StreamStats: A Web-Based Tool for Estimating Streamflow Statistics

by

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General description of StreamStats

- Web application for stream-flow statistics and basin characteristics
- GIS-like interface
- Provides access to GIS data and methods
- Gage site and ungaged site procedures
- Provides fast, consistent, reproducible results

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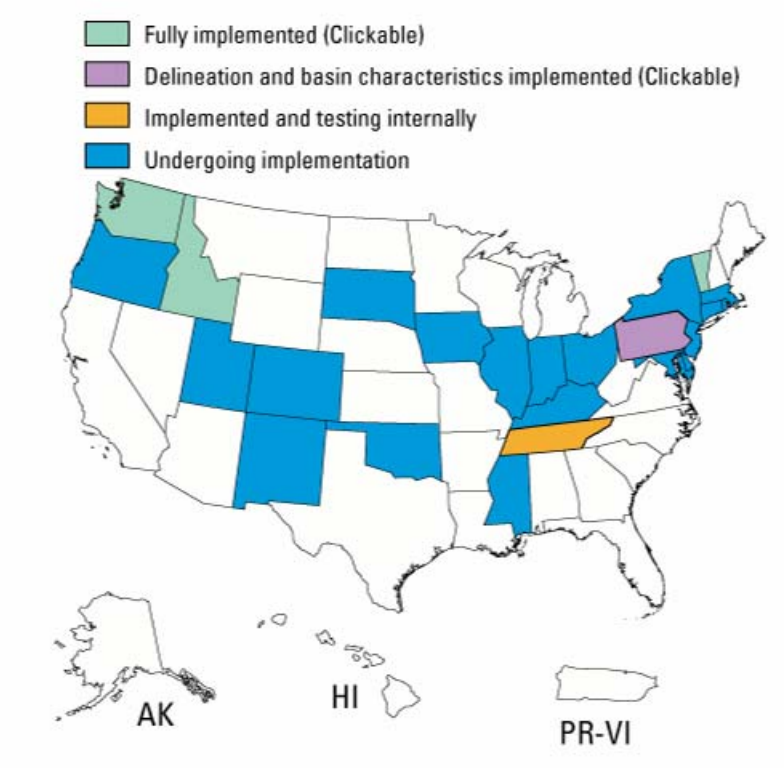
StreamStats is a National Project

- 4 states up and running
- 10 more states plan to start up in FY06
- Each state is developed (and funded) separately



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Overview—Streamflow Statistics

- What—Estimate of streamflow under some condition, e.g. the 100-year flood flow
- Why—Engineering design flows for structures; many other applications
- How Computed—
  - At stream gages: statistical analysis of historic flows
  - Ungaged sites: Regression equations

