

U.S. GEOLOGICAL SURVEY SEDIMENT AND ANCILLARY DATA ON THE WORLD WIDE WEB

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Abstract: A retrieval from the U.S. Geological Survey National Water Information System World Wide Web (NWISWeb) data base yielded more than 2.6-million values of instantaneous-value sediment and ancillary data for 15,415 sites in all 50 States, Puerto Rico, and other locations. The retrieval includes 12,115 sites with suspended-sediment concentration data, about half of which also include particle-size distribution data; 238 sites with bedload discharge data; and 3,623 sites with bed-material particle-size distribution data. Ancillary variables, including water discharge and water temperature, in addition to a large amount of chemical-quality data, are available for many of the sites. The NWISWeb data base represents the single largest repository of USGS electronic instantaneous-value suspended-sediment, bedload, and bed-material data. The NWISWeb data base is described, along with criteria used to retrieve sediment and ancillary data, and selected characteristics of those data.

INTRODUCTION

According to the *National Water Quality Inventory: 1998 Report to Congress*, siltation (a general term applied to fluvial sediment) is considered the top pollutant in U.S. rivers and streams, affecting aquatic habitat, drinking water treatment processes, and recreational uses of waterbodies (U.S. Environmental Protection Agency, 2000a). The U.S. Environmental Protection Agency (USEPA) provides guidance to states, territories, and authorized tribes that exercise their responsibility under section 303(d) of the Clean Water Act for the development of sediment total maximum daily loads (TMDLs) (U.S. Environmental Protection Agency, 2000b). This report summarizes a January 13, 2000, retrieval of electronically available U.S. Geological Survey (USGS) instantaneous-value sediment and ancillary data in support of the USEPA's efforts to develop technically supportable TMDL's based on rational, science-based assessments.

DESCRIPTION OF NWISWEB DATA BASE

As part of its mandate to disseminate water data to the public, the USGS maintains the National Water Information System (NWIS) -- a distributed network of computers and file servers for storing and retrieving water data collected at about 1.5 million sites around the country (U.S. Geological Survey, 2000a). Many types of data are stored in the NWIS, including those that describe site information, time-series (flow, stage, precipitation, chemical), peak flow, ground water, and water quality.

The National Water Information System on the World Wide Web, termed the "NWISWeb", provides users of USGS water information with a geographically seamless interface to the large volume of USGS water data maintained on 48 separate NWIS data bases nationwide (U.S. Geological Survey, 2000b). Data are updated from the NWIS sites on a regularly scheduled basis, and real-time hydrologic and ancillary data are transmitted to the NWISWeb several times a day. The NWISWeb provides several output options: Real-time streamflow, water-level and water-quality graphs, data tables and site maps; tabular output in html (HyperText Markup Language) and ASCII (American Standard Code for Information Interchange) tab delimited files; and lists of selected sites as summaries with reselection for details.

Data may be retrieved by geographical area, and by category of data, such as surface water, ground water, or water quality. Further refinement is possible by selecting specific retrieval criteria and by defining the output desired. NWIS data come from all 50 states, selected territories and border sites, from 1896 to present. Of the 1.5 million sites with NWIS data, about 1.2 million are wells; 350,000 are water-quality sites; and 19,000 are streamflow sites, of which more than 5,000 provide data on a real-time basis. NWISWeb contains about 4.3 million water-quality records and 64 million water-quality samples. The NWISWeb help system is useful for new users (U.S. Geological Survey, 2000c).

WATER-QUALITY DATA BASE AVAILABLE THROUGH NWISWEB

The NWISWeb water-quality data base represents the single largest repository of electronic USGS instantaneous-value sediment and ancillary data. Daily-value suspended-sediment data collected by the USGS from 1930 through September 30, 1994, are available to the public on-line (U.S. Geological Survey, 2000d). This and subsequent daily-value USGS suspended-sediment data are entered into the NWISWeb data base as the data become available (Susan Trapanese, U.S. Geological Survey, written commun., 2000).

