

# COG Region's Potomac Water Quality & Wastewater Treatment Fact Sheet

(current draft, as of 7/28/09)

## Background:

Current Fact Sheet was prepared several years ago to summarize trends for certain water quality parameters associated with nutrients (Total Nitrogen and Total Phosphorus) and to relate the efforts made by the region's wastewater plants to reduce those nutrients over time and to track the corresponding reduction in nutrient loads to the Potomac River (e.g., employing BNR and now ENR for nitrogen, and use of other LOT treatment levels for phosphorus). The Fact Sheets have been used at various times to provide updates to the COG Board, used for briefings for state and local elected officials, and posted on COG's Website.

COG staff will also be working on revising our approach to the proposed Potomac Water Quality report (FY 2011 Work Program & Budget) to integrate this report with the Fact Sheet format.

## Future Plans:

COG's Chesapeake Bay & Water Resource Policy Committee (CBPC) has specifically asked that COG staff work with the WRTC members and other technical staff in the region to update this Fact Sheet.

The proposed updates would be to include the following items:

- Loading data (add 2008 – 2020 data)
- ENR implementation status (actual and planned as of 2011 & relative to 2017 Bay deadline)
- ENR cost data (update know/estimated costs as of 2011)

In addition, the COG staff will also be working to supplement this existing Fact Sheet and/or create new Fact Sheets to address these other regional Water Resource Issues:

- Biosolids management (addressing programs, key issues, and links to nutrient restoration efforts)
- Stormwater management (addressing nutrient and sediment reduction efforts, describe status of permits, general program characteristics, and cost information)
- Other Potomac water quality issues (e.g., updates on existing/proposed TMDLs, other potential concerns such as EDCs, as well as ongoing efforts to provide source water protection and address drinking water supply, etc.)

The intention is to: a) take a modular approach to these topics; b) have the information be specific enough to characterize the progress and contributions by COG's members to address and contribute to improved water quality in the Potomac; c) be general enough to serve multiple audiences; d) be easily and periodically updated; and e) be vetted by the WRTC and its technical work groups so that it can be posted on COG's Web site.

We also intend to make the Potomac Water Quality Report a more dynamic/living document that builds upon these Fact Sheets – but allows for a more comprehensive assessment of water quality trends in the Potomac River estuary.

## What COG Staff Needs From You:

1. Updated data and facts and cost information for your facilities/programs
2. Any edits for current Fact Sheet
3. Ideas for additional topics/areas of focus for these Fact Sheets and/or the Potomac Water Quality Report

COG Regional Water Quality Management Program staff will be scheduling internal meetings to assess the status of the information we have, what we need from our COG jurisdictions/agencies, and to develop a streamlined approach for requesting any additional information/data needs. We expect those requests to be made in April 2011. Please contact Tanya Spano at [tspano@mwkog.org](mailto:tspano@mwkog.org) with any ideas or suggestions for these Fact Sheets, the Potomac Water Quality Report, or any other regional water quality/water resources issues you believe COG should be addressing.



# Potomac River Water Quality and Municipal Wastewater Treatment

July 28, 2009

## About COG

The Metropolitan Washington Council of Governments (COG) is a regional organization composed of 21 local governments surrounding our nation's capital, plus area members of the Maryland and Virginia legislatures, the U.S. Senate, and the U.S. House of Representatives.

COG provides a focus for action and develops sound regional responses to such issues as the environment, affordable housing, economic development, health and family concerns, human services, population growth, public safety, and transportation.

Founded in 1957, COG is an independent, nonprofit association. It is supported by financial contributions from its participating local governments, federal and state grants and contracts, and donations from foundations and the private sector. Policies are set by the full membership acting through its board of directors, which meets monthly to discuss area issues.

## The National Capital Region

The National Capital Region consists of 21 Washington area local governments and comprises the single largest urban area in the Chesapeake Bay watershed – about 4.9 million people – more than 25% of people living in the Bay watershed and 80% of the people living in the Potomac River watershed. Within the National Capital Region there are twenty-four municipal wastewater treatment plants (WWTPs) operated by COG's local governments or wastewater utilities. Seventeen of these are considered major plants (i.e., greater than 2 MGD) with a combined treatment capacity of 753 Million Gallons/Day (MGD); including Blue Plains (370 MGD) – which is the largest treatment plant in the entire Chesapeake Bay watershed. Consequently, municipal point sources are the largest source of nutrient loadings from the region.