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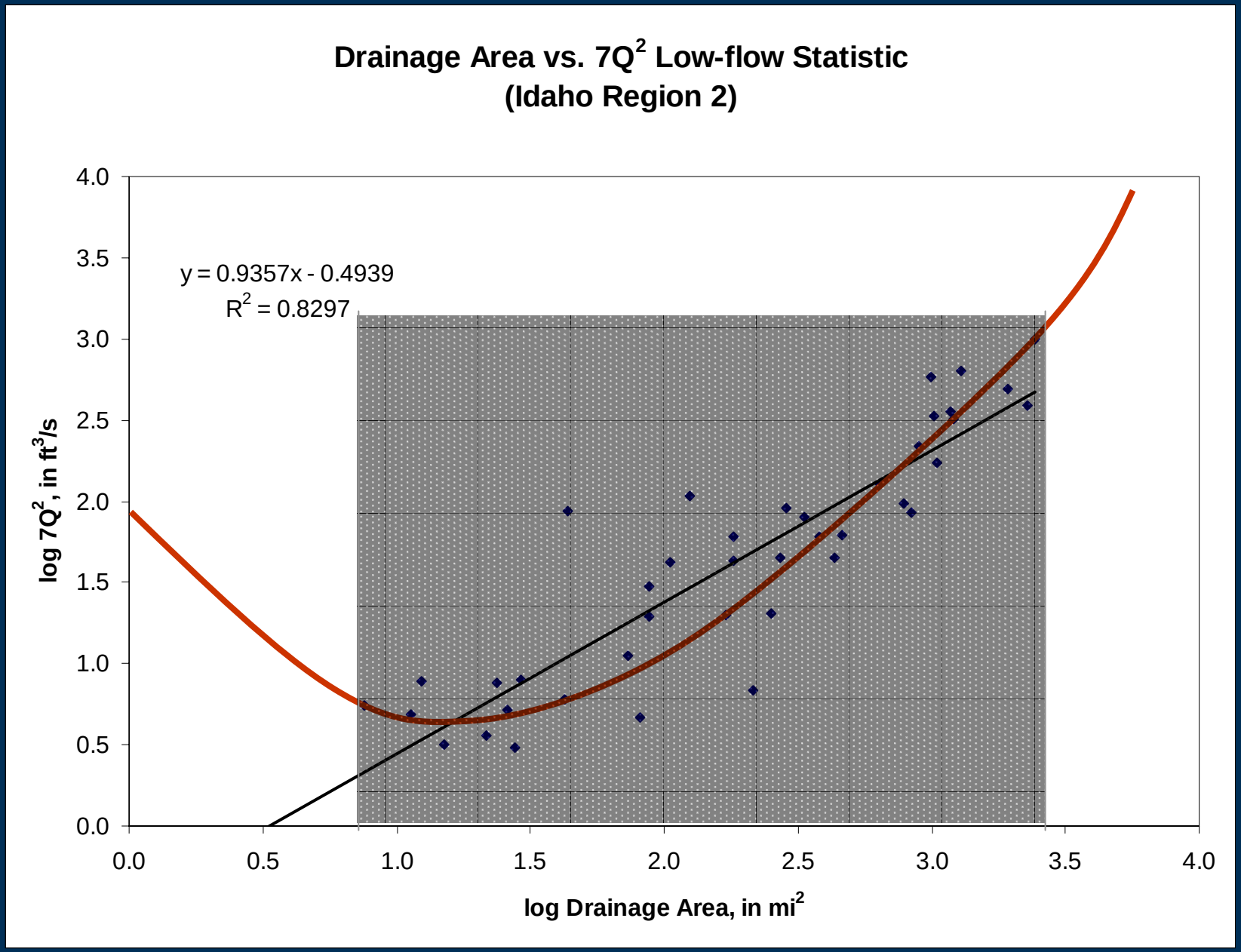
Drainage Area vs. 7Q2 Low-flow Statistic
(Idaho Region 2)
y = 0.9357x - 0.4939
R2 = 0.8297
log 7Q2, in ft3/s
log Drainage Area, in mi2
4.0
3.5
3.0
2.5
2.0
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Streamflow Regression Equations

- Regression equations take the form:

  $$Q_{100} = 758A^{0.643}P^{0.286} \text{ (Wong, 1994)}$$

- Drainage area is used in nearly all equations
- Other common variables include:
  - Basin slope, relief, or mean elevation
  - Precipitation (mean annual; 2-year, 24-hour)
  - Stream length or slope
  - Land use (forest area, wetland and water areas)
  - Basin shape or orientation
  - Soils or surficial geology

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The benefit of GIS-based tools

- Cost—Reduce time to delineate and compute basin characteristics from hours to minutes
- Accuracy—Some measurements much better, others about the same as manual methods
- Consistency—Important for statistical validity
- Reproducibility—Different users will get same results
- Web-based tool provides broad access to:
  - Large geospatial data bases
  - Consistent methods and data

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Some Caveats:

- Estimates are for natural streamflows, NOT
  - Regulated flows, significant diversions/return flows
  - Gaining/losing reaches, non-typical ground-water influence
- Estimates are not valid for extrapolation outside limits of the regression input data (given in report)
- No long-term climate change assumed

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Application Examples

- Engineering Design—Bridges, culverts, flood-plain management
- Water and Land Management—Water rights adjudication, in-stream flows, fish passage/habitat studies
- Water Quality Regulation—Low flows, perennial vs. intermittent streams (TMDL's, NPDES Permits)
- Sampling Network Design—Cover a range of desired flows

