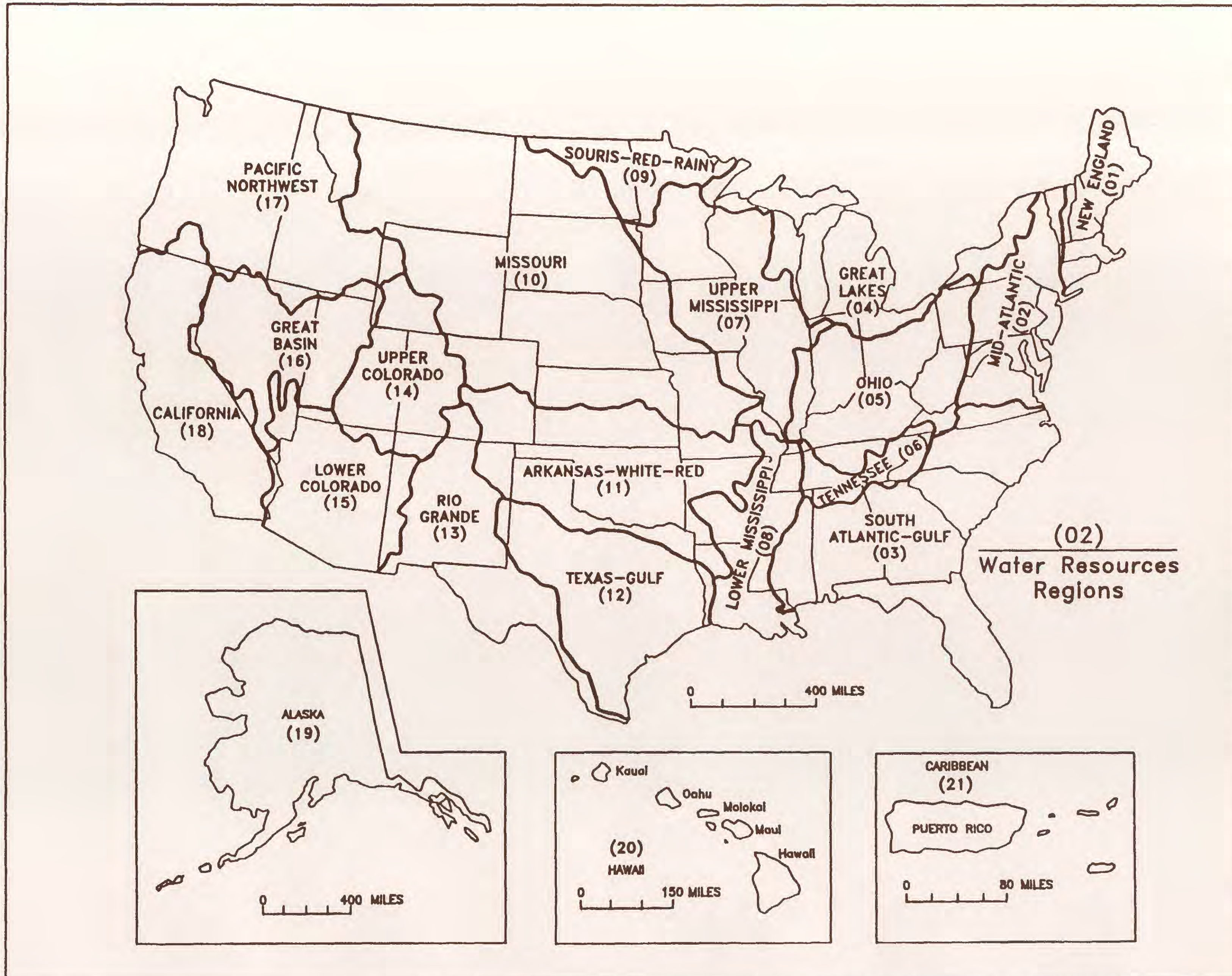
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

NOTES ON SEDIMENTATION ACTIVITIES
CALENDAR YEAR 1990

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Water Resources Division
Office of Water Data Coordination
417 National Center
Reston, Virginia 22092



