



STREAM NOTES

To Aid In Securing Favorable Conditions of Water Flows

Rocky Mountain Research Station

January 2006

Sediment and Water-Quality Sampling Equipment Information

The Federal Interagency Sedimentation Project (FISP) recently published a document, *A Guide to the Proper Selection and Use of Federally Approved Sediment and Water-Quality Samplers*, summarizing existing FISP approved suspended-sediment, bedload, bed-material, and water-quality sampling equipment. The document provides guidance for selecting the appropriate sampling equipment based on flow and site conditions along with general descriptions of the various samplers (Davis, 2005).

For those involved in sediment and water-quality sampling, the report provides useful flow-charts for guiding the user to select the appropriate FISP approved sampling equipment (figures 1 and 2). The flow-chart decision process is primarily based on stream depth and whether samplers in non-wadeable streams are operated by a hand line or a cable and reel system. When using the flow charts, the most extreme flow depths anticipated during sampling should be used. For efficient suspended-sediment and water-quality sampling, the minimum and maximum stream velocity also needs to be

considered when selecting the sampler because the intake nozzle velocity needs to be equal to the incident stream velocity at the nozzle entrance.

The report provides an excellent discussion on the operating parameters and limitations of each of the samplers listed in figures 1 and 2 along with key references (e.g., Edwards and Glysson, 1999) for learning how to properly use the samplers.

Copies of FISP Report QQ, *A Guide to the Proper Selection and Use of Federally Approved Sediment and Water-Quality Samplers*, can be downloaded at the FISP website, <http://fisp.wes.army.mil/Reports-Index.htm>. Additionally, many of the operator manuals listed in figures 1 and 2 can be download from the FISP website.

FISP was created in 1939 to unify and standardize research activities of Federal Agencies involved in sediment sampling activities. The mission of FISP is to provide, identify, and evaluate sampling equipment and techniques for accurate, standardized, calibrated, cost-efficient, and safe measurement and analysis of sediment and water quality. Federal Agencies that

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The **PRIMARY AIM** is to exchange technical ideas and transfer technology among scientists working with wildland stream systems.

CONTRIBUTIONS are voluntary and will be accepted at any time. They should be typewritten, single-spaced, and limited to two pages. Graphics and tables are encouraged.

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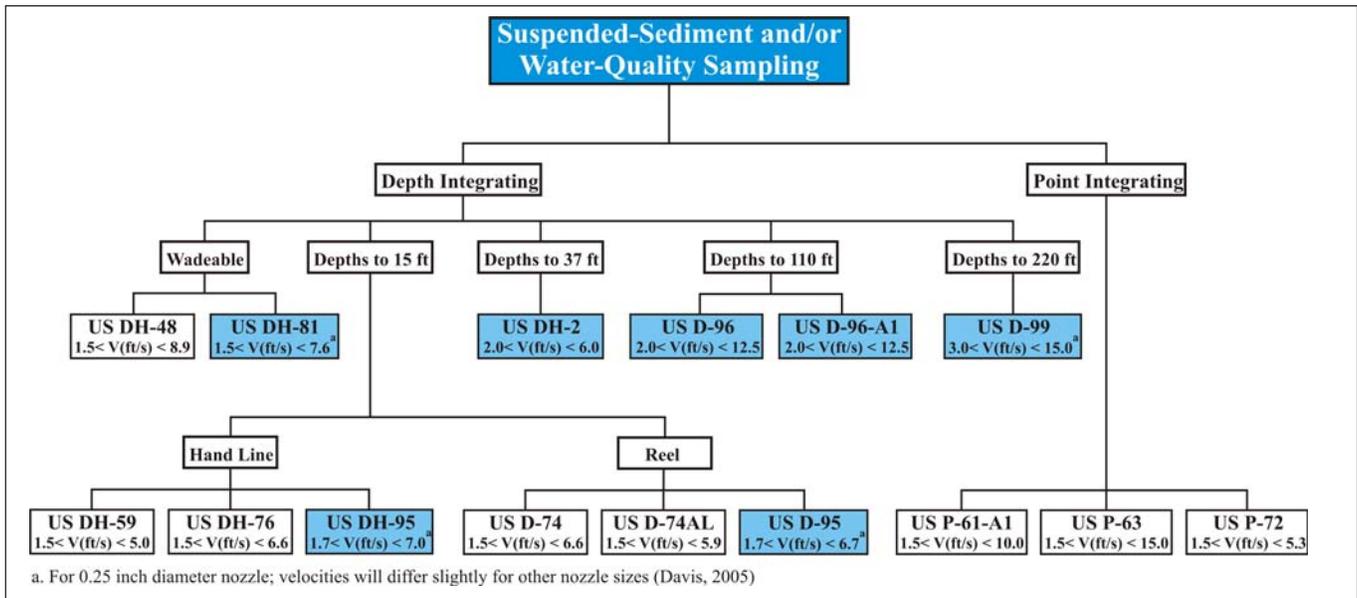