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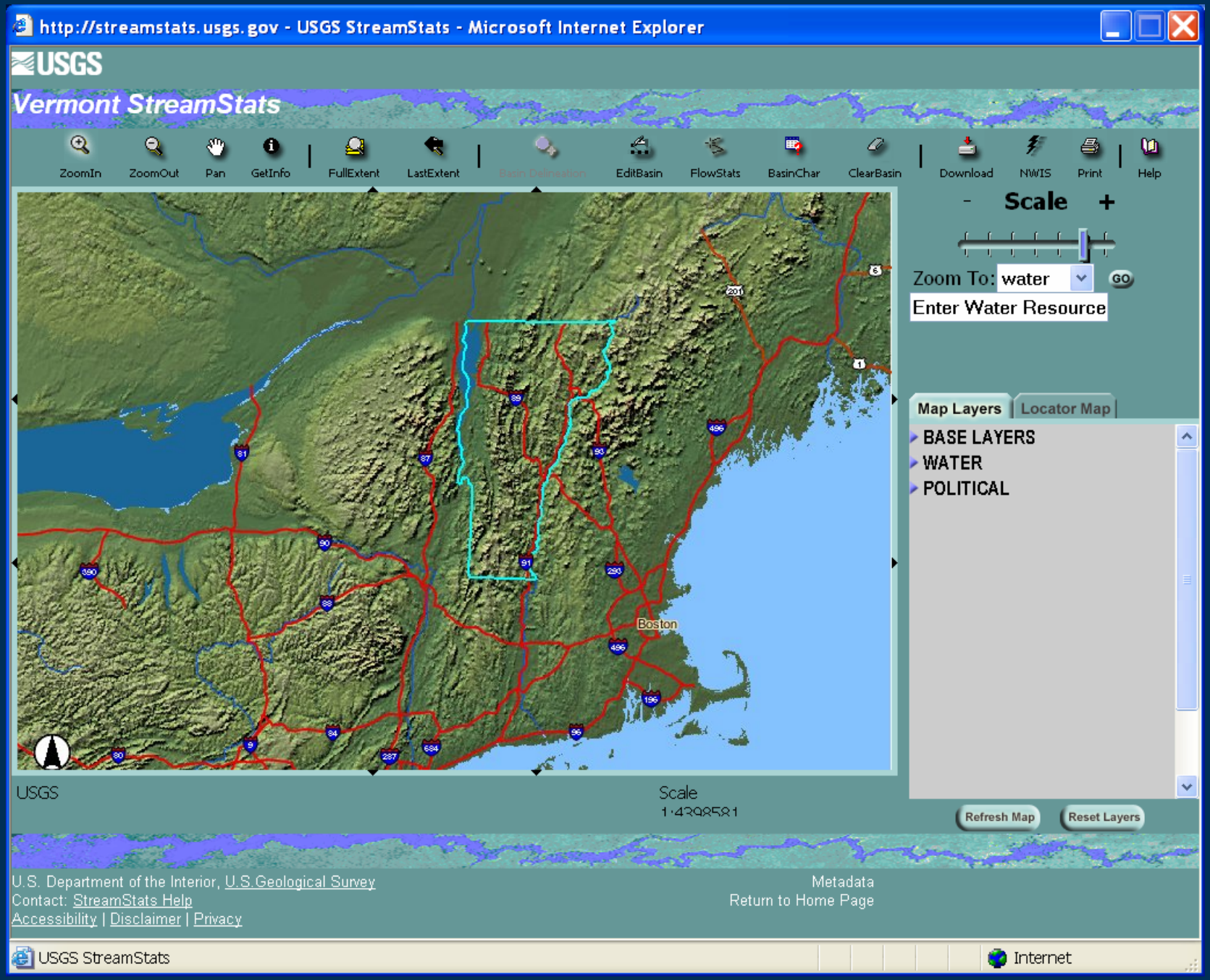
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