



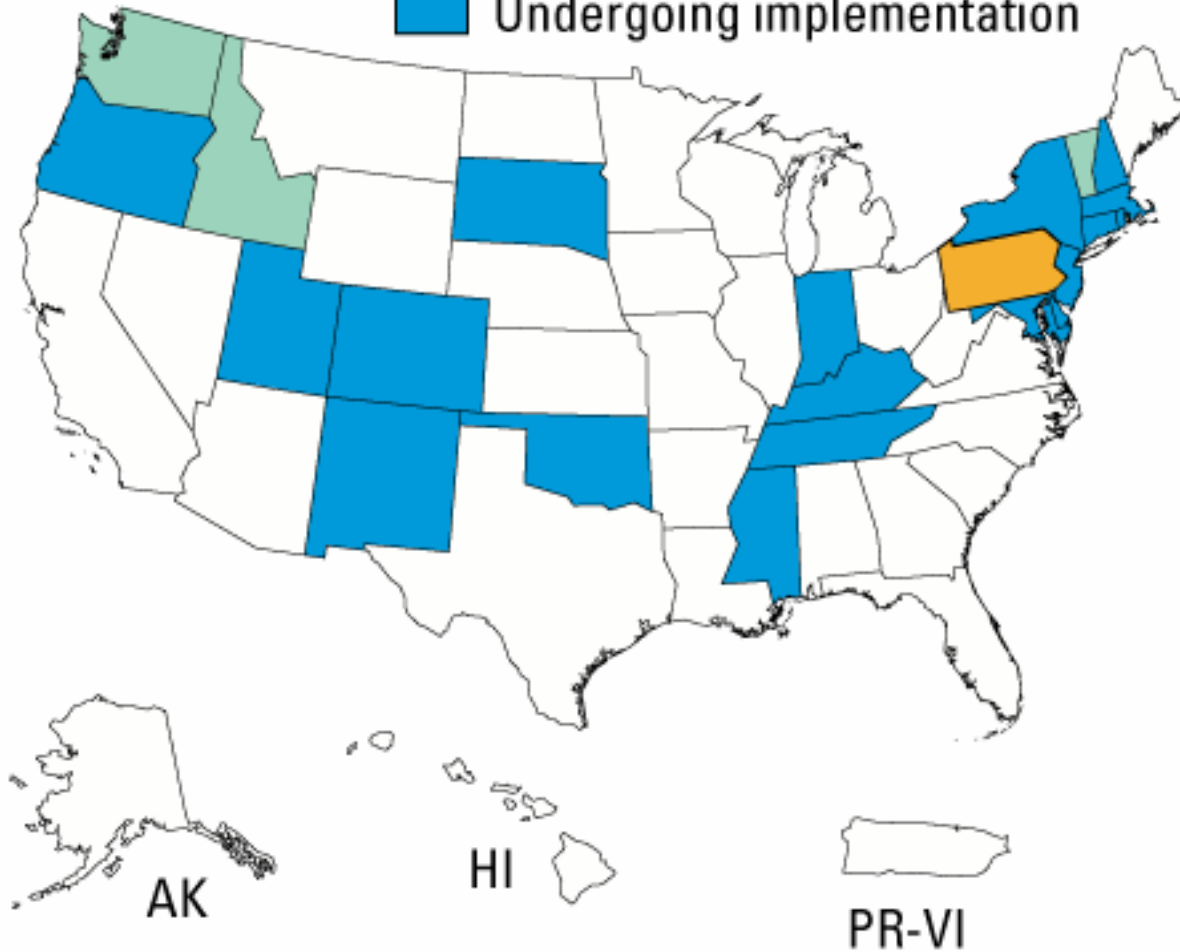
StreamStats:

Delivering Streamflow
Information to the Public

StreamStats Web Application

- Provides estimates of streamflow statistics, basin and climatic characteristics, and other information for user-selected points on ungaged streams
- Automatically measures basin and climatic characteristics for ungaged sites using GIS
- Provides published streamflow statistics, basin and climatic characteristics, and other information for data-collection stations

- Fully implemented (Clickable)
- Implemented and testing internally
- Undergoing implementation



Need for Streamflow Statistics

- Water resources planning, management, and permitting
- Flood-plain mapping
- Instream flow determinations for pollution and habitat
- Design and permitting of facilities such as wastewater-treatment plants, hydropower plants, and water-supply reservoirs
- Design of structures such as roads, bridges, culverts, dams, and levees