Figure 1. Flow chart for selecting suspended-sediment and water-quality sampling equipment based on point or depth integrating sampling, flow depth, and velocity ranges. The samplers with a shaded background can be used to collect suspended-sediment or water-quality samples. Samplers with a non-shaded background can only be used to collect suspended-sediment samples. Flow chart modified from Davis (2005).

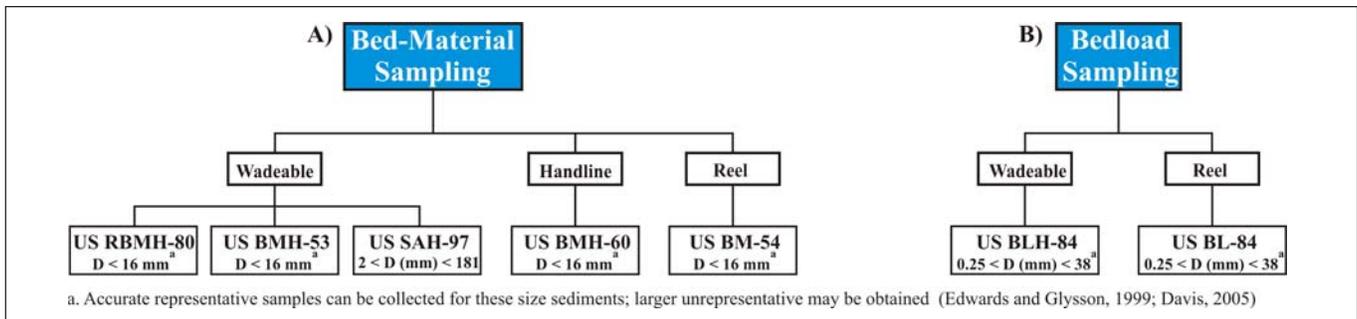


Figure 2. A) Flow chart for selecting bed-material sampling equipment based on the technique used to collect the sample. B) Flow chart for selecting bedload sampling equipment based on the technique used to collect the sample. Flow chart modified from Davis (2005).

sponsor and support FISP include the USDA Agriculture Research Service, U.S. Army Corps of Engineers, U.S. Bureau of Land Management, U.S. Bureau of Reclamation, U.S. Environmental Protection Agency, USDA Forest Service, and U.S. Geological Survey.

It should be noted that there are other suspended-sediment, bedload (e.g., Helley-Smith, bedload traps, etc.), and bed-material sampling equipment (e.g., McNeil Sediment Core Sampler, USFS Freeze Core Bed Material Sampler, etc.) that are not listed in figures 1 and 2 or mentioned in the document, but have been utilized by scientists in various studies. Samplers not listed by FISP should not be considered inferior or inadequate to those listed in figures 1 and 2, but simply

indicate they have not been tested for calibration and accuracy by FISP.

References

- Davis, B.E., 2005, A Guide to the Proper Selection and Use of Federally Approved Sediment and Water-Quality Samplers, Report QQ, Federal Interagency Sedimentation Project, 35 p. Document is available at <http://fisp.wes.army.mil/Reports-Index.htm>.
- Edwards, T.K., and Glysson, G.D., 1999, Field Methods for Measurement of Fluvial Sediment, U.S. Geological Survey Techniques of Water Resources Investigations, book 3 chapter C2, 89 p. Document is available at <http://water.usgs.gov/pubs/twri/>.



