# Population Projection Methodology for Act 220 State Water Plan


**Department of Environmental Protection**
**Bureau of Safe Drinking Water**
**Division of Planning and Conservation**

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## Background and Purpose

In water resource planning, population data is a key component for estimating water supply demands by sectors served by public water supply as well as estimating water supply demands of those who are self-supplied.

The Department of Environmental Protection (Department) developed population projections at the state, county and municipal levels during the 1970s and 1980s for state water planning purposes and has subsequently maintained census and projections data for use in surface water allocation permitting.

## Census Information

Populations from the Federal Census Bureau for the decades 1990, 2000 and 2010 were used as the basis for projections for the years 2020, 2030 and 2040.

## Development of the Census Based Population Projections

The method used for development of the 2020, 2030 and 2040 based population projections employed the Microsoft Excel® FORECAST function, a least squares trending/regression function.

This FORECAST function was used in the past by the Department. Several years ago this function was chosen after a close inspection of the county total population projections from 1990-based projections *(for years 2010 and 2020)* done by the Pennsylvania State Data Center and comparison to 2000-based state total projections *(for years 2010, 2020 and 2030)* done by the U.S. Census Bureau. These county and state totals were compared to those developed by using the FORECAST function.

In both comparisons, the FORECAST function projection method produced acceptable results. The spreadsheet procedure is described in more detail below.

## Spreadsheet Method

1) The 1990, 2000 and 2010 municipal census population figures were entered into a spreadsheet.

2) The projections used the three most recent decades as a basis. These three decades were weighted 1:2:2, respectively, so the 2020 projections were based on the following population census figures: *1990, 2000, 2000, 2010 and 2020*.

3) Columns for *1990, 2000, 2000, 2010 and 2010* were developed in the spreadsheet. The Excel® FORECAST function was used to create the regression curve. The following is an illustration of the 2010 projection:

=FORECAST(2020,$H3:$L3,$H$1:$L$1)

Where $H3:$K3 represents the Y-axis being the five municipal population figures for respective decades *1990, 2000, 2000, 2010 and 2010.*

Where $H$1:L$1 represents the X-axis being the actual decades in question: *1990, 2000, 2000, 2010 and 2010.*

4) Projections for decade 2030 were made by changing the input decade populations to *2000, 2010, 2010, 2020 and 2020.*

5) Projections for decade 2040 were made by changing the base decade populations to *2010, 2020, 2020, 2030 and 2030.*

6) The Department recognized that this method may falsely predict the same rate of growth or decline into the future. Municipalities with past large growth or decline rates tended to skew future predictions To deal with this outlier dilemma, a formula was used in conjunction with the FORECAST function to limit growth or decline rates to a maximum of 15% a year and a minimum of -9% per year. The following is an illustration of the limit formula.

=IF(W3>=0.15,L3/0.85,IF(W3<=-0.09,L3*0.91,IF(W3<0.14,S3,IF(W3>-0.08,S3))))

This formula was applied to future prediction for the years 2020 and 2030.

7) The Department applied this prediction method to past census numbers to explore if an accurate prediction for the known 2010 census numbers could be made. The results confirmed that the use of the FORECAST function in conjunction with the 15% upper and -9% minimum decline yielded and accurate prediction for the known 2010 census.

