Prepared in cooperation with the

New York State Energy Research and Development Authority
The Nature Conservancy

A New Tool for Estimating Daily Mean Streamflow Statistics at Rural Streams in New York State, excluding Long Island

These data can be used to assist with permitting water withdrawals, implementing habitat protection, estimating contaminant loads, or determining the potential impact from chemical spills.

Introduction

Streamflow statistics are essential for many applications, such as, bridge design, the equitable allocation of water among competing needs (human and ecological), and understanding the effects of land-use, water-use and climate change on water resources. Long-term (greater than 10 years) streamflow records provide water-resource managers, policymakers, scientists and engineers with the data necessary to calculate reliable streamflow statistics, for example, the probability of occurrence for a given streamflow.

Streamgages typically monitor streamflow at a single location along a stream reach (fig. 1). This limitation restricts the applicability of streamflow statistics to the vicinity around an existing streamgage. Operation and maintenance of a streamgage requires a qualified hydrographer with years of training and experience, is labor intensive, costly and, at times, dangerous; therefore, it is impractical to have a streamgage at each-and-every location where streamflow statistics may be needed. Currently (2012), the U.S. Geological Survey (USGS) New York Water Science Center (NY WSC) operates and maintains a network of about 240 streamgages as part of the larger National network of over 7,000 streamgages (Norris, 2010). Streamflow at USGS streamgages are collected using nationally consistent methods (Rantz and others, 1982; Turnipseed and Sauer, 2010).

For stream reaches without an existing streamgage (referred to as ungaged), streamflow statistics can be estimated by applying conventional graphical and (or) statistical techniques based on data from nearby streamgages. In many cases, the complete time series of streamflow is needed for making well-informed water-management decisions and (or) scientific conclusions. For these reasons, a scientifically sound, decision-support tool is needed to provide reliable streamflow information for ungaged basins. To address this need, the USGS, in cooperation with New York State Energy Research and Development Authority (NYSERDA) and The Nature Conservancy (TNC), is developing the New York Streamflow Estimation tool (NYSET). This program will enable users to estimate daily-mean streamflow (statistics) at ungaged locations and evaluate hydrologic impacts of withdrawals for various water-uses. These data can be used to assist with permitting water withdrawals, implementing habitat protection, estimating contaminant loads, or determining the potential impact from chemical spills.

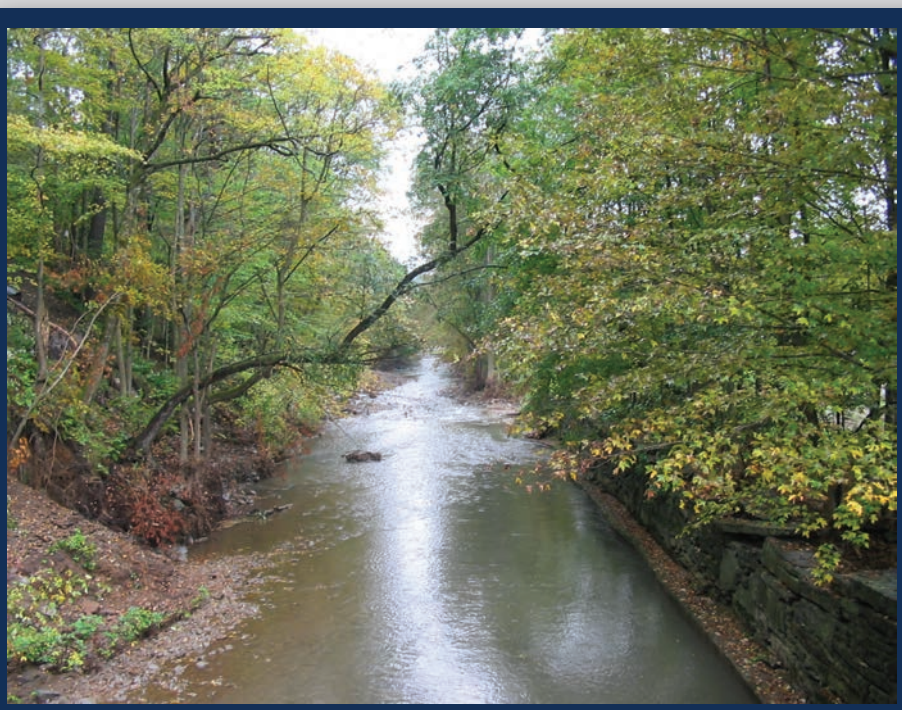

Figure 1. Gaged stream reach at U.S. Geological Survey station number 01422747 East Brook east of Walton, NY

New York Streamflow Estimation Tool

NYSET will produce an estimated daily-mean streamflow each day for the period Oct. 1, 1960 – Sep. 30, 2010 at any user-selected point on nearly all streams in New York, excluding Long Island. To do

this, the user must first, using StreamStats, select a point on a stream, tabulate physical and climate characteristics for the basin draining through that point, and export an electronic file summarizing this information. The electronic file can then be uploaded to NYSET where a streamflow probability curve (flow-duration curve) will be constructed. This is done by applying multiple linear regression equations developed to relate basin characteristics to streamflow probability for USGS streamgages included in this study (fig. 2). A reference streamgage within the existing network will be identified by NYSET to calibrate the estimates based on the correlation of daily-mean streamflow probabilities with the user-selected, ungaged basin (Archfield and Vogel, 2010; Archfield and others, 2010). With this information, daily-mean streamflow can be estimated for the historical period at the user-selected ungaged basin. Daily-mean streamflow statistics can be estimated from the historical daily-mean streamflow database, Finally, the user will have the ability to include individual and cumulative water withdrawals to effectively evaluate their impacts on long-term flow scenarios. For example, the effects of a proposed water withdrawal on daily-mean streamflow can be simulated for a selected river reach.