StreamStats: Map-based Web Application to Obtain Flow Data at Ungaged Streams

The United States Geological Survey (USGS) has been involved with the collection and dissemination of streamflow data for over 100 years to help communities and agencies plan, manage, and protect water resources. Most people are familiar with and have used the USGS Office of Surface Water web site (<http://water.usgs.gov/osw/>) to obtain a wide-range of streamflow and sediment data, water-related publications, and software produced and developed by the agency.

The magnitude, frequency, and duration of flows are often needed by hydrologists, engineers, and water-resource managers for a variety of purposes such as the design of infrastructure in and near streams, delineation and management of flood-hazard areas, channel and habitat restoration, instream-flow quantification, water rights,

and water-supply planning. For each State and some Territories of the United States, the USGS has developed equations for predicting the magnitude and frequency of flood peak discharges at ungaged streams based on basin attributes. For a few States, the USGS has also developed equations for predicting flow duration exceedence discharges. To develop these predictive equations for ungaged streams, multiple-regression analyses are performed on specific streamflow statistics and basin characteristics from gaged streams. The techniques and analyses used to develop the predictive discharge equations for ungaged streams along with the reliability and limitations of the equations can be found in USGS Water Resources-Investigations Reports published for each State. In 1994, the USGS released the National

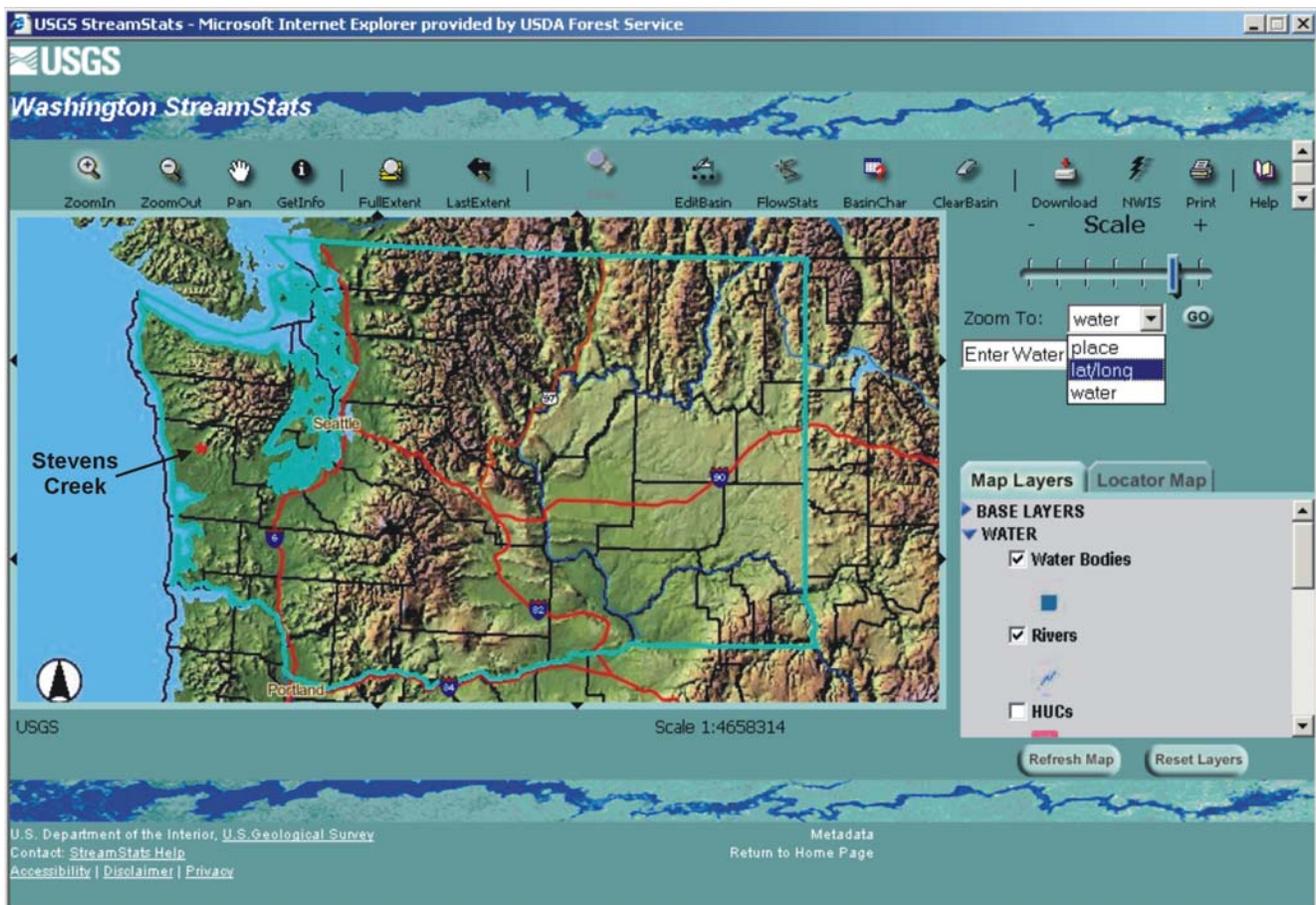


Figure 1. A screen shot of the StreamStats map-based interface for Washington. The star symbol identifies the location of the Stevens Creek watershed, Olympic National Forest, WA.