The tidal section of the Potomac River, a central feature of the region, is affected by many sources of pollution, primarily from non-point source runoff at the fall line (i.e., river flows below Great Falls) and effluent discharges from wastewater treatment plants in the National Capital Region. With rapid population growth in the National Capital Region over the past century, the Potomac River has faced water quality problems such as bacterial contamination, low dissolved oxygen, and nuisance algal blooms. The implementation of secondary and advanced wastewater treatment in the National Capital Region has resulted in significant improvements in water quality and ecological conditions in the Potomac Estuary, including healthy dissolved oxygen levels, reduced nuisance algal blooms, and the return of important living resources such as large mouth bass and submerged aquatic vegetation (SAV). The reductions in wastewater pollutant loadings and improvements in water quality and ecological conditions in the Potomac Estuary represent a major environmental success story.

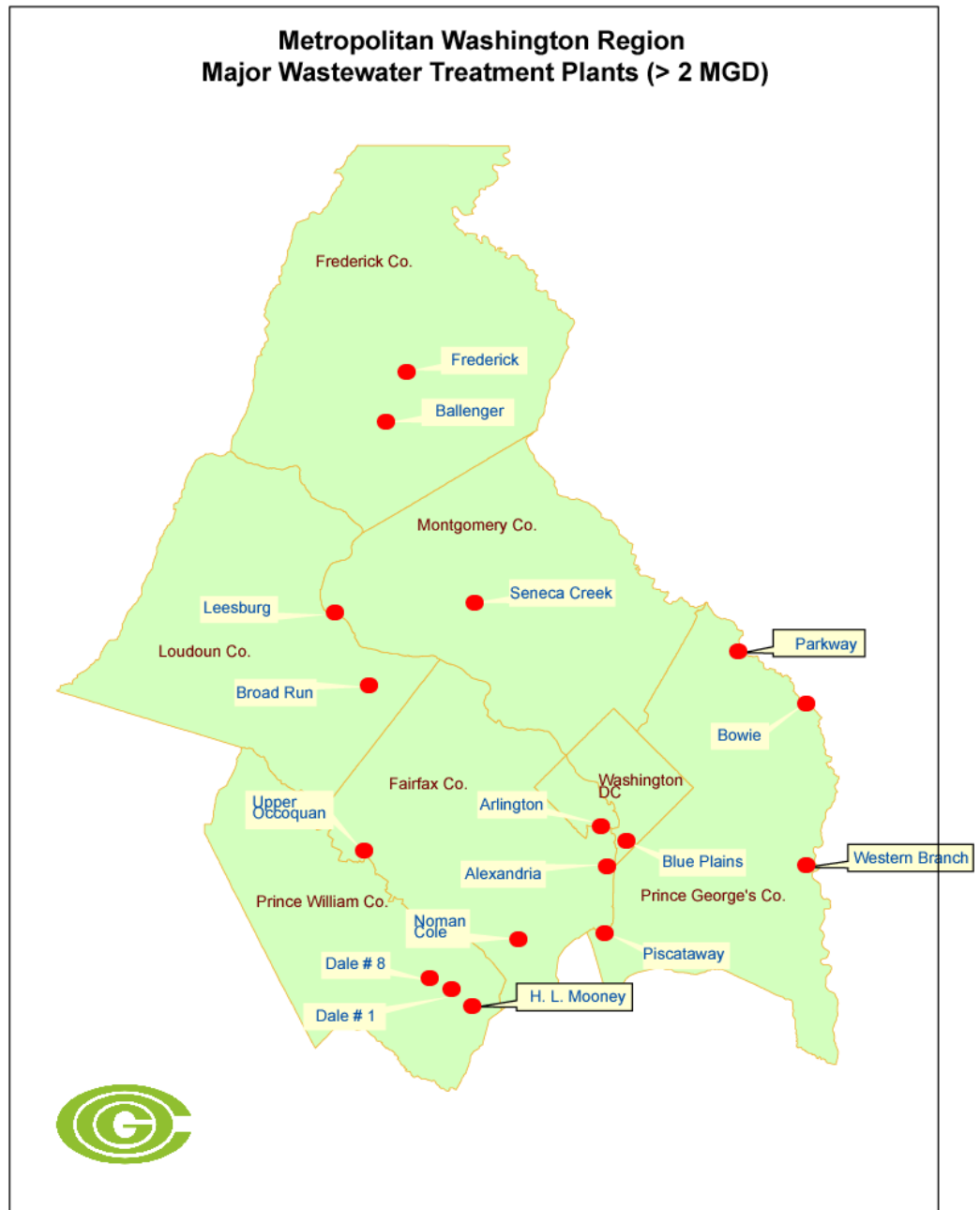
## Wastewater Treatment Leads the Way

In the National Capital Region, fourteen of the major municipal WWTPs discharge treated wastewater effluent into the Potomac Estuary. (The other three major plants discharge to the Patuxent River.) These fourteen Potomac facilities serve more than 4 million people and currently discharge approximately 500 MGD (2008 data). At 370 MGD, the Blue Plains WWTP is the largest advanced WWTP of its type in the world and comprises almost half of the total effluent discharged to the Potomac Estuary from the COG region.