NYSET is planned to be publicly accessible in 2014 with a user-friendly interface incorporating USGS StreamStats and a spreadsheet software package. When complete, NYSET will provide a powerful means to quickly calculate daily-streamflow statistics, estimate altered and unaltered baseline hydrographs, and evaluate various user-specified water use scenarios at ungaged rural sites in New York, excluding Long Island. A USGS report to document the resulting tool will be published, a website will be developed for public access and a series of public outreach forums will be held. The forums will help educate the public about the new tool and how its use can support a proactive approach in protecting drinking water supplies and natural aquatic habitats within New York. It is important to remember that the foundation for NYSET is long-term, high quality USGS streamgage data collected for more than a century. The number and location of long-term USGS streamgages is the primary limiting factor to the accuracy of streamflow information estimated by NYSET. A number of strategically located streamgages with sufficient record length and quality facilitates the continual improvement of estimated streamflow statistics produced by NYSET or similar tools.

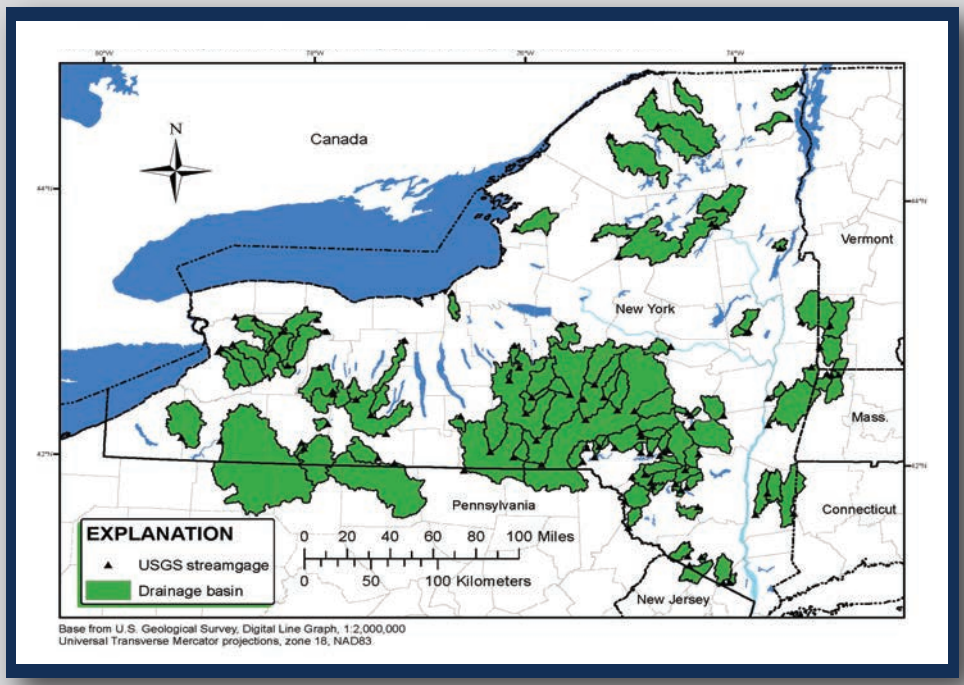

Figure 2. Locations of U.S. Geological Survey (USGS) streamgages and drainage basins used in this study

Related Publications

Archfield, S.A., Vogel, R.M., Steeves, P.A., Brandt, S.L., Weiskel, P.K., and Garabedian, S.P., 2010, The Massachusetts Sustainable-Yield Estimator: A decision-support tool to assess water availability at ungaged stream locations in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2009–5227, 41 p. plus CD-ROM. http://pubs.usgs.gov/sir/2009/5227/pdf/sir2009-5227-508.pdf

Archfield, S. A., and R. M. Vogel, 2010, Map correlation method: Selection of a reference streamgage to estimate daily streamflow at ungaged catchments, Water Resour. Res., 46, W10513, doi:10.1029/2009WR008481 http://www.agu.org/journals/wr/wr1010/2009WR008481/

Norris, J.M., 2010, U.S. Geological Survey streamgage operation and maintenance cost evaluation: U.S. Geological Survey Fact Sheet 2010-3025, 2 p. http://pubs.usgs.gov/fs/2010/3025/

Rantz, S. E. and others, Measurement and Computation of Streamflow, Volume 1. Measurement of Stage and Discharge and Volume 2. Computation of Discharge, U.S. Geological Survey, Water Supply Paper 2175, 631 p. http://pubs.usgs.gov/wsp/wsp2175/index.html

Turnipseed, D.P., and Sauer, V.B., 2010, Discharge measurements at gaging stations: U.S. Geological Survey Techniques and Methods book 3, chap. A8, 87 p. http://pubs.usgs.gov/tm/tm3-a8/

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