- 4) An automated process that takes the measured drainage basin characteristics for the user-selected ungaged stream and calculates the equations used to predict the various streamflow statistics.

The StreamStats map-based interface (figure 1) allows the user to navigate to areas of the map by 1) zooming in and out to locate the site of interest at different scales, or 2) zooming to a named place, named water feature, or a specified latitude and longitude using the “Zoom To” pull down menu. The Map Layers Frame allows users to display features such as roads, highways, 7.5 minute quadrangle boundaries, water bodies, county boundaries, cities, hydrological unit code (HUC) boundaries, and gage stations. Topographic and physical features displayed on the map are scale dependent making it relatively easy to navigate to different areas on the map and to select gaged and ungaged site locations of interest (figure 3).

The various buttons at the top of the Map Frame allow users to query information on features for selected map layers, delineate drainage basin boundaries for ungaged streams, edit the boundaries of the delineated basin, obtain streamflow statistics for the delineated ungaged stream, obtain drainage basin characteristic data for the delineated ungaged stream, retrieve USGS stream gage data and information from the National Water Information System (NWIS), download Environmental Systems Research Institute, Inc. (ESRI) shape files, and print the displayed map.

One of the many excellent features of StreamStats is its ability to plot active and inactive USGS gage stations, making it easier for users to identify the location of gage stations in a given area. The gage stations displayed on the map are linked to the USGS database containing streamflow data, streamflow