The results of the January 13, 2000, retrieval from the then-under-construction NWISWeb water-quality data base (U.S. Geological Survey, 2000e), which are summarized in this paper, do not include all instantaneous-value sediment and ancillary data collected by the USGS. Only those data that were stored in USGS District Office NWIS data bases in the spring of 1999 were used to populate the NWISWeb data base that was the source of the January 13, 2000 retrieval (John Briggs, U.S. Geological Survey, written commun., 2000). There is evidence that a considerable amount of USGS suspended-sediment concentration data and some bedload-transport data are not available on the NWISWeb.

Because the data in NWISWeb are updated periodically, subsequent summary statistics generated from the NWISWeb data base may differ from those presented herein. The U.S. Geological Survey (2000f) provides an introduction to the water-quality data base.

EXPLANATION OF USGS PARAMETER CODES

Values for water-quality parameters (including sediment parameters) from samples or measurements (instantaneous values) are stored under unique record numbers that include the site identification number, date, time, ancillary information that describe the sample and sampling method, and water-quality values for physical properties and chemical and biological constituents. Sample information contained in the records is identified by unique 5-digit parameter codes, such as 80154 for instantaneous suspended-sediment concentration and 00061 for instantaneous water discharge. Each parameter code defines a specific type of data and falls into one of three general classes:

1. Site and sampling-event data.
2. Fixed-value codes, which are used to define a certain part of the process of sample collection, processing, or quality assurance.
3. Chemical, physical, and biological data.

The USGS and USEPA use similar parameter-code definitions, although there are exceptions to the definition convention.

RETRIEVAL PROCESS AND CRITERIA

A two-step retrieval process was used to retrieve sediment and ancillary data from the NWISWeb on January 13, 2000. The initial step was to retrieve water-quality records by searching for records with at least one of the 12 retrieval criteria listed in table 1. Subsequently, by using the list of water-quality record numbers established in the first step, the second step was to retrieve sample information for each record, including as many as 13 site and sampling-event parameter codes, and 156 fixed-value and chemical and physical parameter code values. Site characteristic data retrieved included site name, identification number, state, county, and latitude and longitude location. Types of ancillary data retrieved included the agency that collected the sample, the agency that analyzed the sample, stream velocity, stream discharge, water temperature, sampling method, and the type of sampler used.

The current (2000) version of NWISWeb does not support retrieval by specifying parameter codes; however, there is a parameter grouping search criterion available. A user may select the sediment-parameter grouping and retrieve data that are similar to those that formed the basis for this summary.

RETRIEVAL RESULTS

More than 2.6-million values of instantaneous-value sediment and ancillary data were retrieved for 15,415 sites in all 50 States, Puerto Rico, and other locations, including Canada, Federated States of Micronesia, Guam, and Southern Ryukyu Islands, from the NWISWeb data base on January 13, 2000, by using the retrieval criteria described in table 1. The sediment data were collected by methods described by Edwards and Glysson (1999). Retrieval results for selected types of instantaneous-value sediment data grouped by state or other location are summarized in the appendix. One hundred and forty six sites that were retrieved did not contain a value in the State Code parameter at the time of the retrieval; these sites are grouped under the "To Be Determined" category in the appendix. Instantaneous-value water-quality data and descriptive site information were also available at many of the sites but are not described in this paper.

Table 1. Retrieval criteria for U.S. Geological Survey sediment and ancillary data from the NWISWeb data base, January 13, 2000. Records were retrieved from the water-quality data base when suspended-sediment concentration and water discharge, or any of 11 other parameters were contained in the record.
[mg/L, milligrams per liter; cfs, cubic feet per second; mm, millimeters]

Parameter codes related to suspended sediment:

- 80154 sediment, suspended concentration (mg/L) when paired with 00061 discharge, instantaneous (cfs);
- 70299 solids, residue at 110 degrees C, suspended total (mg/L); and
- 80180 sediment, total, concentration (mg/L).