Water Resources Regions of the United States

NOTES ON SEDIMENTATION ACTIVITIES
CALENDAR YEAR 1990

the
Subcommittee on Sedimentation
of the
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Water Resources Division
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417 National Center
Reston, Virginia 22092

August 1991

PREFACE

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations. The decision to publish the report was made in 1946, from a proposal by the Chairman of the Federal Interagency River Basin Committee, Subcommittee on Sedimentation. The subcommittee approved the proposal and agreed to issue this report as a means of effecting better coordination of the work of various Federal agencies in the field of sedimentation. The report was issued on a quarterly basis in 1946 and 1947, from 1948 to 1953 reports were issued every 6 months, and from 1954 to the present, the report has been issued annually.

Descriptions of work in progress or planned are included in the report, as well as important findings, new methods, new publications, information relating to laboratory and research activities, and other pertinent information. The material is organized by major drainage regions in the conterminous United States, Alaska, Hawaii, and the Caribbean.

Until 1979, each issue of this publication contained a list of stations where sediment data are collected giving the station location, drainage area, and other related information. Because the station list did not change significantly from year to year, it was eventually deleted from the publication. Also, because most users of the station list were only interested in the stations in a certain geographic area, it was felt that their needs could be served more efficiently by acquiring the necessary information through the National Water Data Exchange (NAWDEX). Therefore, locations and addresses of NAWDEX assistance centers ar included in this report.

Information for this report was contributed by the representatives of participating Federal agencies. Suggestions for improving the report are welcome.

CONTENTS

[1]Numbers in parentheses refer to Water Resources Regions shown on the map on the inside of the front cover.

SUBCOMMITTEE ON SEDIMENTATION

Chair FY 1990	Alternate Chair Fy 1990
C. Donald Clarke Soil Conservation Service	David A. Farrell Agricultural Research Service

Representatives	Alternates

Department of Agriculture

David A. Farrell Agricultural Research Service	
Warren C. Harper Forest Service	M. Dean Knighton Forest Service
C. Donald Clarke Soil Conservation Service	

Department of Commerce

Richard B. Perry National Oceanic and Atmospheric Administration	David B. Duane National Oceanic and Atmospheric Administration

Department of Defense

Yung H. Kuo Army Corps of Engineers	Lewis A. Smith Army Corps of Engineers

Department of Energy

Shou-shan Fan
Federal Energy Regulatory Commission

Department of Housing and Urban Development

Truman Goins
Office of Environment and Energy

SUBCOMMITTEE ON SEDIMENTATION--Continued

Representatives	Alternates
Department of the Interior	
Ron Huntsinger Bureau of Land Management	
James Cook Bureau of Mines	Allen Perry Bureau of Mines
Robert Strand Bureau of Reclamation	Roy Rush Bureau of Reclamation
Charles W. Boning U.S. Geological Survey	
William L. Jackson National Park Service	
Ranvir Singh Office of Surface Mining	
Department of Transportation	
D. C. Woo Federal Highway Administration	
Independent Agencies	
John C. Jens Council on Environmental Quality	
Robert E. Thronson Environmental Protection Agency	
Andrew Seiger International Boundary and Water Commission	Paul Storing International Boundary and Water Commission
Anthony Cordone Nuclear Regulatory Commission	Fred Ross Nuclear Regulatory Commission

SUBCOMMITTEE ON SEDIMENTATION--Continued

Representatives	Alternates

Independent Agencies--Continued

Robert T. Joyce
Tennessee Valley Authority

OWDC Liaison: G. Douglas Glysson

Working Group

Technical Committee on Sedimentation Working Groups
Chair: Robert T. Joyce, Tennessee Valley Authority

LOCATIONS OF NAWDEX ASSISTANCE CENTERS

ALABAMA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	520 19th Avenue, Tuscaloosa, AL 35401	
TELEPHONE:	(205) 752-8104	Central Time
	FTS 229-1061	
NAWDEX CONTACT:	Will Mooty	

ALASKA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	4230 University Drive, Suite 201, Anchorage, AK 99508-4664	
TELEPHONE:	(907) 786-7100	Alaska Time
	FTS (907) 786-7100	(Pacific time minus 1 hour)
NAWDEX CONTACT:	Robert D. Lamke	