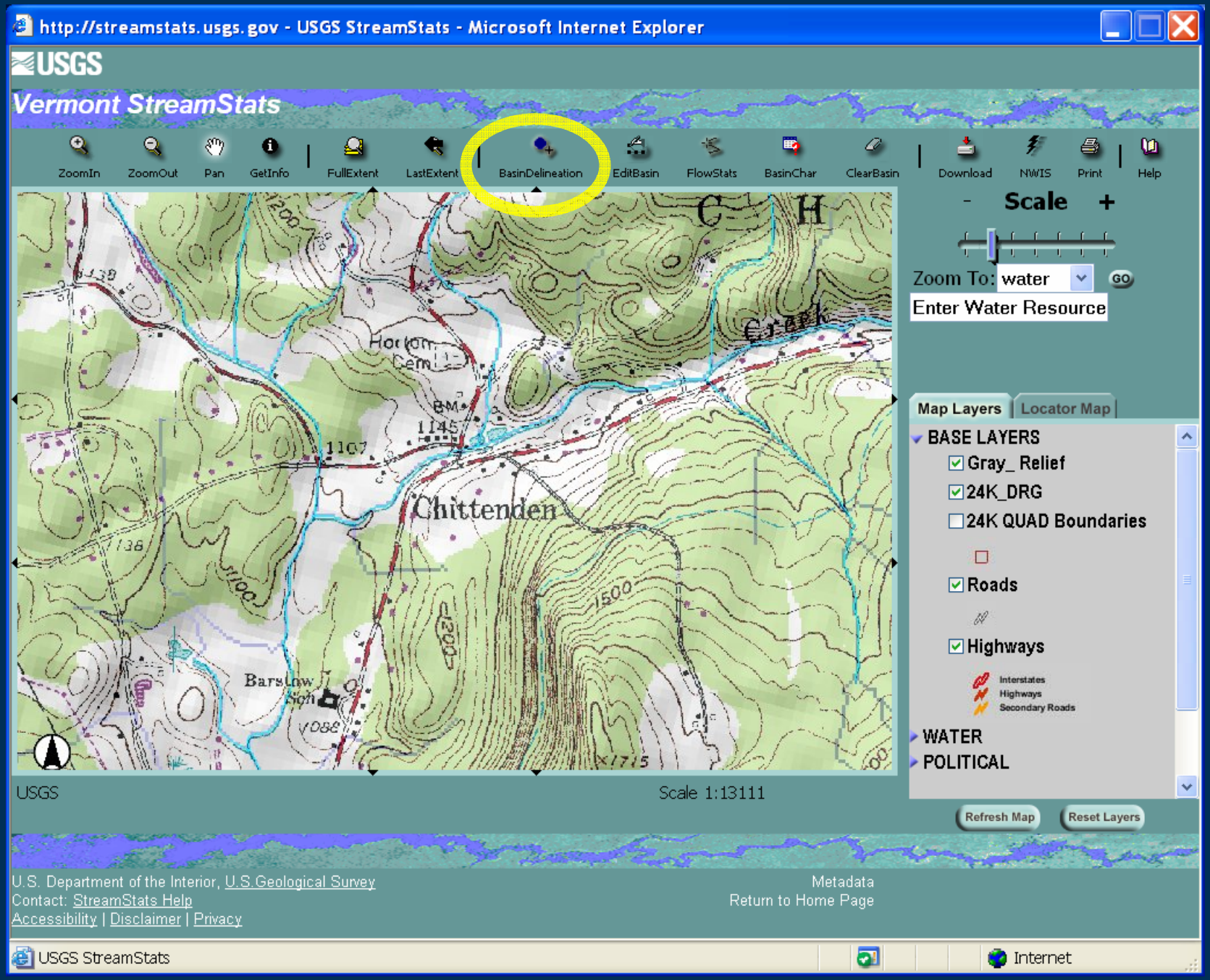
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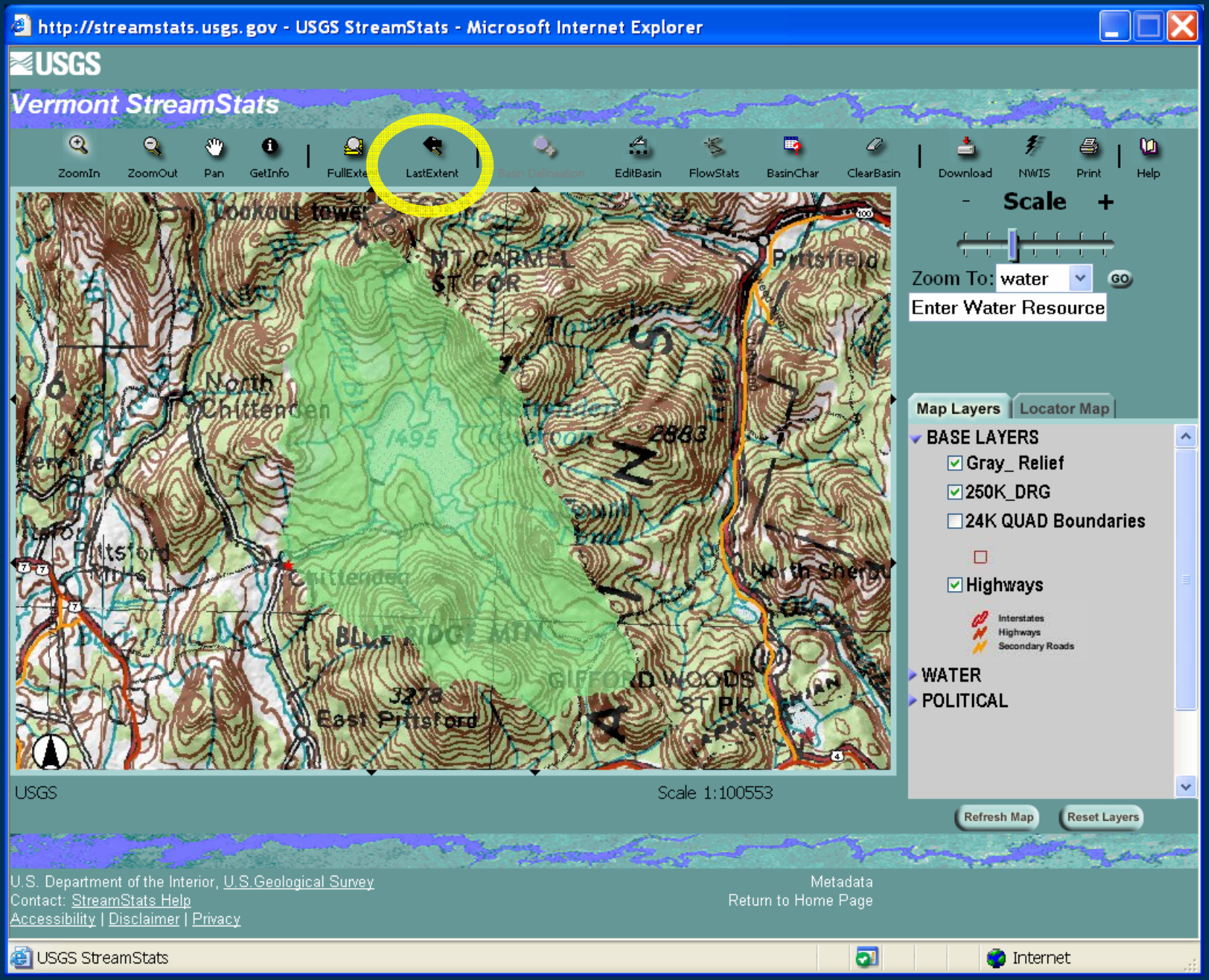
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