Parameter codes related to bedload:

- 04122 discharge, sediment, bedload, average unit, composite samples (tons/day-foot);
- 80225 sediment discharge, bedload (tons/day); and
- 80156 sediment discharge, total, suspended plus bed material (tons/day).

Parameter codes related to bed material:

- 80158 sediment, bed material, fall diameter, distilled water, percent finer than 0.062 mm;
 - 80160 sediment, bed material, fall diameter, distilled water, percent finer than 0.250 mm;
 - 80163 sediment, bed material, fall diameter, distilled water, percent finer than 2.00 mm;
 - 80164 sediment, bed material, sieve diameter, percent finer than 0.062 mm;
 - 80168 sediment, bed material, sieve diameter, percent finer than 1.00 mm; and
 - 80172 sediment, bed material, sieve diameter, percent finer than 16.0 mm.
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Suspended-Sediment Concentrations: At least one set of values of instantaneous-value suspended-sediment concentration (USGS parameter code 80154) and instantaneous-value water discharge (parameter code 00061) was available for 12,115 sites, of which 2,929 had at least 30 such values. A map of sites in the United States and Puerto Rico that have at least 30 paired values of instantaneous-value suspended-sediment concentration and water discharge is shown in figure 1.

Suspended-Sediment Particle-size Distributions: Percentages of suspended sand-size and finer material were available for 6,028 sites, of which 1,342 had at least 30 such values. A map of the sites that have at least 30 values of particle-size distribution of suspended sediment is shown in figure 2. Specifically, the parameters sought were either the percentage of suspended-sediment material finer than a sieve diameter of 0.062 mm (parameter code 70331) or the percentage of suspended-sediment material in distilled water having a fall diameter finer than 0.062 mm (parameter code 70342). Additional particle-size distribution data that describe the percentages of selected clay-, silt-, and sand-size fractions are available for many of these sites.

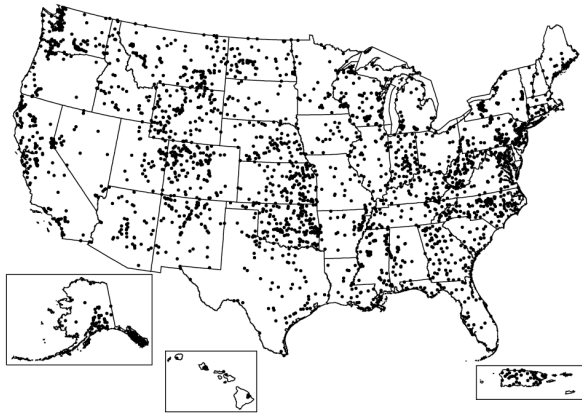


Figure 1. Locations of sites in the United States and Puerto Rico with 30 or more values of paired instantaneous suspended-sediment concentration and water discharge retrieved from the NWISWeb data base, January 13, 2000.

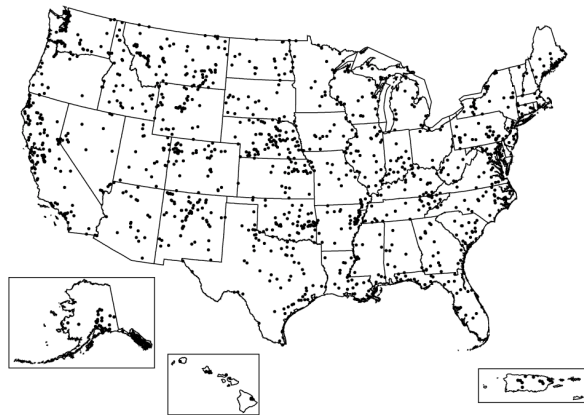


Figure 2. Locations of sites in the United States and Puerto Rico with 30 or more values of particle-size distributions of suspended-sediment retrieved from the NWISWeb data base, January 13, 2000.