**COG Region Major Wastewater Plants Capacity (MGD)**

- Alexandria – 54
- Arlington – 40
- Ballenger Creek - 6
- Bowie – 3.3
- Blue Plains – 370
- Broad Run – 10
- Dale City #1 – 4
- Dale City #8 – 4
- Frederick – 8
- H.L. Mooney – 18
- Leesburg – 5
- Noman Cole – 67
- Parkway - 30
- Piscataway – 30
- Seneca Creek – 20
- UOSA – 54
- Western Branch - 30

**TOTAL – 753**



Major pollution reduction efforts from wastewater treatment plants began in 1959 with the implementation of secondary treatment at Blue Plains and at other COG region WWTPs from 1960 to 1980. Since the early 1970s, WWTP phosphorus loadings have been reduced approximately 96% as limit of technology phosphorus controls (i.e., to achieve 0.1 milligram/liter (mg/l) total phosphorus) were implemented at all of the major wastewater facilities in the region to reduce nuisance algal blooms, increase oxygen levels, and alleviate other eutrophication problems in the Potomac Estuary. Since the 1990s, technologies to achieve advanced levels of nitrogen removal (i.e., to achieve 8 mg/l of total nitrogen) have also been implemented to address the downstream water quality impacts of nitrogen on the lower Potomac River and the Chesapeake Bay. This has reduced WWTP total nitrogen loads from the COG region's WWTPs to the Potomac River by approximately 44%. Similar loading reductions have also occurred from the COG region's WWTPs in the Patuxent River.

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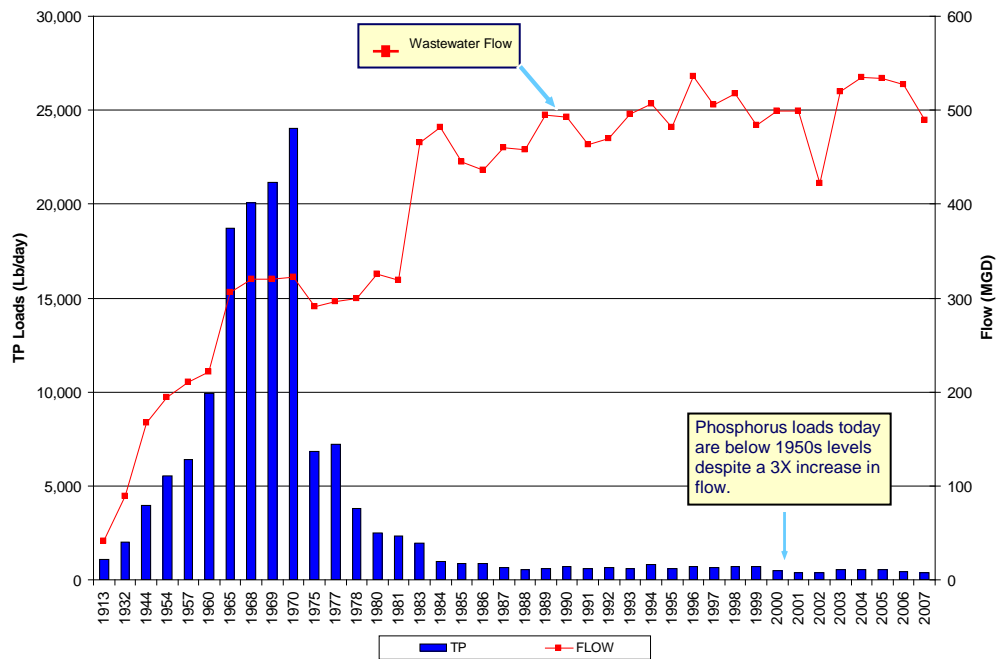
## Enhanced Nutrient Removal