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	4230 University Drive, Room 101, Anchorage, AK 99508-4664	
TELEPHONE:	(907) 561-5555	Yukon Time
	FTS (907) 271-4320	(Pacific time minus 1 hour)
NAWDEX CONTACT:	Elizabeth C. Behrendt	

ARIZONA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	700 West Congress Street, FB-44, Tucson, AZ 85701	
TELEPHONE:	(602) 629-6629	Mountain Time
	FTS 762-6629	
NAWDEX CONTACT:	Colleen Babcock	

ARKANSAS

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	700 West Capitol, 2301 Federal Office Building, Little Rock, AR 72201	
TELEPHONE:	(501) 378-6391	Central Time
	FTS 740-6391	
NAWDEX CONTACT:	John E. Owen	

CALIFORNIA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 2234 Federal Building, 2800 Cottage Way, Sacramento, CA 95825
TELEPHONE: (916) 978-4643 Pacific Time
FTS 460-4643
NAWDEX CONTACT: John Bader

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: 7638 Federal Building, 300 North Los Angeles Street, Los Angeles, CA 90012
TELEPHONE: (213) 894-2850 Pacific Time
FTS 798-2850
NAWDEX CONTACT: Vacant

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: Room 3128, Building 3 (MS 533), 345 Middlefield Road, Menlo Park, CA 94025
TELEPHONE: (415) 323-8111, x2817 Pacific Time
FTS (415) 323-8111, x2817
NAWDEX CONTACT: Bruce S. Deam

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: 504 Custom House, 555 Battery Street, San Francisco, CA 94111
TELEPHONE: (415) 705-1010 Pacific Time
FTS 465-1010
NAWDEX CONTACT: Patricia A. Shiffer

COLORADO

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Building 53, Denver Federal Center, Mail Stop 415, Box 25046, Lakewood, CO 80225
TELEPHONE: (303) 236-4882 Mountain Time
FTS 776-4882
NAWDEX CONTACT: None

ORGANIZATION: Denver Earth Science Information Center, U.S. Geological Survey
ADDRESS: 169 Federal Building, 1961 Stout Street, Denver, CO 80294
TELEPHONE: (303) 844-4169 Mountain Time
FTS 564-4169
NAWDEX CONTACT: Edith C. Johansson

NAWDEX ASSISTANCE CENTERS--Continued

CONNECTICUT

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Abraham A. Ribicoff Federal Building, 450 Main Street, Room 525, Hartford, CT 06103	
TELEPHONE:	(203) 240-3060 FTS 240-3060	Eastern Time
NAWDEX CONTACT:	Lawrence A. Weiss	

DELAWARE

(See U.S. Geological Survey Office in Maryland)

DISTRICT OF COLUMBIA

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	Room 2650, 18th and C Streets, N.W., Washington, DC 20240	
TELEPHONE:	(202) 343-8073 FTS (202) 343-8073	Eastern Time
NAWDEX CONTACT:	Bruce A. Hubbard	

FLORIDA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	227 N. Bronough Street, Suite 3015, Tallahassee, FL 32301	
TELEPHONE:	(904) 681-7620 FTS 965-7620	Eastern Time
NAWDEX CONTACT:	Linda Geiger	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	9100 N.W. 36th Street, Miami, FL 33122	
TELEPHONE:	(305) 594-0655 FTS 350-5382	Eastern Time
NAWDEX CONTACT:	George A. Karavitis	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	224 West Center Street, Suite 1006, Altamonte Springs, FL 32714	
TELEPHONE:	(407) 648-6191 FTS 820-6191	Eastern Time
NAWDEX CONTACT:	Larry Fayard	

FLORIDA--Continued

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 4710 Eisenhower Boulevard, Suite B-5, Tampa, FL 33634
TELEPHONE: (813) 228-2124 Eastern Time
FTS 826-2124
NAWDEX CONTACT: Jack Rega

GEORGIA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 6481 Peachtree Industrial Boulevard, Suite B, Doraville, GA 30360
TELEPHONE: (404) 986-6860 Eastern Time
FTS 257-6890
NAWDEX CONTACT: Keith W. McFadden