Figure 3. Locations of sites in the United States and Puerto Rico with at least 1 value of bedload discharge retrieved from the NWISWeb data base, January 13, 2000.

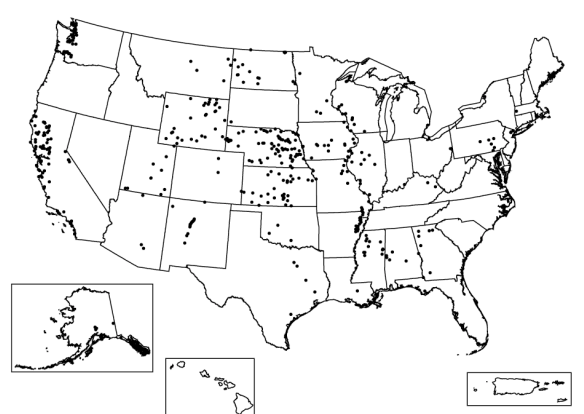


Figure 4. Locations of sites in the United States and Puerto Rico with 10 or more values of particle-size distributions of bed material retrieved from the NWISWeb data base, January 13, 2000.

Bedload Discharge: Bedload-discharge values (parameter code 80225) were available for 238 sites, of which 43 had at least 30 values. A map of the sites that have at least 1 value of bedload discharge is shown in figure 3. Many of the sites also had particle-size distributions associated with the bedload measurement, such as selected sand- and gravel-size fractions.

Particle-size Distribution of Bed Material: Particle-size distribution values of bed material were available at 3,623 sites, of which 474 had at least 10 values. A map of the sites that have at least 10 values of particle-size distribution of bed material is shown in figure 4. The parameters that were retrieved included particle-size distributions based on sieve diameter or fall diameter (USGS parameter codes 80157-80175 inclusive).

Distribution of Drainage Basin Area for Sites with Suspended-Sediment Data: The January 13, 2000, retrieval from the NWISWeb data base found records for 12,115 sites that had at least one pair of values for instantaneous-value suspended-sediment concentration and water discharge. Of these 12,115 sites, drainage area was unavailable for 3,686 sites through the NWISWeb at the time of the retrieval. The distribution of the drainage areas for the remaining 8,429 sites is shown in figure 5. The drainage areas for these sites ranged from 0.002 to 1,140,500 mi², and the median drainage area was 72.1 mi².

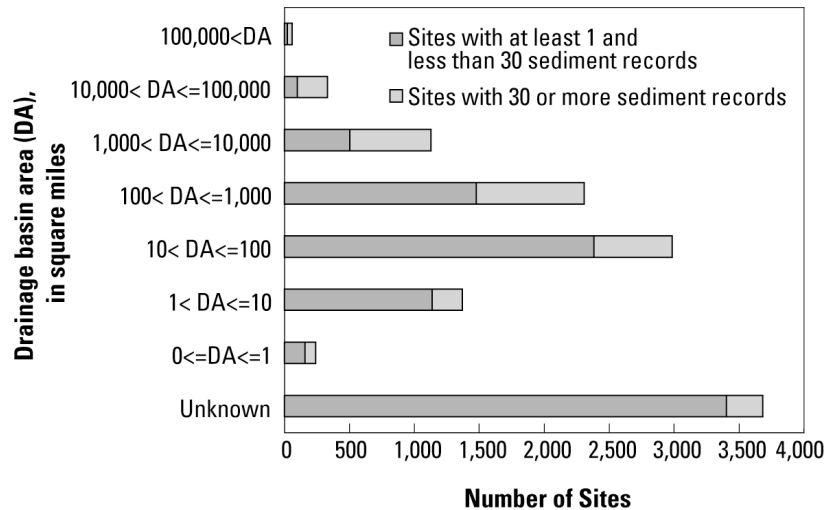


Figure 5. Distribution of drainage areas (DA) for stations with at least one record of paired instantaneous suspended-sediment concentration and water discharge retrieved from the NWISWeb data base, January 13, 2000.