Manually Determining Basin Characteristics

- A 10-square mile basin can take < 1 hour to > 1 day, depending on characteristics measured, source material, and expertise
- The required time increases exponentially with increasing watershed area because of the increasing dendritic patterns and logistical problems when matching between map sheets
- The manual process is not completely repeatable
- The error introduced by determining basin characteristics probably is as large as the uncertainty in the regression models

Estimates for Ungaged Sites

- Streamflow Statistics are estimated from regression equations that relate flows to basin characteristics.
- Examples of basin characteristics: Basin area, slope, shape, climate, vegetation cover, degree of urbanization, geology, . . .
- Usually developed on a State-by-State basis through the USGS cooperative program

Example Regression Equation

- Regression equations take the form:

$$Q_{100} = 0.471A^{0.715}E^{0.827}SH^{0.472}$$

- where:

Q_{100} is the 100-year flood flow, cubic feet
per second

A is drainage area, in square miles

E is mean basin elevation, in feet

SH is a shape factor

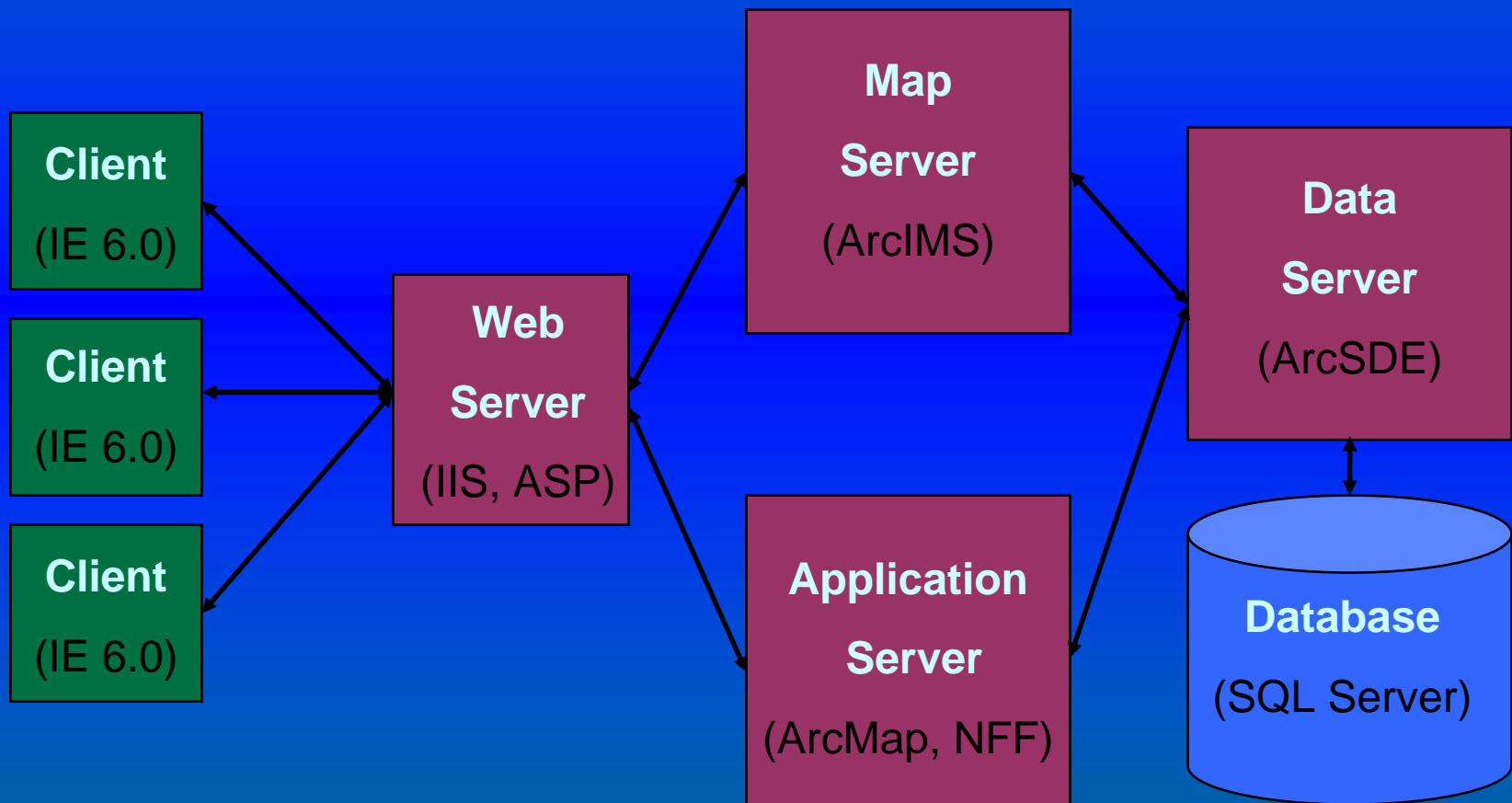
Regression Equations Available for Wyoming