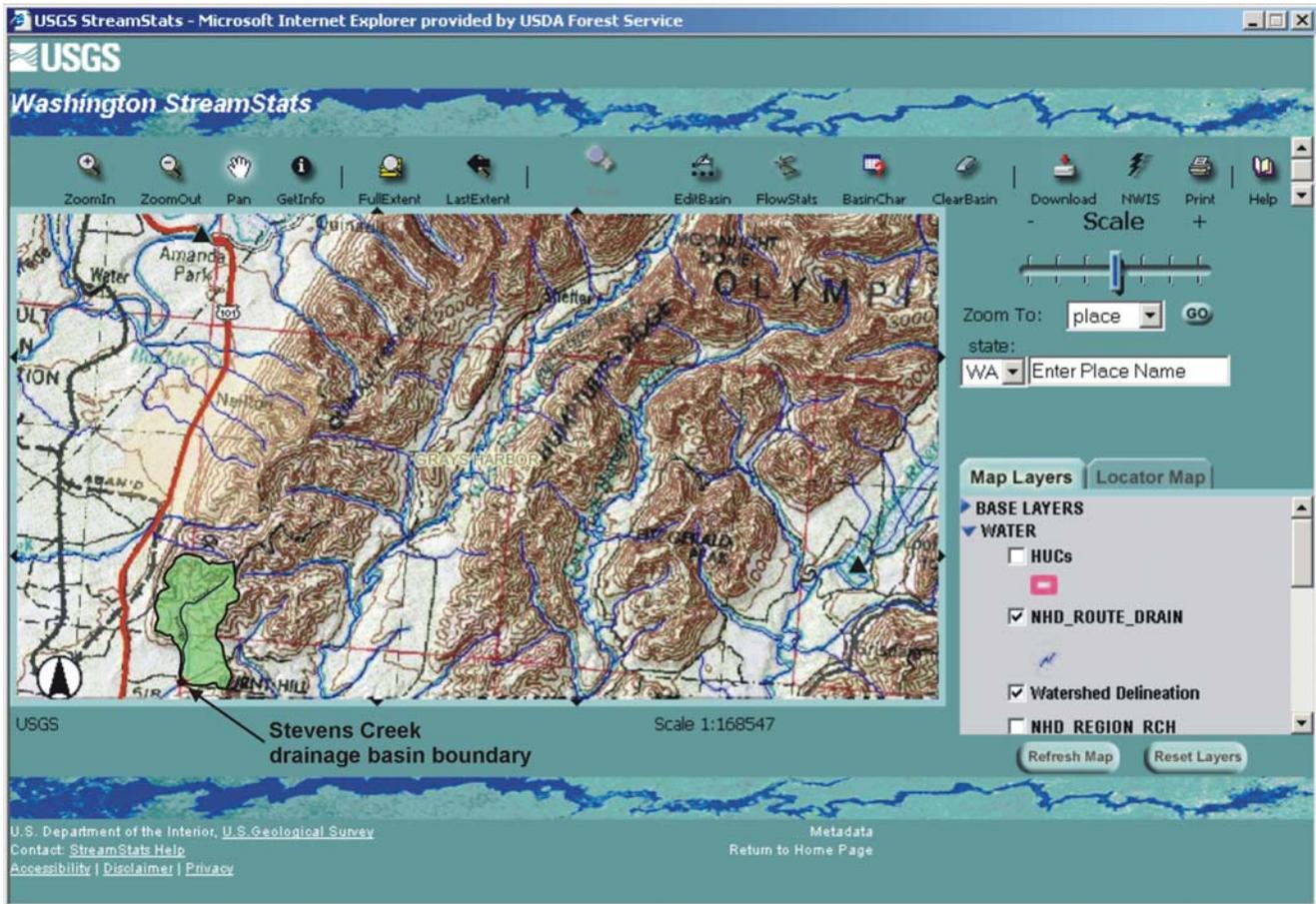


Figure 3. Screen shot showing more detailed topographic and physical features as one zooms in on the area of interest. The Stevens Creek watershed on the Olympic National Forest, WA has been outlined to better highlight its location. USGS gage station locations in the area are identified by darkened triangles.



Table 1. A list of drainage basin characteristics used to calculate streamflow statistics in Idaho, Vermont, and Washington.

Drainage Basin Characteristics	Peak Flow Discharge Estimates			Flow Duration Discharge Estimates	
	Idaho	Vermont	Washington	Idaho ^a	Vermont ^b
Drainage area	X	X	X	X	X
Mean annual precipitation	X		X	X	X
Mean basin elevation	X			X	
Basin relief				X	
Basin slope	X			X	
Main channel slope				X	
Percent forested area	X			X	
Percent area of slopes greater than 30%	X	X		X	X
Percent area of north facing slopes greater than 30%	X				
Percent area covered by lakes		X			
Northing of drainage basin centroid		X			

a. Mean daily discharges exceeded the 20th, 50th, and 80th percent of the time for each month.

b. Mean daily discharges exceeded the 25th, 50th, and 75th percent of the time.

statistics, and site information. The user simply needs to click on the “NWIS” button followed by a click on the USGS gage station of interest to directly link to the NWIS database storing the streamflow data, streamflow statistics, and site information for the station.

The type of drainage basin data needed for using the equations to predict streamflow statistics varies from State to State (table 1). Some of the drainage basin parameters are quite time intensive to collect and potentially inaccurately determined because of the user’s inexperience and/or ability to collect the measurements. The ability of StreamStats to determine multiple drainage basin data in tens of seconds from a user selected location is impressive. Moreover, it provides a more accurate and consistent process for determining the necessary drainage basin variables.