HAWAII

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 677 Ala Moana Boulevard, #415 Honolulu, HI 96813-5412
TELEPHONE: (808) 541-2653 Alaska-Hawaii Time
FTS 551-2653 (Pacific Time minus 2 hours)
NAWDEX CONTACT: Iwao Matsuoka

IDAHO

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 230 Collins Road, Boise, ID 83702
TELEPHONE: (208) 334-1750 Mountain Time
FTS 554-1750
NAWDEX CONTACT: Luther C. Kjelstrom

ILLINOIS

ORGANIZATION: Illinois State Water Survey Division
ADDRESS: 2204 Griffith Drive, Champaign, IL 61820
TELEPHONE: (217) 333-4952 Central Time
FTS (217) 333-4952
NAWDEX CONTACT: Robert A. Sinclair

ILLINOIS--Continued

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Busey Bank County Plaza, Fourth Floor, 102 East Main Street, Urbana, IL 61801
TELEPHONE: (217) 398-5595 Central Time
FTS (217) 958-5595
NAWDEX CONTACT: Gary O. Balding

INDIANA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 5957 Lakeside Boulevard, Indianapolis, IN 46278-1996
TELEPHONE: (317) 290-3333 Eastern Time
FTS 335-3333
NAWDEX CONTACT: Don Arvin

IOWA

ORGANIZATION: Iowa Department of Natural Resources, Geological Survey Bureau
ADDRESS: 123 North Capitol Street, Iowa City, IA 52242
TELEPHONE: (319) 335-1575 Central Time
FTS (319) 335-1575
NAWDEX CONTACT: Richard L. Talcott

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Room 269, Federal Building, 400 South Clinton, Box 1230, Iowa City, IA 52244
TELEPHONE: (319) 337-4191 Central Time
FTS (319) 337-4191
NAWDEX CONTACT: Delmer J. O'Connell

KANSAS

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 4821 Quail Crest Place, Lawrence, KS 66049
TELEPHONE: (913) 842-9909 Central Time
FTS (913) 842-9909
NAWDEX CONTACT: Charlene Merry

NAWDEX ASSISTANCE CENTERS--Continued

KENTUCKY

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 2301 Bradley Avenue, Louisville, KY 40217
TELEPHONE: (502) 582-5241 Eastern Time
FTS 352-5241
NAWDEX CONTACT: Sandy J. Couts or Harry C. Rollins

LOUISIANA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: P.O. Box 66492, 6554 Florida Boulevard, Baton Rouge, LA 70896
TELEPHONE: (504) 389-0281 Central Time
FTS 687-0281
NAWDEX CONTACT: Wendy Lovelace

MAINE

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 26 Ganneston Drive, Augusta, ME 04330
TELEPHONE: (207) 622-8209
FTS 833-6209
NAWDEX CONTACT: William P. Bartlett

MARYLAND

ORGANIZATION: General Sciences Corporation
ADDRESS: 6100 Chevy Chase Drive, Suite 200, Laurel, MD 20707
TELEPHONE: (301) 953-2700 Eastern Time
FTS (202) 953-2700
NAWDEX CONTACT: Stuart Wollman

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 208 Carroll Building, 8600 LaSalle Road, Towson, MD 21204
TELEPHONE: (301) 828-1535 Eastern Time
FTS 922-7872, 7849
NAWDEX CONTACT: Robert W. James, Jr. or John F. Hornlein

MASSACHUSETTS

ORGANIZATION:	ENSR, Inc.	
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TELEPHONE:	(508) 635-9500 FTS (508) 635-9500	Eastern Time
NAWDEX CONTACT:	Donald P. Galya	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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TELEPHONE:	(617) 565-6860 FTS 835-6860	Eastern Time
NAWDEX CONTACT:	David McCartney (temporary)	

MICHIGAN

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	6520 Mercantile Way, Suite 5, Lansing, MI 48911	
TELEPHONE:	(517) 377-1608 FTS 374-1608	Eastern Time
NAWDEX CONTACT:	Gary C. Huffman or Stephen P. Blumer	

MINNESOTA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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TELEPHONE:	(612) 229-2600 FTS (612) 229-2600	Central Time
NAWDEX CONTACT:	Allan D. Arntson	