SUMMARY

A retrieval from the U.S. Geological Survey National Water Information System World Wide Web (NWISWeb) data base yielded more than 2.6-million values of instantaneous-value sediment and ancillary data for 15,415 sites in all 50 States, Puerto Rico, and other locations. The NWISWeb data base provides a mechanism to retrieve on-line USGS instantaneous data and is a tool that is easily accessible and straightforward to use. The data base represents the single largest repository of USGS electronic instantaneous-value suspended sediment, bedload, and bed material data.

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APPENDIX. Retrieval results from the NWISWeb data base for selected types of instantaneous fluvial-sediment and water-discharge data grouped by U.S. State, Puerto Rico, and other selected locations, January 13, 2000.

| State name | Number of sites with sediment and ancillary data retrieved in State | Sites with suspended-sediment concentration (80154) data and associated water-discharge (00061) data | | Sites with particle-size distribution of suspended-sediment data, percent finer than sieve diameter 0.062 mm (70331 or 70342) | | Sites with bedload-discharge data (80225) | | Sites with particle-size distribution of bed-material data (one or more parameter codes 80157 through 80175) | |
|--------------------------------|---|--|--|---|--|---|--|--|--|
| | | Number of sites with at least 1 sample | Number of sites with at least 30 samples | Number of sites with at least 1 sample | Number of sites with at least 30 samples | Number of sites with at least 1 sample | Number of sites with at least 30 samples | Number of sites with at least 1 sample | Number of sites with at least 10 samples |
| Alaska | 422 | 412 | 68 | 216 | 30 | 19 | 4 | 40 | 7 |
| Alabama | 266 | 259 | 40 | 32 | 10 | 0 | 0 | 14 | 8 |
| Arkansas | 159 | 151 | 37 | 123 | 32 | 0 | 0 | 36 | 17 |
| Arizona | 179 | 124 | 46 | 60 | 23 | 1 | 1 | 69 | 3 |
| California | 639 | 450 | 185 | 407 | 139 | 129 | 21 | 339 | 84 |
| Colorado | 591 | 575 | 136 | 266 | 48 | 16 | 2 | 70 | 2 |
| Connecticut | 222 | 85 | 16 | 19 | 7 | 0 | 0 | 156 | 0 |
| Dist. of Columbia | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Delaware | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| Florida | 596 | 82 | 28 | 39 | 21 | 0 | 0 | 134 | 1 |
| Georgia | 244 | 202 | 72 | 146 | 22 | 0 | 0 | 100 | 8 |
| Hawaii | 60 | 59 | 21 | 26 | 9 | 0 | 0 | 8 | 0 |
| Iowa | 187 | 123 | 28 | 59 | 20 | 0 | 0 | 99 | 16 |
| Idaho | 419 | 398 | 47 | 180 | 30 | 12 | 9 | 30 | 0 |
| Illinois | 309 | 268 | 33 | 250 | 26 | 0 | 0 | 69 | 12 |