- Miller, K.A., 2003, Peak-flow characteristics of Wyoming streams: U.S. Geological Survey Water-Resource Investigations Report 03-4107, 79 p.
 - ↳ **Statewide peak-flow equations**
- Lowham, H.W., 1988, Streamflows in Wyoming: U.S. Geological Survey Water-Resources Investigations Report 88-4045, 78 p., 1 pl.
 - ↳ **Statewide annual-mean flow equations**

Regression Equations Available for Wyoming (continued)

- Rankl & others, 1994, Wind River and part of Bighorn River, WRIR 94-4014
 - ☞ Monthly flow equations for Wind River and part of Bighorn River drainage basins
- Mason & others, 2005, Sweetwater County
 - ☞ Annual, monthly, low, peak flow, and flow-duration equations, 29 sites
- Bartos & others, 2006, Carbon County
 - ☞ Annual, monthly, low, peak flow, and flow-duration equations, 26-42 sites

System Design



User Interface

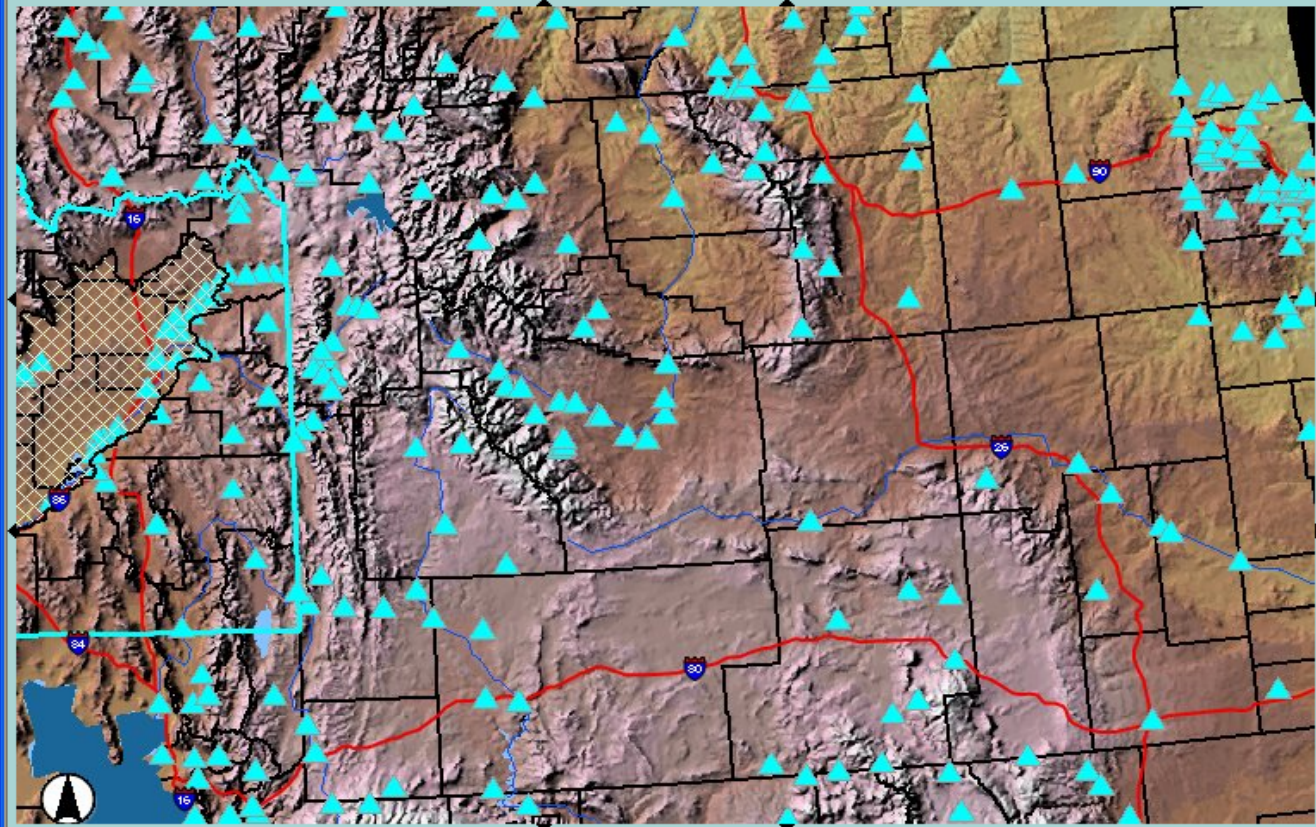
[Stream Stats](#)