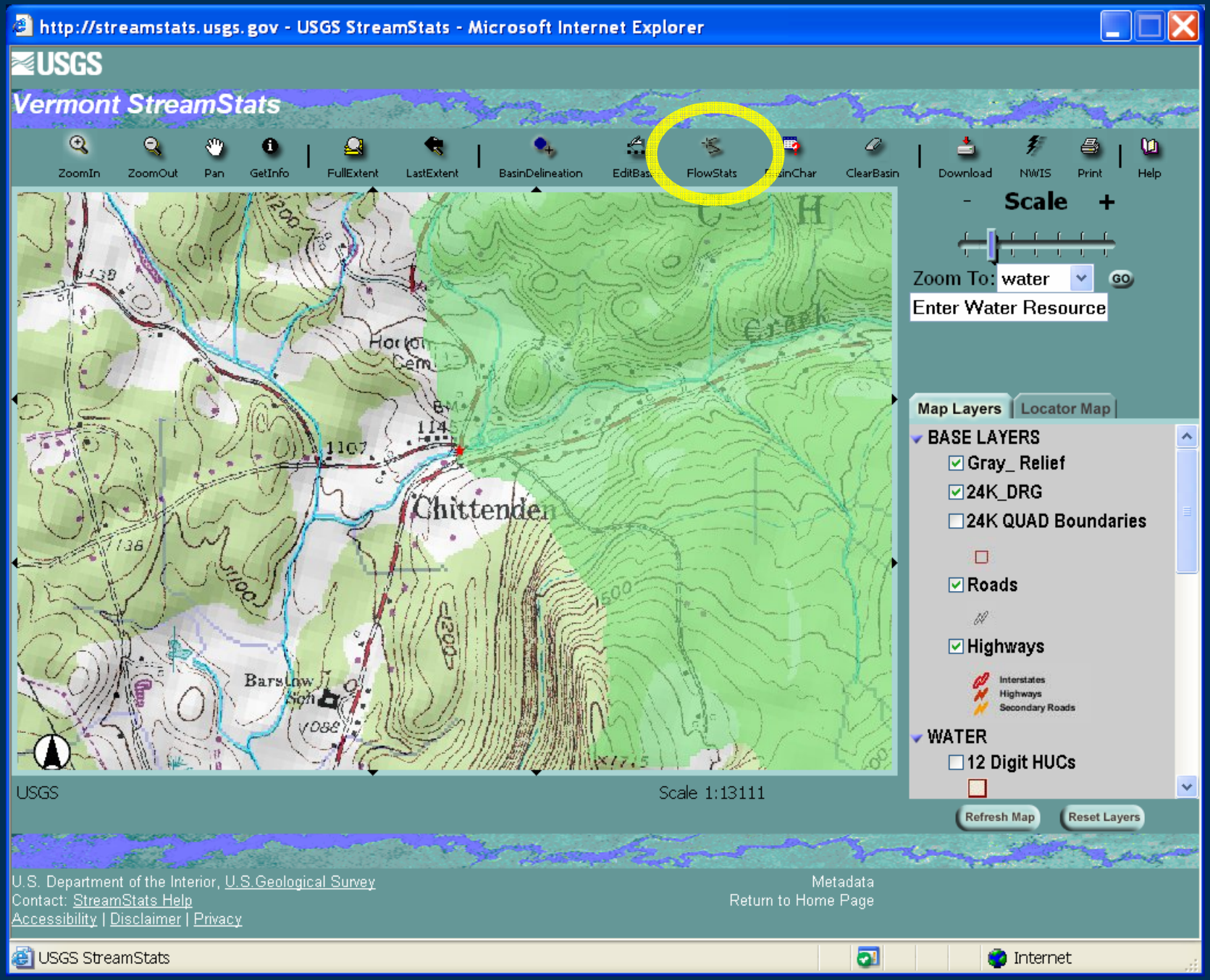
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USGS science for a changing world StreamStats