MISSISSIPPI

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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NAWDEX CONTACT:	Fred Morris, III	

MISSOURI

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 1400 Independence Road, Mail Stop 200, Rolla, MO 65401
TELEPHONE: (314) 341-0834 Central Time
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NAWDEX CONTACT: Loyd Waite

MONTANA

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NAWDEX CONTACT: Melvin White

NEBRASKA

ORGANIZATION: Nebraska Natural Resources Commission
ADDRESS: 301 Centennial Mall South, P.O. Box 94876, Lincoln, NE 68509
TELEPHONE: (402) 471-2081 Central Time
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NAWDEX CONTACT: Mahendra K. Bansal, Head, Data Bank Section, Natural Resources Information System

ORGANIZATION: U.S. Geological Survey, Water Resources Division
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FTS 541-5082
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NEVADA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
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NAWDEX ASSISTANCE CENTERS--Continued

NEW HAMPSHIRE

(See U.S. Geological Survey Office in Massachusetts)

NEW JERSEY

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
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NAWDEX CONTACT:	Deloris W. Speight

NEW MEXICO

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NEW YORK

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NAWDEX ASSISTANCE CENTERS--Continued

NORTH CAROLINA

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	FTS (919) 787-2627
NAWDEX CONTACT:	Melvin D. Edwards

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	FTS 672-4789	
NAWDEX CONTACT:	Pamilee Breton	

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TELEPHONE:	(701) 250-4604	Central Time
	FTS 783-4604	
NAWDEX CONTACT:	Russell E. Harkness	

OHIO

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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TELEPHONE:	(614) 469-5553	Eastern Time
	FTS 943-5553	
NAWDEX CONTACT:	Ann E. Arnett	

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ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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TELEPHONE:	(405) 231-4256	Central Time
	FTS 736-4256	
NAWDEX CONTACT:	John S. Havens	

OREGON

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	10615 S.E. Cherry Blossom Drive, Portland, OR 97216
TELEPHONE:	(503) 231-2262 Pacific Time
	FTS 429-2262
NAWDEX CONTACT:	Lawrence E. Hubbard

PENNSYLVANIA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	P.O. Box 1107, Fourth Floor, Federal Building, 228 Walnut Street, Harrisburg, PA 17108
TELEPHONE:	(717) 782-3851 Eastern Time
	FTS 590-3851
NAWDEX CONTACT:	Robert Helm

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	Great Valley Corporate Center, 111 Great Valley Parkway, Malvern, PA 19355
TELEPHONE:	(215) 647-9008 Eastern Time
	FTS (215) 647-9008
NAWDEX CONTACT:	Cynthia L. Gilliam

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	Room 2204, Moorhead Federal Building, 1000 Liberty Avenue, Pittsburgh, PA 15222
TELEPHONE:	(412) 644-2864 Eastern Time
	FTS 722-2864
NAWDEX CONTACT:	Greg Wehner

PUERTO RICO (includes Virgin Islands)

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	GPO Box 4424, San Juan, PR 00936
TELEPHONE:	(809) 783-4660 Atlantic Time
	FTS 498-4346, 4342
NAWDEX CONTACT:	Vacant

RHODE ISLAND

(See U.S. Geological Survey Office in Massachusetts)

SOUTH CAROLINA

ORGANIZATION: South Carolina Water Resources Commission
ADDRESS: 1201 Main Street, Suite 1100 Capital Center, Columbia, SC 29202
TELEPHONE: (803) 737-0800 Eastern Time
FTS (803) 737-0800
NAWDEX CONTACT: Theresa Greaney

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Stephenson Center, Suite 129, 720 Gracern Road, Columbia, SC 29210-7651
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FTS 230-6100
NAWDEX CONTACT: David E. Bower

SOUTH DAKOTA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
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FTS (605) 353-7176
NAWDEX CONTACT: Rick D. Benson

TENNESSEE

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 810 Broadway, Suite 500, Nashville, TN 37203
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FTS 852-5424
NAWDEX CONTACT: Lori R. Mercer

