction/transportation development. Through more stringent fleet performance standards and transportation conformity, the 1990 Clean Air Act will implement additional programs to offset the increase of mobile source emissions due to population growth.

Data Source: Broward County DPEP, Air Quality Division, Rosalia Bunge, (954) 519-1262

Vehicle Miles Traveled per Year, millions:

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

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

Data source: Broward County DPEP, Transportation Planning Division, Ossama Al Aschkar (954) 357-6653

Vehicle Miles Traveled/day/1000 people:

Measurement: This benchmark is a measurement of vehicular traffic and represents the total miles traveled in a given area for a specified period by 1,000 people.

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

Data source: Broward County DPEP, Transportation Planning Division, Ossama Al Aschkar (954) 357-6653.

Number of Takeoff/Landing Cycles/year

Measurement: This is a computer model-generated measure representing emissions of aircraft that normalizes the pollutant emitting characteristics of the different aircraft and activities. It is based upon aircraft type and five specific operating modes in the cycle; approach, taxi/idle-in, taxi/idle-out, takeoff and climb out.

Explanation: Aircraft activities which affect ground level air pollutant concentrations occur within a mixing zone. We define them as landing and takeoff cycles (LTO's). The emissions of concern are based on the duration of the LTO cycle and the engine operation mode for a given aircraft category (commercial, military, etc.). Aircraft operations generate emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂), and particulate matter (PM). These pollutants are precursors for ozone and acid rain that in turn contribute to poor air and water quality. Poor air affects public health, especially children and the elderly. The decrease in the number of cycles (LTOs) per year is due to the gradual

replacement of smaller aircraft by larger, more efficient airplanes.

Data source: Broward County Aviation Department, Ty Winkler (954) 359-6135, Public Information (954)359-6116

Total and Per Capita Electricity Consumption:

Measurement: This is a measure of the total electric power consumed in Broward County annually including residential and nonresidential (kilowatt-hours).

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

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

Total Waste Landfilled and Combusted, tons/year

Measurement: Data provided to the FDEP by Broward County OIWM and published by FDEP, Bureau of Solid and Hazardous Waste, Division of Waste Management, in the Solid Waste Management in Florida Annual Report.

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.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Sermin Unsal, (954) 519-1460

RESPONSES TO AIR RESOURCE PRESSURES

Number of Alternative Fuel Vehicles in Government and Commercial Fleets

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

Explanation: Vehicular traffic is a major source of air pollution. The incomplete combustion of gasoline in motor vehicles results in the emissions of hydrocarbons and oxides of nitrogen. These pollutants react in the presence of sunlight to produce ozone, the pollutant of main concern in the area. Ozone can cause respiratory distress to individuals with impaired respiratory functions. The Energy Policy Act of 1992 established goals to reduce dependence on imported oil by requiring federal and state fleets to increase the percentage of their vehicles operating on alternative fuels. Energy diversification protects our energy security, enhances environmental protection, and promotes economic development.

Data source: Broward County Public Works Department, Energy Management Section, Don Steigerwald, (954) 357-8569 and the South Florida Regional Planning Council, Larry Merritt, (954) 985-4416

Reductions in emissions of hazardous air pollutants, tons/year

Measurement: This is the amount of hazardous air pollutants reduced from stationary source categories such as power plants, municipal waste and biological incinerators, dry cleaners, furniture manufacturing, etc. The EPA has promulgated regulatory emission standards for these pollutants.

Explanation: Emissions of hazardous air pollutants contribute to air pollution in Broward County and have a negative health impact. Various industrial and commercial operations generate such emissions. The 1990 Clean Air Act directs the EPA to control hazardous air pollutants. The reduction of hazardous air pollutant emissions will result in improved air quality and health effects.

Data Source: Broward County DPEP, Air Quality Division, Rosalia Bunge, (954) 519-1262

Bike-friendly roadway, miles

Measurement: This measure tracks the miles of bike-friendly designed roadway available to the residents of the county to encourage the use of bicycles as an alternative means of transportation. The categories of such roadways include the following:

Dedicated lanes

- o miles of bike lanes
- o miles of non-designated lane

Shared lanes

- o miles of wide-curb lanes
- o miles of paved shoulder

Explanation: Motor vehicle traffic is a major source of air pollution and a major source of precursors for the pollutant ozone. Poor air quality affects public health, especially children and the elderly. In 1989 the Broward County Commission adopted the Bikeway Element of the Broward County Comprehensive Plan. This plan provided direction to implement a bicycle program and the framework for the infrastructure improvements. It is important to integrate the use of bicycles as alternative means of transportation and their facilities into the transportation system. This will preserve air quality by reducing the production of ozone precursors.