Streamflow Statistics Report

Date: Wed Apr 5 2006 15:21:27
Site Location: Vermont
Latitude: 43.6943
Longitude: -72.5870
Drainage Area: 19.4 mi2

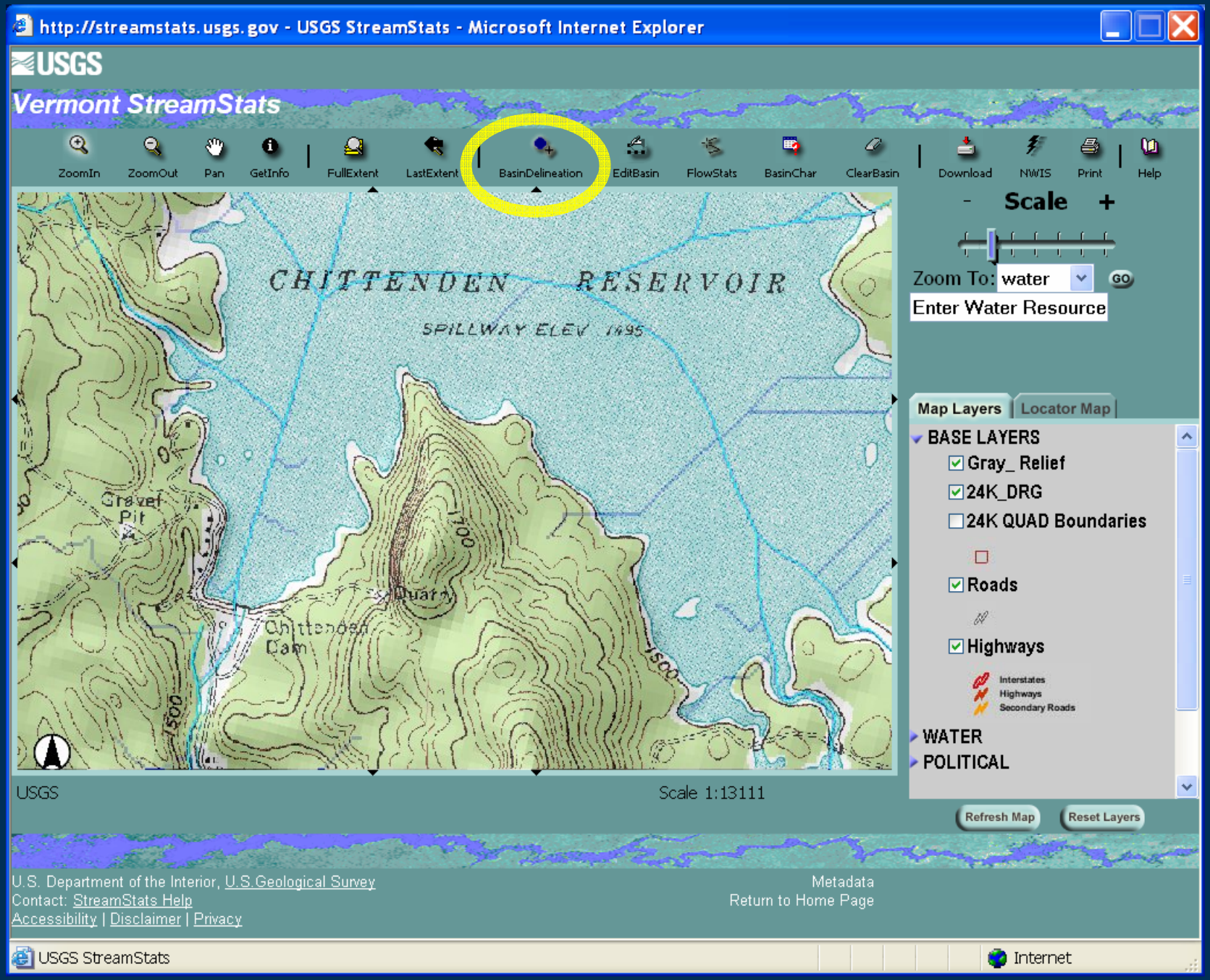
Peak Flow Basin Characteristics

100% Statewide Peak Flow (19.4 mi2)

Parameter	Value	Min	Max
Drainage Area (square miles)	19.4	0.211	850
Percent Lakes and Ponds (percent)	6.17	0	6.86
Percentage of Basin Above 1200 ft (percent)	99.7	0	100
Geographic Factor (dimensionless)	135833.7	-87	296194

Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
Q2	393	42	1.4	197	784
Q5	593	40	2.3	301	1170
Q10	734	41	3.2	369	1460
Q25	938	42	4.6	468	1880
Q50	1100	43	5.5	549	2200
Q100	1270	44	6.3	608	2650
Q500	1720	49	7.6	762	3870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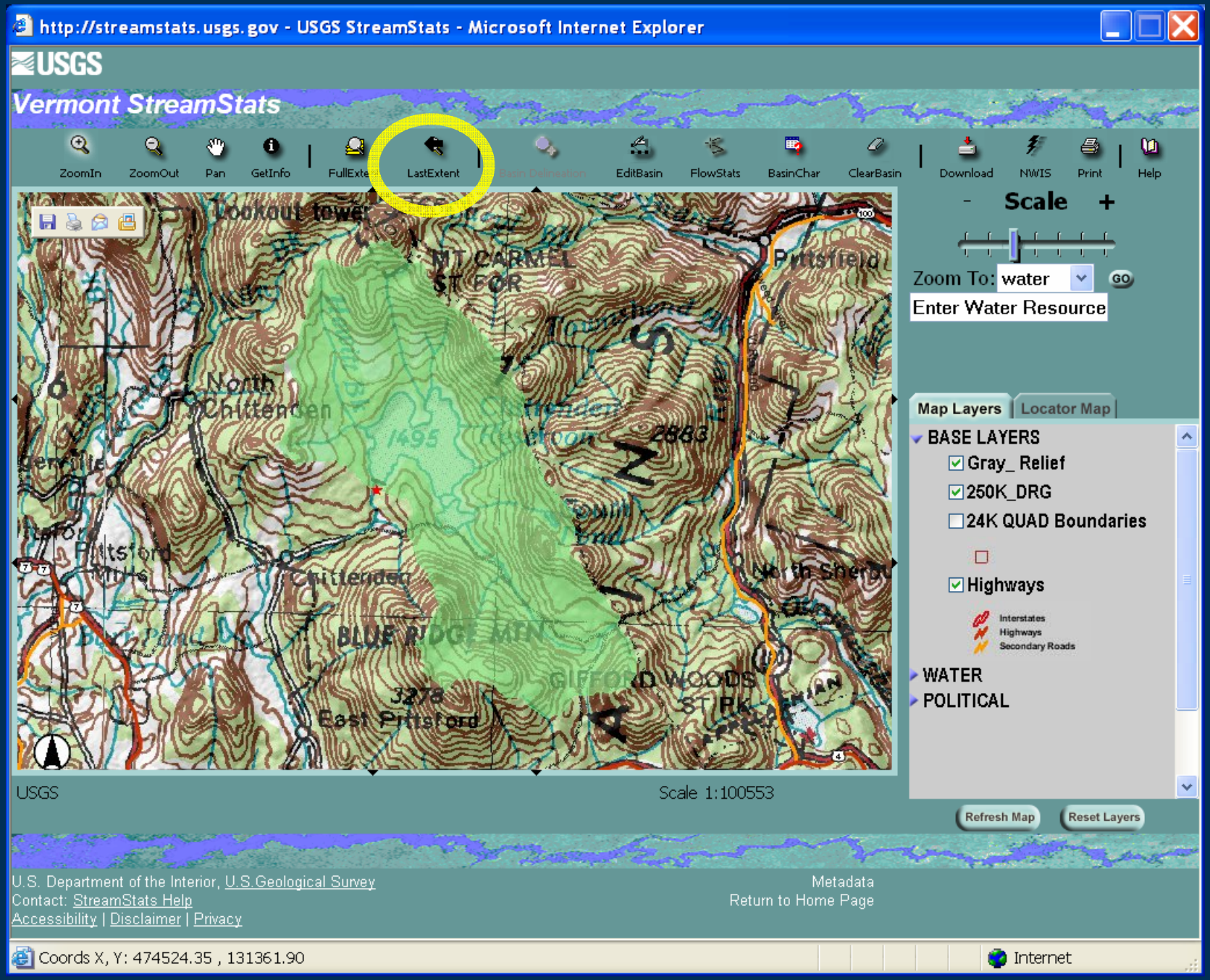
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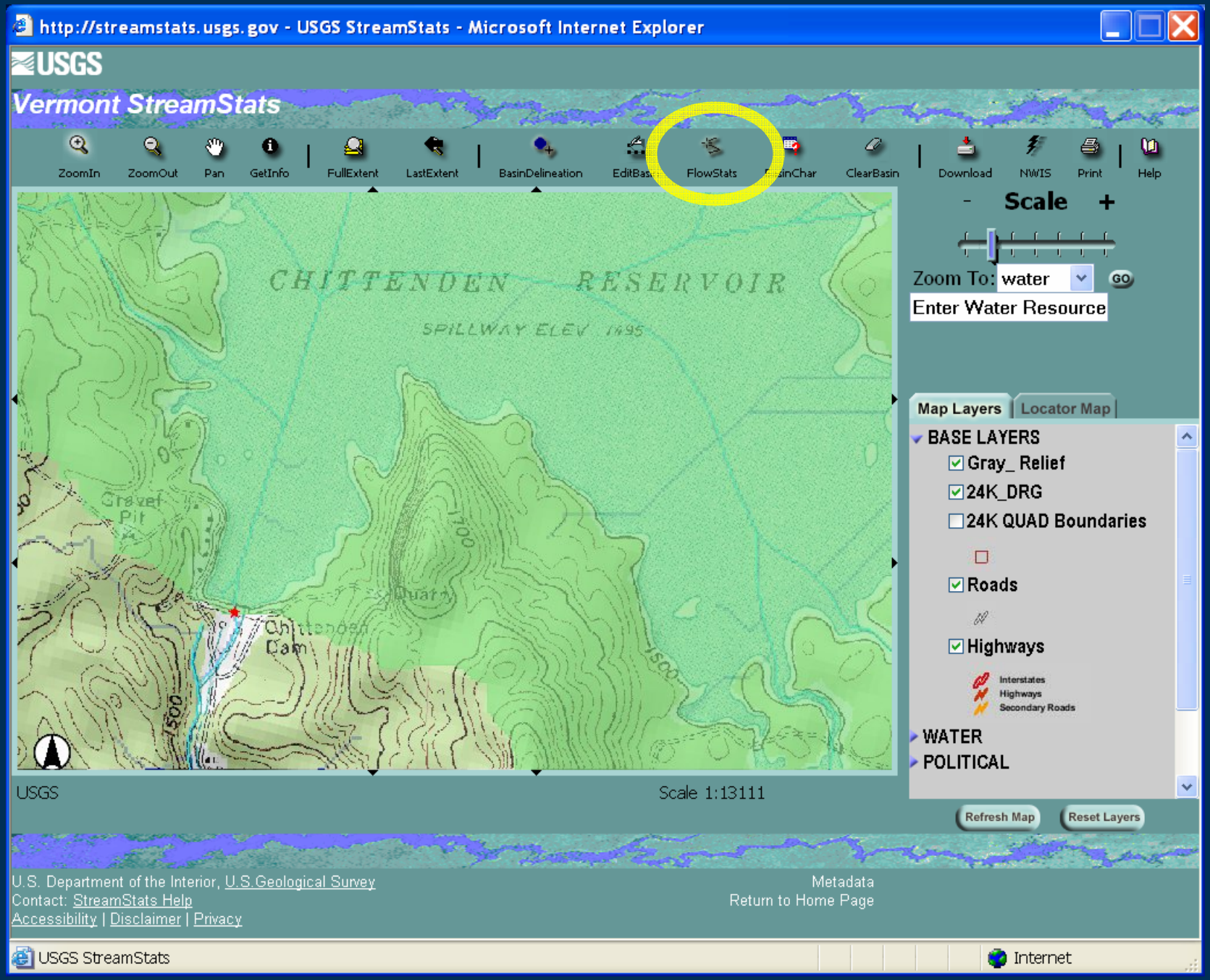
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Streamflow Statistics Report