NAWDEX ASSISTANCE CENTERS--Continued

TEXAS

ORGANIZATION:	Texas Natural Resources Information System
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TELEPHONE:	(512) 463-8402 Central Time FTS (512) 463-8402
NAWDEX CONTACT:	Dr. Charles Palmer

UTAH

ORGANIZATION:	Utah Division of Water Rights
ADDRESS:	Room 231, 1636 West North Temple, Salt Lake City, UT 84116
TELEPHONE:	(801) 533-6071 Mountain Time FTS (801) 533-6071
NAWDEX CONTACT:	James Riley

ORGANIZATION:	Center for Water Resources Research
ADDRESS:	Utah State University, UMC-82, Logan, UT 84322
TELEPHONE:	(801) 750-3155 or 3172 Mountain time FTS (801) 750-3155 or 3172
NAWDEX CONTACT:	David G. Tarboton

ORGANIZATION:	U.S. Geological Survey, Water Resources Division
ADDRESS:	Room 1016, Administration Building, 1745 West 1700 South, Salt Lake City, UT 84104
TELEPHONE:	(801) 524-5654 Mountain Time FTS 588-5654
NAWDEX CONTACT:	Pat Fikstad

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey
ADDRESS:	8105 Federal Building, 125 South State Street, Salt Lake City, UT 84138
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NAWDEX CONTACT:	Wendy R. Hassibe

VERMONT

(See U.S. Geological Survey Office in Massachusetts)

NAWDEX ASSISTANCE CENTERS--Continued

VIRGINIA

ORGANIZATION: Virginia Water Resources Research Center
ADDRESS: Virginia Polytechnic Institute and State University, 617 North Main Street, Blacksburg, VA 24060-3339
TELEPHONE: (703) 231-8033 Eastern Time
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NAWDEX CONTACT: T.W. Johnson

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 3600 West Broad Street, Room 606, Richmond, VA 23230
TELEPHONE: (804) 771-2427 Eastern Time
FTS 925-2427
NAWDEX CONTACT: Byron J. Prugh, Jr.

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: National Water Data Exchange, 421 National Center, Reston, VA 22092
TELEPHONE: (703) 648-5663 Eastern Time
FTS 959-5663
NAWDEX CONTACT: Carol Lewis

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: 507 National Center, Room 1C402, Reston, VA 22092
TELEPHONE: (703) 648-6045
FTS 959-6045
NAWDEX CONTACT: Information Services

WASHINGTON

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Suite 600, Pacific Northwest Area, Washington District, 1201 Pacific Avenue, Tacoma, WA 98402
TELEPHONE: (206) 593-6510 Pacific Time
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NAWDEX CONTACT: L.A. Fuste

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: 678 U.S. Courthouse, West 920 Riverside Avenue, Spokane, WA 99201
TELEPHONE: (509) 353-2524 Pacific Time
FTS 439-2524
NAWDEX CONTACT: Thomas L. Servatius

WEST VIRGINIA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	603 Morris Street, Charleston, WV 25301	
TELEPHONE:	(304) 347-5130, 5132 FTS 930-5130, 5132	Eastern Time
NAWDEX CONTACT:	Elizabeth Hanna	

WISCONSIN

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
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NAWDEX CONTACT:	Robert Bodoh	

WYOMING

ORGANIZATION:	Wyoming Water Research Center	
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TELEPHONE:	(307) 766-2143 FTS (307) 766-2143	Mountain Time
NAWDEX CONTACT:	Barry Lawrence	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	2617 East Lincolnway, Suite B, Cheyenne, WY 82001	
TELEPHONE:	(307) 772-2153 FTS 328-2153	Mountain Time
NAWDEX CONTACT:	Sharon L. Green	

Interagency Advisory Committee on Water Data
Annual Subcommittee Report
Fiscal Year 1990

Subcommittee Name: Sedimentation

Chair FY 1990: C. Don Clarke
Agency: Soil Conservation Service
Telephone: 202/382-0136

Chair FY 1991: David A. Farrell
Agency: Agricultural Research Service
Telephone: 301/344-4246

Accomplishment During the Year

The subcommittee met six times during the year, once in a joint session with the technical Committee on Sedimentation in Las Vegas, Nevada, and five times in Washington, D.C. The Technical Committee met twice, once in Las Vegas, Nevada, and once in Minneapolis, Minnesota.