Data source: Broward County DPEP, Transportation Planning Division, Mark Horowitz (954) 519-1487.

Number of mass transit passenger trips/yr, millions

Measurement: The number of trips made by the citizens of Broward County utilizing Mass transit (i.e., buses, shuttles, Tri-Rail).

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

Data source: Broward County Mass Transit Division, Tri-County Commuter Rail Authority, Marketing Department, Robert Fossa (954)357-8336 and Mary Jane Lear (954) 788-7937 or (954) 942-7245

Number of community shuttles**Number of community shuttle riders**

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 a given period.

Explanation: The Broward Division of Mass Transit (BCT) in cooperation with the Community Transportation Initiative (CTI) of the Department of Planning and Environmental Protection (DPEP) 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.

Data Source: Broward County Division of Mass Transit, Service Development Team, Bob Fossa (954) 357-8336 and the Broward County DPEP, Transportation Planning Division, Enrique Zelaya (954) 357-6635

Miles of Greenways

Measurement: This is the number of miles of pathways dedicated for bicyclists, pedestrians and equestrians for utilitarian and recreational or transportation uses that are in or next to canal, utility or transportation rights-of-way.

Explanation: Motor vehicle traffic is a major source of air pollution and an overriding concern of many Broward County residents when choosing travel modes. Providing an enjoyable environment of interconnected of multipurpose paths for bicyclists and pedestrians increases the likelihood that Broward county residents will choose non-polluting modes of travel.

Data Source: Broward County DPEP Administration, Mark Horowitz (954) 519-1487

STATE OF OUR WATER RESOURCES

Percent improvement in fresh water quality in C-13 canal, compared to 1995 baseline

Measurement: This benchmark is calculated based on the data obtained from DPEP's surface water quality monitoring network along the fresh water portion of the C-13 canal (Florida Turnpike to Interstate 95). We measured improvements against the 1995 (baseline) water quality index. The index is calculated using the Florida Department of Environmental Protection's Florida Stream Water Quality Index (WQI) to rate the quality of fresh water systems. The WQI is based on the measurement of six water quality categories: water clarity, dissolved oxygen, oxygen-demanding substances, bacteria, nutrients and biological diversity with each category potentially having more than one parameter. We converted 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 DPEP 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 DPEP regulations.

Data source: Broward County DPEP, Environmental Monitoring Division, George Riley, (954) 519-1241

Percent improvement in marine water quality in C-13/C-14 canal compared to 1995 baseline

Measurement: This benchmark is calculated based on the data obtained from DPEP's surface water quality monitoring network within the tidal portion of the C-13 and C-14 Canals (Pompano and Middle River Canals, east of I-95). We measure improvements against the 1995 (baseline) water quality index. The index is calculated using the Florida Department of Environmental Protection's Trophic State Index, to rate the quality of estuarine systems. The Trophic State Index is based on measurements of chlorophyll and nutrients. Calculating an overall index 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) include the redevelopment of areas constructed before the implementation of surface water management regulations, the 5-year renewal of surface water management licenses issued before 1989, and 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 is subject to DPEP regulations.

Data source: Broward County DPEP, Environmental Monitoring Division, George Riley, (954) 519-1241

Percent of beach water quality test results rated as satisfactory

Measurement: This benchmark tracks the percentage of beach water quality measurements rated as satisfactory, based upon weekly enterococci and fecal coliform testing at fifteen public beaches and recreational water ways in Broward County.

Explanation: The Broward County Health Department, with the State Department of Health has initiated (1998) a program to provide scientific information on the quality of coastal beach and recreational waters to the public. The program involves monitoring of enterococci species and fecal coliform bacteria levels at fifteen locations along Broward's Atlantic coast and Intracoastal waterway. The density of enterococci species and fecal coliform bacteria as indicator groups in seawater show the relationship to swimming-associated gastroenteritis.

Data Source: Broward County Health Department and Florida Department of Health, Howard Rosen, (954) 467-4854

% of Time under water use restrictions in previous five years

Measurement: This is a measure of water adequacy as water managers in Broward County and South Florida strive to deal effectively with drought conditions.