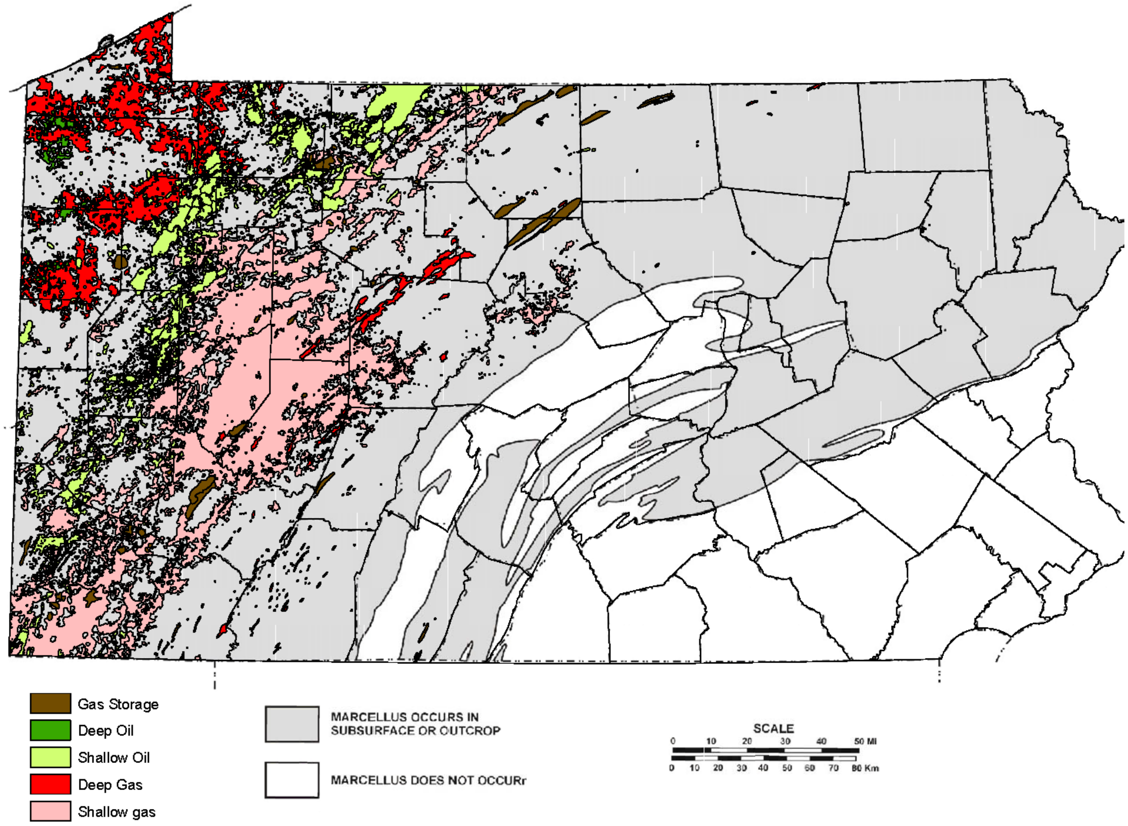
**<u>Significant Trends That May Alter Population Projections</u>**

The Department also explored current events that could alter present and future population growth trends. The impact of Marcellus Shale exploration and the economic impact on population growth was considered. The largest Marcellus shale’s drilling counties include:

Bradford
Washington
Green
Tioga
Susquehanna

Lycoming
Fayette
Westmoreland
Armstrong
Butler

OCCURRENCE OF MARCELLUS FORMATION IN PENNSYLVANIA




There are well-documented reports of strong economic activity in these counties. Motel rooms and campground space is hard to reserve. Surplus housing stock is being consumed. The Department also examined labor force data from Washington County and Bradford County, Pennsylvania, and found only very minor changes in total labor force change.

The Department also examined a study by Thomas Kinnaman from Bucknell University. The study title was "The Economic Impact of Shale Gas Extraction: A Review of Exciting Studies". The Department also spoke with staff from Penn State University's Marcellus Shale Outreach Center. After examining this data, the Department concluded that while the economic impact of natural gas development is positive, the Department is unable to recognize an impact on population trends at this time.

The Department recognized the need for local planning offices to review and comment on the Department's projections. The Department spoke with the York, Lancaster, Lycoming and Monroe County Planning Commissions. The Department also spoke with staff from the University of Pittsburgh concerning southwestern Pennsylvania population projections.

## Final Adjusted Projections

The Department manually adjusted the population numbers slightly upward from the prediction for the cities of Pittsburgh and Philadelphia. This was done after consultation with University of Pittsburgh and a more detailed review of Philadelphia population data.