Planning continued on the Fifth Federal Interagency Sedimentation Conference which is to be held March 18-21, 1991, in Las Vegas, Nevada. Abstracts for 198 papers have been received. There will be time at the Conference for 196 oral presentations in four concurrent sessions. Robert Joyce, TVA, is serving as Chairman of the Conference; G. Douglas Glysson, USGS, is serving as Chairman of the Operations Committee; and Shou-shan Fan, FERC, is serving as Chairman of the Technical Program Committee.

A panel discussion on "Legal and Institutional Issues and Practical Sediment Management" will be held. Plans are being made to invite the Governor of Nevada and Assistant Secretaries of Interior and Agriculture to be keynote speakers. Additionally, speakers from China and Canada are to be invited. Plans are to invite Phil Cohen, Chief Hydrologist, USGS, to deliver the welcome.

The second Conference announcement was mailed, and first and second exhibitors announcements have been mailed.

The Subcommittee sponsored a bridge scour symposium on October 17-19, 1989. The proceedings have been distributed.

The Notes on Sedimentation Activities for calendar year 1989 are being printed.

A review draft of the Five Year Summary of Reservoir Sedimentation Surveys 1981-85 is being reviewed by the Subcommittee.

Revision of Chapter Three of the National Handbook of Recommended Methods for Water-Date Acquisition is advancing.

The report on the Modeling Symposium, the third phase of a project to develop guidelines for selecting and properly using computer models to estimate sediment transport, is being prepared.

The Technical Committee on Sediment oversees the Federal Interagency Sedimentation Project (FISP) at the St. Anthony Falls Hydraulics Laboratory in Minneapolis, Minnesota.

The Project developed a Dynatrol housing which may be purchased for about $500. Field tests revealed two shortcomings of Dynatrol: (1) slowness in responding to temperature changes and (2) long calibration time.

A Hubbel bed material sampler is being made with a 15 inch wide opening. It will be sent to USBR for testing.

Development of the plummet type sediment gage is continuing, but has been slowed due to the retirement of Joe Beverage. Joe Szalona is testing sediment concentrations using a plummet connected to an electronic balance and is working on methods to dampen eddy currents that persist after the pump has been stopped.

Three section of Chapter 3 (Sediment), National Handbook of Recommended Methods for Water Data Acquisition, are being typed by the Bureau of Reclamation.

The D-77 valve has been redesigned from an internal valve to an external mechanism. This was necessary to eliminate contamination. The Project has ordered special Teflon caps through the Corps of Engineers to replace polyethylene caps.

The holding force of the P-61 pinch valve has been increased from 3 to 11 pounds in response to HIF. The unit is back at HIF for reevaluation and engineering prior to field testing.

More work is needed to gain approval of an ASTM standard on laboratory procedures for making sediment concentration analyses. The main hurdle involves the necessity for a round robin test among several laboratories.

The autoclavable cable-suspended sampler (DH-89) was sent to HIF for evaluation of possible application to sampling under ice.

Reports Published:

The following FISP reports and papers were published during FY 90.

Snapshot Sampler
"History of the Sedimentation Project"
"Gages for Measuring Fluvial Sediment Concentration"
Sedigraph Report
Dynatrol Calibration and Operating Manual

At the ASCE Hydraulics Division Meeting in August 1990, the Subcommittee sponsored two sessions on "Major Sedimentation Issues and Activities at the Selected Federal Agencies". The following papers were included in the proceedings. Those preceded with an asterisk were presented orally.