Explanation: The South Florida Water Management District (SFWMD) imposes water-use restrictions during drought conditions when water levels in the regional system or groundwater levels monitored locally fall below a target level. The District calculates the percentage by dividing the number of months when water restrictions were in effect (even for a single day) by sixty months (five year periods). SFWMD predicts that without enhancements in our current water management system, Service Area 1 (north Broward and lower Palm Beach County) and Service Area 2 (central and southern Broward County) will experience increasing shortages. These shortages may be from 15% and 16% of the time in 1990 to 37% and 29% in 2010 respectively. Three major water resources planning efforts are currently underway to reduce water use restrictions by increasing storage capabilities and improving the efficiency of water management. The three plans are as follows: the Comprehensive Everglades Restoration Plan (CERP), a state and federal partnership, the Lower East Coast Regional Water Supply Plan (LEC) overseen by the SFWMD, and the Broward County Integrated Water Resources Plan, managed by DPEP. As they develop, these planning efforts will reduce or maintain the periods in water shortages despite increasing demands on water resources with increasing population. The CERP and LEC components alone may result in reductions of these shortages to 9% and 14%. The IWRP should further enhance these improvements.

Data source: Lower East Coast Regional Water Supply Plan (Draft), March 1997, South Florida Water Management District Broward County DPEP, Water Resources Division, Nancy Gassman, PhD, (954) 519-1464

Total and per capita solid waste produced, tons/year

Measurement: This measure tracks the quantity of solid waste produced in Broward County. Broward County OI WM provides data on waste production by Broward County to the FDEP. The FDEP, Bureau of Solid and Hazardous Waste, Division of Waste Management, published the data in the Solid Waste Management in Florida Annual Report.

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.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Sermin Unsal, (954) 519-1460

% of available waste water treatment disposal capacity

Measurement: We compute the percentage of available disposal capacity by dividing the actual volume of waste water disposed of by the total permitted disposal volume. Disposal methods include ocean outfalls, deep injection wells, spray irrigation and surface water (for advanced-treated waste water only). We compute the actual available volume as a rolling 12-month average as of June 30 as reported by treatment works within Broward County.

Explanation: The availability of waste water disposal volume can be a limiting factor for the economic health of the community. The development review process includes an evaluation of the waste water treatment and disposal capacity of the treatment works that will receive waste water from a proposed development. Demand for development that strains disposal capacity may result in reduced levels of treatment or the need to commit funds for infrastructure improvements. Regulatory agencies may withhold development permits if adequate treatment and disposal capacity is not available.

Data source: Broward County DPEP, Water Resources Division, John Crouse, (954) 519-1264

PRESSURES ON WATER RESOURCES

Percentage of the county where central domestic sewer service is not available

Measurement: This is the area within the urban portion of the County lacking domestic wastewater sewer service. 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 from the Biscayne Aquifer, a shallow groundwater aquifer. Its proximity to the surface leaves it vulnerable to various types of contamination including septic systems. In older areas of the county, aging tanks and drain fields may cause the septic system to fail to treat incoming sewage and household waste effectively. A reduction of these systems especially in industrial areas will lower the contamination threat to the aquifer.

Data source: Broward County DPEP, Water Resources Division, John Crouse, (954) 519-1264

Net gain/loss in septic system wastewater flow, gallons/day and equivalent residential connections

Measurement: This is the net gain or loss in wastewater flow handled by septic tank facilities associated with certain building permit approvals granted for the subject period. The flow figures used are those identified for new septic tank installations minus those identified for septic to sewer conversions. We determine the equivalent residential connection figure by dividing the net gain or loss by 300.

Explanation: This benchmark complements the information provided by the "Area on Septic Tanks" benchmark. It is a measure of progress designed to deal with both sides of the equation. It provides a comparative analysis of development approvals that either involve flows associated with new on-site treatment and disposal system installations or add to the total flows handled by sanitary sewer facilities.

Data source: Broward County DPEP, LUPD, Monthly Reports - Development Review Section, Martin Weigand, (954) 519-1251

Municipal Water Consumption, Per Capita, gallons/day

Measurement: This tracks the consumption water resources by the residents of Broward County.