- Displays maps and enables site selection
- Displays default data layers for selected scale ranges and allows adding/subtracting map layers
- Zoom and pan to places of interest
- Zoom to named geographic location or stream
- Evaluate basin boundaries in the map frame
- Print maps and download data shown in the map frame



Idaho StreamStats

ZoomIn
 ZoomOut
 Pan
 GetInfo
 FullExtent
 LastExtent
 Watershed Delineation
 EditBasin
 FlowStats
 BasinChar
 ClearBasin
 Download
 NWIS
 Print
 Help



+ Scale -

 Zoom To:

Map Layers **Locator Map**
BASE LAYERS
WATER

- Water Bodies
- Rivers
- HUCs
- Unavailable Area
- Undefined Area
- Watershed Delineation
- Stream Gages
- 100K NHD REGION RCH

USGS Scale 1:4082824



Example Point Selection

The screenshot displays the USGS Idaho StreamStats web application interface. The browser address bar shows the URL: <http://streamstats.usgs.gov> - USGS ID StreamStats - Microsoft Internet Explorer.

The application header includes the USGS logo and the text "Idaho StreamStats". Below the header is a toolbar with various navigation and analysis tools: ZoomIn, ZoomOut, Pan, GetInfo, FullExtent, LastExtent, BasinDelineation, EditBasin, FlowStats, BasinChar, ClearBasin, Download, NWIS, Print, and Help.

The main map area shows a topographic map with stream networks. A red circle highlights a specific point on the map, labeled "390". The map also shows "Moose Wilson" and "Creek". The scale is indicated as "Scale 1:21938".

On the right side, there is a "Scale" control with a slider and a "Zoom To:" dropdown menu set to "water". Below this is a text input field labeled "Enter Water Resource".

The "Map Layers" panel is open, showing the following layers:

- BASE LAYERS
 - WATER
 - HUCs
 - Unavailable Area
 - Undefined Area
 - Watershed Delineation
 - Stream Gages
 - Stream_GRID
 - 100K NHD_REGION_RCH

At the bottom of the map area, there are "Refresh Map" and "Reset Layers" buttons.

The footer contains the following information:

- U.S. Department of the Interior, U.S. Geological Survey
- Contact: [StreamStats Help](#)
- [Accessibility](#) | [Disclaimer](#) | [Privacy](#)
- Metadata
- [Return to Home Page](#)
- Coords X, Y: 758877.11 , 283726.08
- Internet

Drainage Boundaries

1. User selects point on stream
2. Point is transferred to a cell in a flow-direction grid derived from a DEM
3. GIS determines boundary from flow-direction grid up to points at which the boundary for the new site intersects boundaries in boundary map layer
4. GIS accumulates all upstream areas and dissolves internal boundaries

Example Drainage Boundary

http://streamstats.usgs.gov - USGS ID StreamStats - Microsoft Internet Explorer

USGS
Idaho StreamStats

ZoomIn ZoomOut Pan GetInfo FullExtent LastExtent Basin Delineation EditBasin FlowStats BasinChar ClearBasin Download NWIS Print Help

Scale
Zoom To: water GO
Enter Water Resource

Map Layers Locator Map

- BASE LAYERS
- WATER
 - HUCs
 - Unavailable Area
 - Undefined Area
 - Watershed Delineation
 - Stream Gages
 - 100K NHD_REGION_RCH
 - 100K NHD_ROUTE_RCH

USGS Scale 1:68356

Microsoft Internet Explorer

The delineation was completed successfully with the following warning(s):
- OUTSIDE OF IDAHO: STREAMFLOW ESTIMATES CONSIDERED NOT VALID

Click OK to keep this basin polygon, or Cancel to delete it.