To obtain the drainage basin data, the user needs to be zoomed into a scale less than 1:24,000 or the “BasinDelineation” button will not be activated. After clicking on the “BasinDelineation” button and clicking on the point in the stream to be measured, the StreamStats application delineates the drainage basin boundary (figure 4). A pop-up window warns the user to check the delineated drainage basin for accuracy before the clicking on the “FlowStats” or “BasinChar” buttons. The StreamStats application allows the user

to edit the delineated basin so that is more accurately delineated. Simply click on the “EditBasin” button and remove or add areas to the existing delineated drainage basin boundary.

When the “FlowStats” button is clicked, the StreamStats application determines the drainage basin characteristics needed as input into the equations for predicting streamflow statistics. The drainage basin data are then automatically loaded into the NFF program that interfaces with StreamStats to calculate the streamflow statistics for the ungaged stream. The estimated streamflow statistics, standard errors associated with the streamflow statistics, drainage basin characteristics, and the range of values for a given drainage basin variable used to develop the predictive equations for the selected site will appear in a pop-up Web Browser window (figure 5).

For the most part, the StreamStats application is quite impressive and easy to use, but there are a couple of items that would improve the application. First, the Map Frame window is small and cannot be expanded in the Internet Explorer Web-browser to display more of the map. This makes navigating the map to specific locations at small scales somewhat difficult. Second, the Map Frame does not allow the user to manually select the map scale, instead, map scale is determined to the degree to which the user zooms in or zooms out of the map. Third, edits made to