Explanation: Per capita usage, the average amount of potable water each person in Broward County uses on a given day, is calculated based on how much water the utilities and owner-operated potable water wells provide to users divided by the population of the County. Uses of that water include public water supply, irrigation, domestic and commercial self-supply, recreational use, and agriculture. Compared with 1995, the per capita use value in 1990 is high because agriculture held a greater amount of Broward County land with higher irrigation needs.

Data source: South Florida Water Management District wide Water Supply Assessment, July 1998, Management District-wide Water Management Plan Vol II, April 1995 and Broward County DPEP, Water Resources Division, Nancy Gassman, PhD, (954) 519-1464

Cumulative number of wells lost to salt water intrusion

Measurement: This measure shows the impact of changing water management practices on saltwater intrusion into coastal well fields.

Explanation: With increasing water use demands including public water supply, coastal well fields are forced to pump more water under potentially lower groundwater elevations. Under these conditions, salt water can move inland and enter the wells making the raw water untreatable by certain types of water treatment plants. The number of wells listed is a cumulative value to date.

Data source: Broward County DPEP, Water Resources Division, Darrel Dunn, PhD, (954) 519-1464

Number of hazmat & storage tank licenses

Measurement: This is the number of hazardous materials and storage tank licenses issued by DPEP in the year reported. It includes facilities with current facility management licenses for hazardous materials, storage tank, or well field hazardous materials activities. It also includes the number of facilities with current consolidated facility management licenses for hazardous materials/storage tank activities and well field hazardous materials/storage tank activities. A current license is one that DPEP issues before the end of the quarter and that expires on or after the end of the quarter. The number does not include unissued new licenses in process or facilities facing enforcement action for non-renewal or operating without a license.

Explanation: Businesses that handle and store hazardous materials represent a potential threat to ground and surface water quality. The DPEP licenses and inspects facilities operated by these businesses to minimize the threat.

Data Source: Broward County DPEP, Land Use and Permit Division, Connie Boden, (954) 519-1215

Percentage of Developed Land Subject to Surface Water Management Regulation

Measurement: We compute the percentage of developed land that includes surface water management features by dividing the area of developed land with surface water management features by the total area of developed land.

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.

Data Source: Broward County Surface Water Coordination Committee, South Broward Drainage District, Neil Kalin (954) 680-3337 and the South Florida Water Management District, Tony Waterhouse (954) 713-3200

RESPONSES TO WATER RESOURCE PRESSURES

Percentage of contaminated sites cleaned up to state standards

Measurement: This is the cumulative percentage of petroleum-contaminated sites cleaned up to state standards.

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 well field 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.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Lorenzo Fernandez, (954) 519-1249

Number of licensed hazmat sites inspected

Number of licensed hazmat sites inspected and found in compliance

Measurement: This is a measure of the activities of DPEP to inspect the holders of hazardous material licenses in Broward County. We find the total number of inspections via a query of the agency's computerized Compliance Management System. The query provides the number of sites inspected in a given month. The output is then corrected for sites that have received an Licensing Non-Compliance Notice or Warning Notice for the same month. This leaves all sites visited and found to have no compliance problems, for a given month. We compile annual figures from the monthly reports.

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

Data Source: Broward County DPEP, Pollution Prevention and Remediation Division, Jeff Halsey, (954) 519-1468

Number of facilities receiving a direct, one-on-one pollution prevention initiative

Measurement: This measure tracks the total number of facilities receiving one or more pollution prevention consultations designed to reduce sources of hazardous waste.

Explanation: At its core, pollution prevention (P2) means to reduce waste at the source of the waste generation. We designed compliance *inspections* to ensure the proper handling of a waste once a facility has created it. The purpose of pollution prevention *consultations* is to help prevent or reduce the creation of that waste in the first place. Pollution prevention and compliance inspections together provide a full spectrum of regulatory services. In 1999, we begin in earnest developing a P2 program. The ultimate goal of this program is to reduce the amount and toxicity of waste generated in Broward County.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Jeff Halsey, (954) 519-1468

STATE OF OUR LAND RESOURCES

Protected Land

- o Conservation and passive recreational land**
- o Active recreational land**
- o Other protected land**

o East coast buffer

Unprotected Land

o Proposed fee simple

o Potential open space

o Potential PDR

o Potential management agreements

o Listed east coast buffer

Measurement: These measures track the conservation and recreational lands system in Broward County. Land tracked includes existing Protected lands and Unprotected (developable) lands.

Existing protected lands:

Conservation and passive recreation lands: this category includes environmentally-sensitive lands and predominantly passive recreational parks.