OK Cancel

Microsoft Internet Explorer

Be sure to thoroughly check the delineated basin for accuracy before clicking the Flow Statistics or the Basin Characteristics buttons. Click on the Flow Statistics button to get a limited set of basin characteristics and estimates of streamflow statistics for the site. Click on the Basin Characteristics button to get an extended list of basin characteristics for the site.

OK

Example Output

http://streamstats.usgs.gov - USGS ID StreamStats - Micr...

File Edit View Favorites Tools Help

Google Search 3 blocked

Select Basin Characteristics

- Area in square miles
- Elevation in feet
- Forest in percent
- Maximum elevation in feet
- Minimum elevation in feet
- Precipitation in inches
- Relief in feet
- Slope in percent
- Slope greater than 30 percent in percent
- Slope greater than 30 percent and facing North in percent


Compute Characteristics

Done Internet

http://streamstats.usgs.gov - Streamstats Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Google Search 3 blocked



Basin Characteristics Report

Date: Thu Aug 24 2006 11:45:04
Latitude: 43.6153
Longitude: -110.8223

Warning from delineation: OUTSIDE OF IDAHO: STREAMFLOW ESTIMATES CONSIDERED NOT VALID

Parameter	Value
Area in square miles	13.9
Relief in feet - requires 'DEM' grid with vertical units defined	4090
Average elevation in feet - requires 'DEM' grid with vertical units defined	9030
Maximum elevation in feet - requires 'DEM' grid with vertical units defined	10900
Minimum elevation in feet - requires 'DEM' grid with vertical units defined	6800
Average area slope in percent	44.7
Percent of area with slope greater than 30%	66.2
Percent of area with slope greater than 30% and facing North	23.6
Percent of area covered by forest - requires 'Forest' grid (0=no forest, 1=forest)	26.7
Mean annual precipitation in inches - requires 'Precipitation' grid with values in inches	59.4


Done Internet

Example Output

http://streamstats.usgs.gov - Streamstats Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Google Search 3 blocked Check AutoLink AutoFill Options



Streamflow Statistics Report

Date: Thu Aug 24 2006 11:47:31
Site Location: Idaho
Latitude: 43.6153
Longitude: -110.8223
Drainage Area: 13.9 mi²

Warning from delineation: OUTSIDE OF IDAHO: STREAMFLOW ESTIMATES CONSIDERED NOT VALID

Peak Flow Basin Characteristics

100% Peak Flow Region 8 (13.9 mi²)

Parameter	Value	Min	Max
Drainage Area (square miles)	13.9	2.5	874.8
Mean Basin Slope from 30m DEM (percent)	44.7	5.1	53.6
Slopes Greater Than 30 Percent (percent)	66.2	1.2	88.7

Low Flow Basin Characteristics

100% Low Flow Region 8 (13.9 mi²)

Parameter	Value	Min	Max
Drainage Area (square miles)	13.9 (below min value 16.3)	16.3	874.8
Percent Forest (percent)	26.7	2.3	93.9
Mean Annual Precipitation (inches)	59.4 (above max value 56)	14.2	56
Mean Basin Elevation (feet)	9030 (above max value 8951)	5691.9	8951
Mean Basin Slope from 30m DEM (percent)	44.7	6.1	49.7
Slopes Greater Than 30 Percent (percent)	66.2	1.2	86.6

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

Done Internet

Example Output

http://streamstats.usgs.gov - Streamstats Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Google Search 3 blocked Check AutoLink AutoFill Options

Streamflow Statistics

Statistic	Flow (ft ³ /s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval		
				Minimum	Maximum	
Peak-Flow Statistics						
Q1.5	110	74		36	333	
Q2	132	69		45.6	379	
Q2.33	145	68		51.4	411	
Q5	191	64		70.7	516	
Q10	229	63		86	611	
Q25	275	63		103	732	
Q50	305	64		114	819	
Q100	351	64		129	951	
Q200	384	65		140	1060	
Q500	414	67		148	1160	

Done Internet

Example Output

http://streamstats.usgs.gov - Streamstats Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Google Search 3 blocked Check AutoLink AutoFill Options