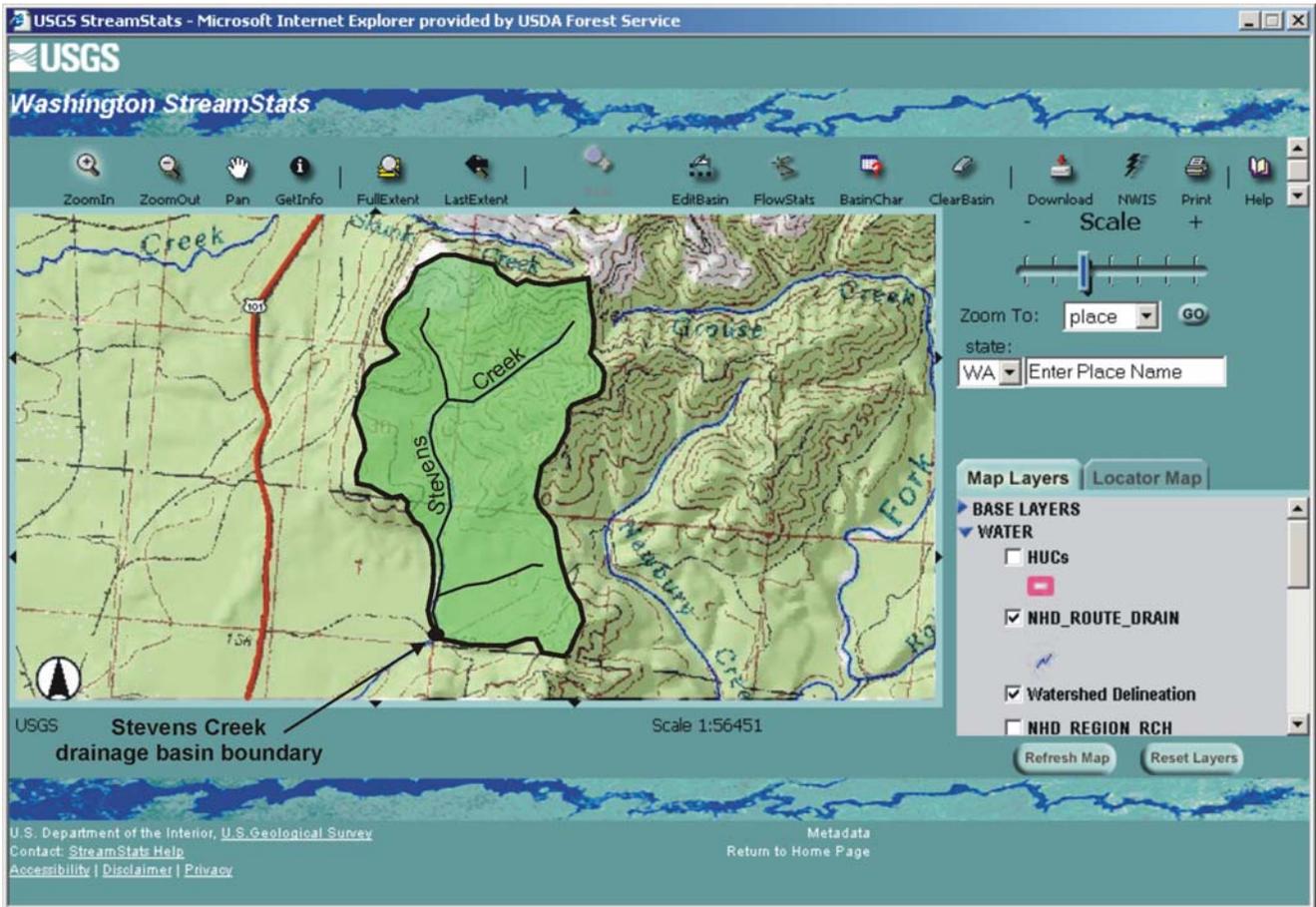


Figure 4. Screen shot showing the delineated drainage basin boundary of Stevens Creek on the Olympic National Forest, WA. The Stevens Creek drainage basin has been outlined to better highlight its location.

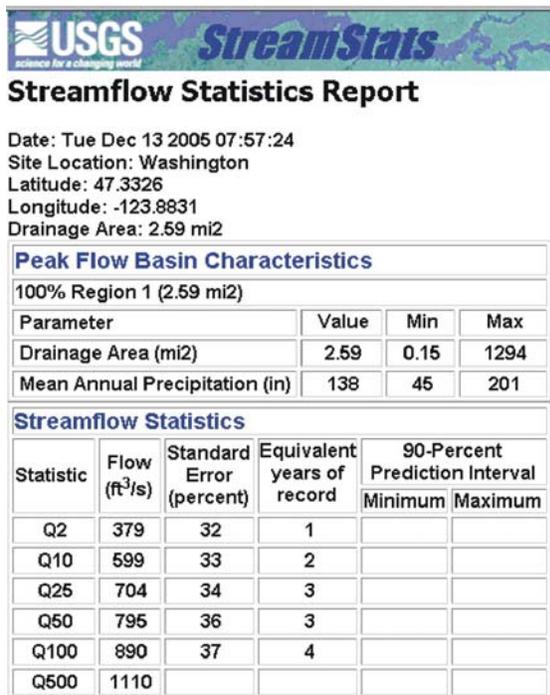


Figure 5. Screen shot showing the streamflow statistics report for Stevens Creek, Olympic National Forest, WA.

the original drainage basin boundary are not saved preventing the user from reviewing their changes.

With these minor criticisms aside, StreamStats is a powerful and excellent tool for those needing streamflow statistics at ungaged streams and for spatially identifying USGS gage stations in an area. Those working in Idaho, Vermont, and Washington are fortunate to have such a tool at their disposal.

References

- Ries III, K.G., Steeves, P.A., Coles, J.D., Rea, A.H., and Stewart, D.W., 2004, StreamStats: A U.S. Geological Survey Web Application for Stream Information, U.S. Geological Survey Fact Sheet FS 2004-3115, 4 p.
- Ries III, K.G. and Crouse, M.Y., 2002, The National Flood Frequency Program, version 3.2: A computer program for estimating magnitude and frequency of floods for ungaged sites, U.S. Geological Survey Water-Resources Investigations Report 02-4168, 42 p.



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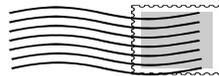
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Mailing List Update



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Feel free to contact Dan Cenderelli (970-295-5984) to discuss ideas for contributions. Or submit typed, single-spaced contributions limited to 2 pages to Dan Cenderelli at dcenderelli@fs.fed.us in electronic format. If possible, include graphics and photos that help explain ideas.

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