Active recreational lands: includes predominantly active recreational facilities/parks.

Other protected lands: include mitigation sites and other public or private lands predominantly managed for conservation.

East Coast buffer: lands acquired by the SFWMD within the East Coast Buffer program.

Unprotected (developable) lands:

Proposed fee-simple: conservation lands and green space proposed for acquisition within the DPEP Land Acquisition Program.

Potential open space: this category includes lands without any ecological value identified with the sole purpose of providing open space in those areas of the County which lack an adequate amount of conservation lands and green space with a potential for acquisition.

Potential PDR: lands that appear to be characterized by a predominant agricultural use on aerial photographs that could be considered for less-than-fee-simple acquisition.

Potential management agreements: include lands that Broward County or by a city already owns, are characterized by high ecological value and currently not managed for conservation.

Listed East Coast buffer: lands listed in the SFWMD East Coast Buffer Acquisition Program.

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.

Data source: Broward County DPEP, Biological Resources Division, Valaria Volin, (954) 519-1297

Percent of tree canopy coverage in Broward County, east of conservation areas

Measurement: We are creating the Broward County Tree Canopy coverage from infra-red aerial photo images using the Normalized Difference Vegetation Index ratio technique, allowing the masking of all urban features from the image, leaving us only to classify the remaining vegetation as tree or non-tree. We then run a supervised classification on the image to create a thematic layer of tree canopy. We then mosaic these layers together, creating a seamless coverage of tree canopy across Broward County.

Explanation: As part of the Commission's New Vision goal to protect the environment, the DPEP has embarked on a project to map the tree canopy in Broward into their Geographical Information Management System. This is being done to give local jurisdictions a tool for managing their urban forest. Trees reduce our energy bills, clean our air, keep pollution out of our waterways, save tax dollars for storm water drainage, recharge our drinking water supply. They also reduce noise pollution, support our multi-billion dollar tourist industry, support birds and wildlife and make our community more attractive, cohesive and livable.

Data source: Broward County DPEP, Planning Services Division, Victoria Morrow, (954) 357-6618

PRESSURES ON LAND RESOURCES

Number of new commercial structure/addition approvals issued

Measurement: Before the issuance of construction permits for all new commercial structures and additions within Broward County, developers must obtain approvals from DPEP. The approval process includes an evaluation of potential environmental impacts of the proposed construction. To find the number of approvals issued, we query the DPEP Permit Monitoring System for the number of approvals issued during the calendar year.

Explanation: A crude measure of pressures on our land resources is the number of commercial building permits issued by municipalities and Broward County. All building permits require review and approval by DPEP. 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 execute the construction of an approved project.

Data source: Broward County DPEP, Land Use and Permitting Division, Martin Weigand, (954) 519-1251

Broward County population

Measurement: Annual Broward County population estimates are based upon the 1990 Census. The Bureau of Economic and Business Research at the University of Florida provides the annual projections.

Explanation: Population increases are direct impacts 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.

Data source: Broward County DPEP, Planning Services Division, Bill Leonard, (954) 357-6033

Wetlands impacted by development, acres

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

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.

Data Source: Broward County DPEP, Biological Resources Division, Barbara Chow, (954) 519-1419

RESPONSES TO LAND RESOURCE PRESSURES

Percent of solid waste recycled

Measurement: The measure tracks to 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.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Sermin Unsal, (954) 519-1460

Litter cleanup campaigns, pounds/event/volunteer of shoreline litter collected

Miles of adopted highway

Measurement: The "pounds/event/volunteer of shoreline litter collected" is a measure of the quantity of litter collected per person during annual coastal cleanup campaigns. The Center for Marine Conservation, a nonprofit organization committed solely to protecting ocean environments, sponsors the Florida Coastal Cleanup. The Center holds the event annually and it involves the cleanup of 23 miles of Broward County shoreline.

Florida Department of Transportation's Adopt-A-Highway Program is a volunteer partnership for litter cleanup and prevention education. Groups are enlisted to maintain two-mile portions of highway shoulder and median. We compute the total miles by multiplying the number of volunteer groups in the program by two.

Explanation: These benchmarks are measures of the effectiveness and public involvement in litter cleanup campaigns within the county. The shoreline cleanups in 1997, 1998, 1999 and 2000 involved underwater dives at Lauderdale by the Sea that included

closing a fishing pier and cleaning under the pier to recover lead fishing weights. The 1998 figures were up due to an old broken boat hull at one site although participation went down due to heavy rains during days leading up to the event and storms that were forecast for the weekend.