| Indiana | 349 | 257 | 59 | 187 | 18 | 6 | 0 | 49 | 0 |
| Kansas | 410 | 366 | 118 | 208 | 29 | 0 | 0 | 157 | 38 |
| Kentucky | 401 | 389 | 53 | 158 | 26 | 0 | 0 | 30 | 3 |
| Louisiana | 648 | 68 | 28 | 70 | 28 | 0 | 0 | 33 | 1 |
| Massachusetts | 102 | 44 | 12 | 25 | 7 | 0 | 0 | 60 | 1 |
| Maryland | 137 | 104 | 18 | 31 | 6 | 0 | 0 | 39 | 0 |
| Maine | 27 | 25 | 10 | 13 | 9 | 0 | 0 | 3 | 0 |
| Michigan | 225 | 221 | 56 | 75 | 24 | 0 | 0 | 35 | 0 |
| Minnesota | 438 | 239 | 35 | 186 | 18 | 0 | 0 | 92 | 5 |
| Missouri | 135 | 129 | 24 | 101 | 19 | 0 | 0 | 34 | 13 |
| Mississippi | 189 | 170 | 66 | 43 | 14 | 0 | 0 | 33 | 13 |
| Montana | 379 | 377 | 114 | 319 | 85 | 0 | 0 | 28 | 5 |
| North Carolina | 333 | 309 | 127 | 141 | 19 | 0 | 0 | 64 | 0 |
| North Dakota | 218 | 146 | 57 | 112 | 21 | 5 | 0 | 146 | 16 |
| Nebraska | 221 | 156 | 73 | 146 | 74 | 0 | 0 | 191 | 73 |
| New Hampshire | 31 | 20 | 3 | 16 | 3 | 0 | 0 | 5 | 0 |
| New Jersey | 289 | 269 | 67 | 46 | 13 | 0 | 0 | 97 | 3 |
| New Mexico | 359 | 326 | 84 | 279 | 61 | 0 | 0 | 137 | 43 |
| Nevada | 156 | 119 | 46 | 99 | 21 | 6 | 2 | 20 | 0 |
| New York | 313 | 259 | 65 | 123 | 32 | 0 | 0 | 151 | 0 |
| Ohio | 428 | 422 | 22 | 73 | 4 | 0 | 0 | 52 | 1 |
| Oklahoma | 247 | 210 | 145 | 120 | 51 | 0 | 0 | 14 | 3 |
| Oregon | 425 | 351 | 48 | 116 | 21 | 0 | 0 | 100 | 0 |
| Pennsylvania | 956 | 808 | 114 | 73 | 35 | 0 | 0 | 185 | 6 |
| Puerto Rico | 159 | 129 | 43 | 41 | 11 | 0 | 0 | 11 | 0 |
| Rhode Island | 10 | 6 | 1 | 5 | 1 | 0 | 0 | 1 | 0 |
| South Carolina | 58 | 42 | 16 | 42 | 16 | 0 | 0 | 3 | 0 |
| South Dakota | 130 | 120 | 21 | 77 | 18 | 4 | 0 | 26 | 1 |
| Tennessee | 273 | 240 | 44 | 203 | 27 | 0 | 0 | 48 | 0 |
| Texas | 249 | 241 | 74 | 182 | 62 | 0 | 0 | 42 | 5 |
| Utah | 164 | 152 | 42 | 91 | 20 | 0 | 0 | 49 | 10 |
| Virginia | 224 | 219 | 31 | 65 | 16 | 0 | 0 | 24 | 0 |
| Vermont | 23 | 20 | 3 | 13 | 2 | 0 | 0 | 5 | 0 |
| Washington | 719 | 453 | 130 | 170 | 34 | 0 | 0 | 152 | 18 |
| Wisconsin | 510 | 475 | 111 | 270 | 28 | 0 | 0 | 123 | 12 |
| West Virginia | 642 | 637 | 94 | 43 | 11 | 0 | 0 | 25 | 0 |
| Wyoming | 370 | 337 | 112 | 219 | 36 | 38 | 4 | 153 | 30 |
| Other Locations | | | | | | | | | |
| Canada | 11 | 4 | 3 | 4 | 3 | 0 | 0 | 7 | 0 |
| Federated States of Micronesia | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Guam | 8 | 2 | 1 | 1 | 1 | 0 | 0 | 6 | 0 |
| Ryukyu Islands, Southern | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| To Be Determined | 146 | 59 | 0 | 17 | 0 | 2 | 0 | 26 | 16 |
| Total | 15,415 | 12,115 | 2,929 | 6,028 | 1,342 | 238 | 43 | 3,623 | 474 |