Presently, all of the major wastewater treatment plants in the National Capital Region use a variety of advanced treatment processes equivalent to Biological Nutrient Removal (BNR) to achieve approximately 8 mg/l total nitrogen levels. In the mid-1970's though, it was clear that additional nutrient (phosphorus and nitrogen) reductions would be needed throughout the Chesapeake Bay watershed to address low dissolved oxygen and other water quality impairments in the Bay and its tributaries (e.g., the Potomac River). The COG region's wastewater plants were already treating phosphorus to levels of technology, and by the late 1990's had begun to reduce their nitrogen loads - but it was recognized that additional levels of nitrogen reductions at wastewater treatment plants would be needed to address downstream water quality impacts and help Bay restoration efforts.

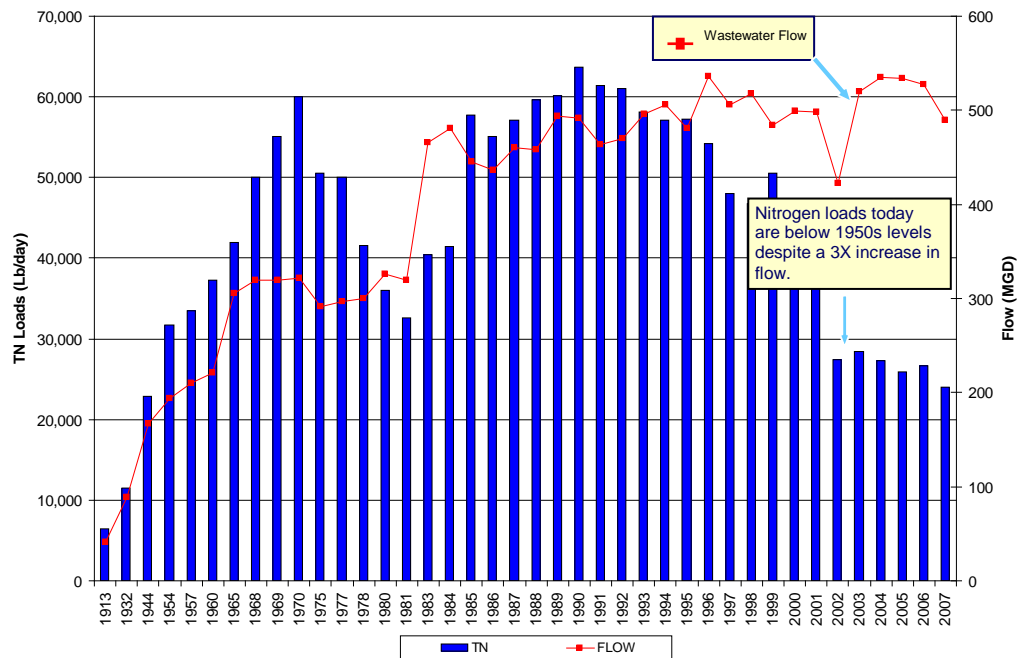
The Chesapeake Bay Program, under the US Environmental Protection Agency (EPA), is currently quantifying the necessary load reduction levels that will be required from all loading sources to the Bay and its tributaries (i.e., agriculture – animal and crop, stormwater, air, septic, and wastewater treatment plants). These reduction requirements will be defined as Total Maximum Daily Load (TMDL) allocations for each state/major river/basin (e.g. Potomac River). These TMDLs (92 in total) will be issued by no later than May 2011. Those allocations will then be sub-allocated through State Implementation Plans (SIPs) (i.e., analogous to Tributary Strategies) and will include specific allocations for all source sectors – including wastewater treatment plants. The nutrient allocations for wastewater plants will be regulated loading caps that cannot be exceeded. As a result, once these caps are reached options such as trading and/or implementation of new even more advanced treatment technologies will be needed in order to allow WWTPs to increase their treatment capacity beyond current levels.