Streamflow Statistics

Statistic	Flow (ft ³ /s)	Standard Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
Mean Annual Flow Statistics					
Qa	114				
January Flow-Duration Statistics					
Jan_Q20	51.9				
Jan_Q50	46.6				
Jan_Q80	44.4				
February Flow-Duration Statistics					
Feb_Q20	48.8				
Feb_Q50	44.4				
Feb_Q80	41.2				
March Flow-Duration Statistics					
Mar_Q20	44.8				
Mar_Q50	42.2				
Mar_Q80	39.8				
April Flow-Duration Statistics					
Apr_Q20	27.9				
Apr_Q50	17.9				

Done Internet



District Access
[Water](#)
Resources

National Water Information System: Web Interface

Data Category: Geographic Area:

USGS 13016305 GRANITE C AB GRANITE C SUPPLEMENTAL, NR MOOSE, WY

Available data for this site

Stream/River Site Description

LOCATION
Latitude 43°36'14", Longitude 110°48'17" NAD27
Teton County, Wyoming , Hydrologic Unit 17040103

DESCRIPTION
Drainage area: 14.9 square miles
Datum of gage: 6,400 feet above sea level NGVD29.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Real-time	This is a real-time site		
Peak streamflow	1995-07-09	2005-06-22	11
Daily Data			
Discharge, cubic feet per second	1995-06-02	2006-08-23	4101
Daily Statistics			
Discharge, cubic feet per second	1995-06-02	2005-09-30	3774
Monthly Statistics			
Discharge, cubic feet per second	1995-06	2005-09	
Annual Statistics			
Discharge, cubic feet per second	1995	2005	

OPERATION:
Record for this site is maintained by the USGS Wyoming Water Science Center
Email questions about this site to [Water Webserver Team](#)





District Access
[Water](#)
[Resources](#)

National Water Information System: Web
Interface

Data Category:

Real-time

Geographic Area:

United States

GO

USGS 13016305 GRANITE C AB GRANITE C SUPPLEMENTAL, NR MOOSE, WY PROVISIONAL DATA SUBJECT TO REVISION

Available data for this site

Time-series: Real-time data

GO

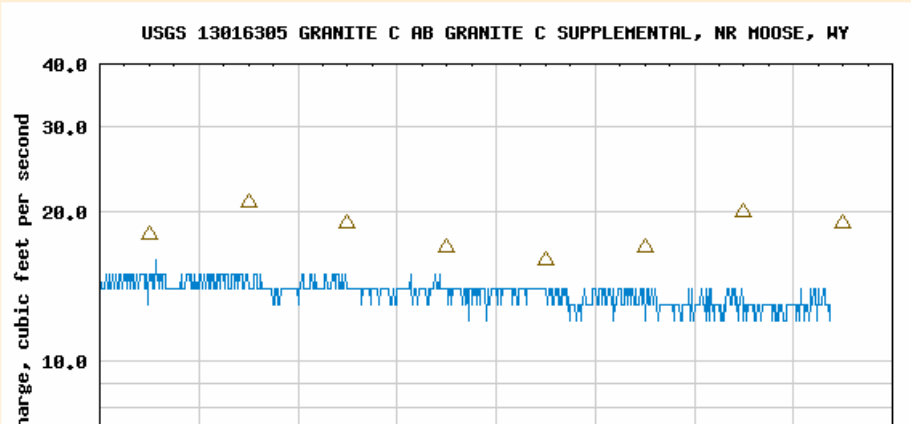
- Site home page
- Site inventory review (internal)
- Site map
- Time-series: Real-time data
- Time-series: Daily data
- Time-series: Daily statistics
- Time-series: Monthly statistics
- Time-series: Annual statistics
- Surface-water: Peak streamflow
- Surface-water: Field measurements
- Offsite: EPA Surf your Watershed
- Check national server for more information

Station operated by the U.S. Geological Survey, District.

Available Parameters	
<input type="checkbox"/>	All 4 Available Parameters for this site
<input checked="" type="checkbox"/>	00060 Discharge
<input checked="" type="checkbox"/>	00065 Gage height (from DCP)
<input checked="" type="checkbox"/>	70969 DCP battery voltage
<input checked="" type="checkbox"/>	72114 DCP TransmittedPower

Discharge, cubic feet per second

Most recent value: 13 08-24-2006 09:00



StreamStats Benefits

- Published statistics are readily available
- Ungaged site process takes < 10 minutes
- Large collections of maps, equipment, and software are not necessary
- Consistent information delivery
- Little or no additional error is introduced
- Only basic understanding of hydrology, computer science, geographic analysis is needed
- Reduced information requests