Data source: "Tons/event/volunteer of shoreline litter collected": Broward County DPEP, Biological Resources Division, Pamela Fletcher, (954) 519-1218

"Number of miles of adopted roadway": Florida Department of Transportation, Barbara Kelleher, (954) 777-4090

STATE OF OUR MARINE RESOURCES

Coral Reef Health Indices; 1st, 2nd, & 3rd reefs

- o Diversity of coral polyp coverage
- o Diversity of number of individuals per species
- o Evenness in distribution of live coral polyp coverage
- o Evenness in distribution of numbers of individual species

Measurement: Stony coral abundance, diversity, and evenness are calculated values commonly used to characterize the relative health of coral reef communities. In general, a diversity index value (H') for stony corals is a way of comparing the relative abundance of each species of coral among different populations of corals or different reef sites. Evenness (J') is the calculated ratio value of H' divided by H' max and it increases value as the number of species increases and reaches its maximum value of one when the number of individuals of each species at a given site is the same. We don't expect to see substantial increases or decreases in index values over time and would hope for maintenance of existing values. Data collection annually will continue beyond the year 2000. As yearly data becomes available, comparison to previous years will allow detailed evaluation of trends in the ecological condition of the reef community.

C = stony coral live polyp coverage (%)

N = numbers of individuals

H' = diversity index

J' = evenness (H'/H' max)

H' max = 1N(# of species)

H'C = diversity of live coral polyp coverage

H'N = Diversity of numbers of individuals per species

J'C = Evenness in distribution of live coral polyp coverage

J'N = Evenness in distribution of numbers of individuals per species

Explanation: Broward County initiated a coral reef community monitoring program involving the measurement of the relative

abundance and diversity of stony corals and the abundance of octocorals and sponges at eighteen reef sites throughout Broward's coastal waters. Coral reef communities and associated sea life of those communities are an important natural resource for recreation and the fishing and diving industries in Broward. The sound ecological condition of this resource community is a key indicator of the general condition of all the marine resources adjacent to the Broward coast.

Data source: Broward County DPEP, Biological Resources Division, Louis Fisher. (954) 519-1255

Average beach width at high tide, feet

Total beach acreage

Linear feet of critically-eroded beach

Measurement: This is a measure of the ability of Broward County's beaches to provide storm protection and recreational beach area. Critically-eroded beaches are those beaches whose width at high tide we deem inadequate to provide storm wave damage protection and/or recreational opportunities. For the purposes of this survey, we assume the threshold width is 75 feet from road, seawall, or toe of the dune to the high water contour. This definition is different from that used by the State of Florida in determining critically-eroded beaches. FDEP monuments (where we take beach width measurements) where beach width is less than 75 feet from road, seawall, or toe of the dune to high water contour. We scale the distances from Countywide Survey profile plots.

Explanation: Broward's beaches serve two critical functions: to provide storm wave protection for upland property, structures, and infrastructure, and to drive our recreational economic engine. Vital to the beaches' storm protective function is their width. Adequate beach width allows storm waves to break and dissipate energy harmlessly; however, in so protecting the upland, storm waves cause some net erosion of beach sand. Broward County's beaches protect almost \$4 billion in upland structures and property. Maintenance of beach width adequate to protect against a moderate frequency storm event is very important. Beach acreage is a useful measure because it indicates the amount of recreational space available to beach users. As a \$600 million annual contributor to Broward County's economy, the beaches are a foundation of our tourist economy. Our beaches also provide critical nesting habitats for several threatened and endangered species of sea turtles and adequate acreage is necessary for this purpose. We measure beach width from the shorefront reference monument (established by the State of Florida) to the zero foot elevation contour (NGVD). Acreage is based on 24 miles of beachfront in Broward County.

Data source: Broward County DPEP, Biological Resources Division, Steve Higgins, (954) 519-1265

Florida West Indian manatee population

Broward County West Indian manatee mortality

Measurement: We count manatees statewide in a synchronized or synoptic manner to get the most accurate population count possible. This is done following a major cold front that concentrates the animals in warm water refuges.