Recognizing the need to achieve these additional nitrogen reductions, COG's local governments and wastewater utilities are moving forward with upgrades to the region's major wastewater treatment plants to implement what is generally referred to as enhanced nutrient removal (ENR) technologies. Using ENR technologies, these plants are expected to reduce nitrogen in their effluents down to about 3 to 4 mg/l total nitrogen - approximately a 50% reduction of already low discharge levels. The cost of these upgrades is estimated to be at least \$1.5 billion.

Annual Total Phosphorus Loads From Regional WWTPs



Annual Total Nitrogen Loads From Regional WWTPs



## Ecological Benefits of Advanced Treatment

Water quality and biological resource data from the Potomac Estuary clearly show a link between significant reductions in wastewater loadings of nutrients and other pollutants, and improvements in the river. Dissolved oxygen, needed by fish and crabs to survive, has historically been depleted by excess nutrients. However, as pollutant loads from the COG region's WWTPs have declined, dissolved oxygen levels in the river have increased to

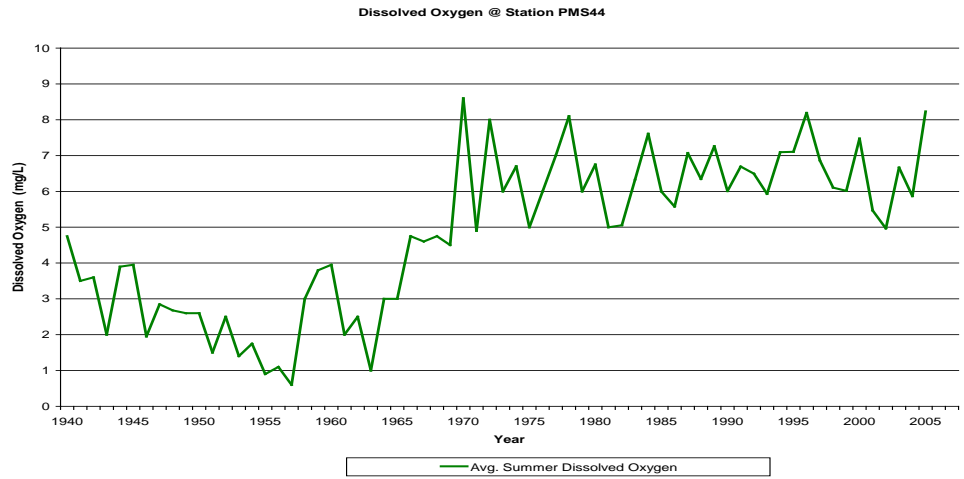
**COG's Members**

- District of Columbia
- Bladensburg
- Bowie
- College Park
- Frederick
- Frederick County
- Gaithersburg
- Greenbelt
- Montgomery County
- Prince George's County
- Rockville
- Takoma Park
- Alexandria
- Arlington County
- Fairfax
- Fairfax County
- Falls Church
- Loudoun County
- Manassas
- Manassas Park
- Prince William County

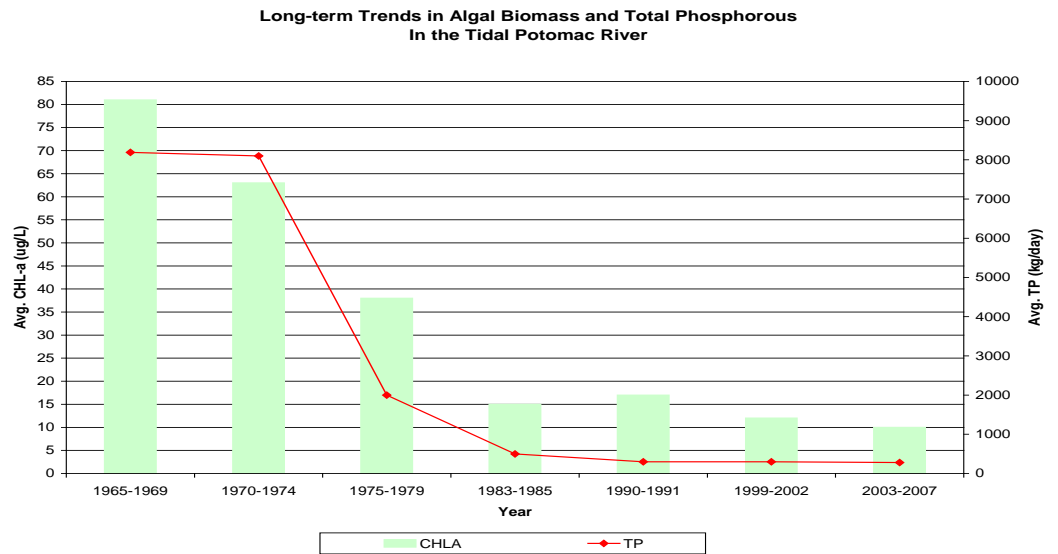
levels that allow the Potomac's aquatic creatures to thrive. For example, the Potomac Estuary now supports one of the top largemouth bass fisheries in the country.