Date: Wed Apr 5 2006 15:13:46
Site Location: Vermont
Latitude: 43.6943
Longitude: -72.5870
Drainage Area: 15.7 mi2

Peak Flow Basin Characteristics

100% Statewide Peak Flow (15.7 mi2)

Parameter	Value	Min	Max
Drainage Area (square miles)	15.7	0.211	850
Percent Lakes and Ponds (percent)	7.59 (above max value 6.86)	0	6.86
Percentage of Basin Above 1200 ft (percent)	100	0	100
Geographic Factor (dimensionless)	136132.0	-87	296194

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
Q2	307		1.4		
Q5	465		2.3		
Q10	575		3.2		
Q25	735		4.6		
Q50	861		5.5		
Q100	996		6.3		
Q500	1350		7.6		

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Select Basin Characteristics

- [x] Area in square miles
- [ ] Precipitation in inches
- [ ] Y coordinate of centroid
- [x] Percent area covered by lakes
- [ ] High elevation index percent of area > 1200 ft.

Compute Characteristics

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Basin Characteristics Report

Date: Wed Apr 5 2006 16:56:22
Latitude: 43.6943
Longitude: -72.5870

Parameter	Value
Mean annual precipitation in inches	49.6
Percent of area covered by lakes and ponds	6.17

Done Internet

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For more info:

- StreamStats Web Site

  http://streamstats.usgs.gov/

- Also of Interest:
  - NHDPlus (DEM-based Catchments and more)
    - Mon 4:35 Rm A4
    - NHDPlus Poster 080
  - New England SPARROW
    - Thu 8:25 Rm A5

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