Explanation: The manatee is an endangered species whose existence is threatened by several anthropomorphic activities including injuries or death from boat and ship impacts, water control structures, water pollution and habitat reduction and toxic algal blooms and other problems. We address some of these problems through various means. The goal 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. Likewise, County mortality data may show the population's health or the effectiveness of local manatee protection measures.

Data source: Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission, Bruce B. Ackerman, PhD, (727) 896-8626, ext. 1912

Number of sea turtle nests

Percent of surveyed nest left in-situ

Measurement: Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March through October. We record the number of nests deposited and the location of each. We move to hatcheries those nests in sites that are not amenable to successful emergence and entry of hatchling sea turtles into the surf.

Explanation: The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to DPEP for beach renourishment projects. The goal of the program is to reduce the number of sea turtle nests that required relocation and maximize the survivability of nests left on the beach. We conduct the Conservation Program during non-renourishment years to allow for continuity of data collection and analysis. We expect that the number of sea turtle nests that require relocation in the year 2000 will be less due to the enactment of a sea turtle lighting ordinance in the City of Pompano Beach. The ordinance will require shading or suspension of beach lighting during the nesting and hatching season. Compliance will allow additional nests to be left *in-situ*.

Data source: Broward County DPEP, Biological Resources Division, Louis Fisher, (954) 519-1255

PRESSURES ON OUR MARINE RESOURCES

No. of registered vessels

Measurement: We obtain the number of vessels registered in the county from the number of renewal notices mailed in Broward County by the Florida Department of Motor Vehicles. The DMV provides an annual report to the Broward County Revenue Collection Division. The total number includes pleasure and commercial vessels.

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.

Data source: Broward County Revenue Collection Division, Eileen Kavanaugh, (954) 765-5050

Number of saltwater fishing licenses

Measurement: The total number of saltwater fishing licenses issued (July 1 to June 30) includes resident and nonresident sportsman saltwater licenses of all duration periods, including lifetime and senior licenses. It also includes charter vessel licenses.

Explanation: Recreational and commercial fishing activities exert a direct impact on our marine resources. State regulations require a saltwater fishing license to fish in marine waters. This number serves as a proxy for pressures on County marine resources.

Data source: Florida Fish and Wildlife Conservation Commission, Tallahassee, Sandra Gilliam, (850) 488-3641

RESPONSES TO MARINE RESOURCE PRESSURES

Number of shipwreck reefs

Number of square feet of modular reefs

Number of square feet of boulder 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.

Explanation: Very little baseline data exists for fish populations on Broward County's natural and artificial reefs. A study is currently underway (sponsored by the National Marine Fisheries Service) to census and determine seasonal dynamics of the fish assemblages on the county's *natural* reefs. If funding becomes available, we will expand this to perform similar measurements on the *artificial* reefs. Comparison of natural reef populations to artificial reef populations will allow the development of reefs that function more like natural reef systems. We may redefine the performance measures to consider this information.

Data source: Broward County DPEP, Biological Resources Division, Ken Banks, (954) 519-1207

Number of mooring buoys

Measurement: Mooring Broward County has installed and maintains buoys along popular diving and fishing portions of our coral reef system. The goal is to maintain the ones in place and add more in the future.

Explanation: Coral reef communities and the associated benthic communities are an important natural resource for recreation and the fishing and diving industries. We intend mooring buoys to reduce the impacts associated with anchoring of boats on the reefs. We have not done a quantitative analysis, but use of the mooring buoys currently in place seems high and presumably that use is eliminating some anchor damage. We would like to increase the number of mooring buoys in the more popular areas as we secure funds for installation and maintenance.

Data source: Broward County DPEP, Biological Resources Division, David Stout, (954) 519-1452

Sea Turtle Management

- o Percent of sea turtle nests relocated to open beach hatcheries**
- o Percent of sea turtle nest relocated to enclosed hatcheries**
- o Number of sea turtle hatchlings released**

Measurement: Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March through October. We record the number of nests deposited and the location of each. We relocate to hatcheries those nests in sites that are not amenable to successful emergence and entry of hatchling sea turtles into the surf.

Explanation: The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to DPEP 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 data collection and analysis. We expect that the number of sea turtle nests that require relocation in the year 2000 will be less due to the enactment of a sea turtle lighting ordinance in the City of Pompano Beach. The ordinance will require shading or suspension of beach lighting during the nesting and hatching season. Compliance will allow additional nests to be left in-situ.

Data source: Broward County DPEP, Biological Resources Division, Louis Fisher, (954) 519-1255