**Long-term trends in summer DO levels on the Potomac River near the Wilson Bridge (mile PMS-44).**

\*Data for 1940-1981 is averaged for June-September from USEPA (STORET) data. Data from 1982-2007 is averaged for July-September from MWCOG.



**Long-term trends in Algal Biomass and Total Phosphorus in the Tidal Potomac River**



Source: MWCOG, 2005; USEPA, 1992.

Observed concentrations of nitrogen have decreased significantly and algal blooms do not have the intensity or the magnitude they once had, primarily because of large phosphorus reductions. A resurgence of submerged aquatic vegetation in the Potomac starting in the 1980s has been directly related to improvements in water clarity resulting from reductions in nutrient and suspended solids loadings from the COG region's WWTPs, and subsequent reductions in ambient algae, phosphorus, and nitrogen (Carter and Rybicki, 1990 and 1994).

## Contact Us

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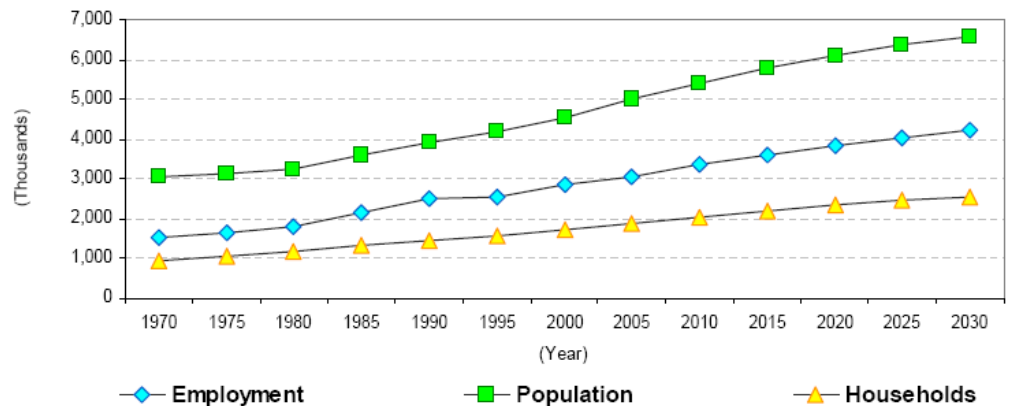
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## Population Trends & Implications

From the 1940s to 2005, the region's population nearly quadrupled with the population reaching an estimated 4.9 million residents. Regional forecasts (as of Round 7.1 data) reveal dramatic increases in employment, households, and population by 2030. Under the intermediate scenario, regional employment would increase 39% from 2005 to 2030. Also, under this scenario, more than 657,000 households would be added during the period 2005 to 2030. Regional population is forecast to increase by about 64,000 persons a year, reaching nearly 6.6 million in 2030. From 2000 to 2030, more than 2 million people will have been added to the region, which are half a million more people than were added during the previous 30-year period. COG's local governments and utilities have made tremendous efforts over the years to reduce water consumption and wastewater flows through the use of water conservation programs, the wide-spread use of water saving appliances and plumbing fixtures, and extensive sewer system rehabilitation projects. Despite these efforts, wastewater flows are expected to increase (although at a somewhat reduced level) as the region's population grows. This will place an even greater demand on the COG region's WWTPs to reduce nutrients and maintain water quality. The Bay TMDLs and its associated loading caps for wastewater plants will also present a clear challenge to growth in the region.

**Historic and Forecast Growth  
Washington DC-MD-VA MSA<sup>1</sup>**



Source: Round 7.1 Cooperative Forecasts  
<sup>1</sup>Based on the 1983 definition of the Washington Metropolitan Statistical Area (MSA)