*"Major Sedimentation (Erosion) Issues and Ongoing Research and Developments at the ARS" by Kenneth G. Renard, Joe C. Willis, and David Farrell, Agricultural Research Service

"Sediment Issues Related to Management of the National Forests" by Warren C. Harper, Forest Service

*"Major Sedimentation Activities in the SCE" by C.D. Clarke, Soil Conservation Service

*"Corps of Engineers Sedimentation Management Program" by Yung-Huang Kuo, Corps of Engineers

*"Major Sedimentation Issues and Ongoing Investigation at the FERC", by Shou-shan Fan and Fred E. Springer, Federal Energy Regulatory Commission

"Sedimentation Issues Confronting the Bureau of Reclamation" by Robert Strand, Bureau of Reclamation

*"Major Sedimentation Issues and Ongoing Research at the USGS" by Harvey Jobson and Edmund D. Andrews, U.S. Geological Survey

*"Major Sedimentation Issues in EPA" by Robert Thronson, Environmental Protection Agency

Action Plans for Coming Year

The Subcommittee plans to meet six times in the coming year, including a joint meeting with the Technical Committee. The Technical Committee plans to meet twice during FY 91.

"Sediment Deposition in U.S. Reservoirs: Summary of Data Reported 1981-85" is to be published.

Notes on Sedimentation Activities 1990 will be published.

Revision of Chapter Three of the National Handbook of Recommended Methods for Water-Data Acquisition will be completed and submitted to the Federal Advisory Committee on Water Data for acceptance and publication.

The Subcommittee recommends that all technical data be published in electronic format.

The Subcommittee is considering a request from the Technical Committee to make a recommendation that each member agency require all personnel to purchase sediment sampling equipment from FISP or from vendors which conform to FISP standards in the manufacture of such equipment.

Recommendations

None

NEW ENGLAND REGION

GEOLOGICAL SURVEY

St. John Subregion

1. Suspended-sediment data are being collected bimonthly at St. John River near Van Buren, ME, as a part of the National Stream Quality Accounting Network (NASQAN).

Penobscot Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Penobscot River at Eddington, ME, as a part of NASQAN.

Kennebec Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Kennebec River near North Sidney, ME, as a part of NASQAN.

Androscoggin Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Androscoggin River at Brunswick, ME, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Wild River at Gilead, ME, as a part of the National Hydrologic Benchmark Network.

Maine Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at St. Croix River at Milltown, ME.

Saco Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Saco River at Cornish, ME, and on a bimonthly basis at Presumpscot River near West Falmouth, ME, as a part of NASQAN.

Connecticut Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Connecticut River at North Walpole, NH, and at Connecticut River at Thompsonville, CT, as a part of NASQAN.

2. Suspended-sediment data are being collected on approximately a daily basis at Salmon River near East Hampton, CT, to determine daily sediment loads. The data collection is being done in cooperation with the State of Connecticut Department of Environmental Protection, and will be completed on September 30, 1990.

Massachusetts-Rhode Island Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Pawcatuck River at Westerly, RI, as a part of NASQAN.

Connecticut Coastal Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Housatonic River at Stevenson, CT, and quarterly at Shetucket River at South Windham, CT, and at Quinebaug River at Jewett City, CT, as a part of NASQAN.

St. Francois Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Black River at Coventry, VT, as part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
10 Causeway, Room 926
Boston, MA 02222-1040

NEW ENGLAND REGION (01)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
St. Johns	Meduxnekeag	Meduxnekeag	Aroostock	ME

b. River Basin Studies

Major Drainage	Watershed	Stream	County	State
Connecticut River	North River	North	Franklin	MA

2. Special Studies

Maine - Five nutrient and sediment control systems (NSCS) were constructed from 1989 to 1990 in the Long-Cross Lakes Hydrologic Unit Area (St. John River Basin) to improve the quality of runoff from potato cropland. NSCS components include a runoff collection system, sediment basin, primary grass filter, constructed wetland, deep-water pond, and polishing filter. Monitoring data indicates the NSCS provides reductions in total phosphorus, suspended solids, and volatile suspended solids of at least 85 percent and up to 100 percent. Additional installations are planned.

MID-ATLANTIC REGION

GEOLOGICAL SURVEY

Richelieu Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Richelieu River (Lake Champlain) at Rouses Point, NY, as a part of the National Stream Quality Accounting Network (NASQAN).

Upper Hudson Subregion

1. Suspended-sediment data are being collected on a daily basis at Hudson River at Stillwater, NY, and Hudson River at Waterford, NY, in cooperation with the New York State Department of Environmental Conservation. Suspended-sediment data are being collected on a periodic basis at Hudson River at Rogers Island at Fort Edward, NY, and Hudson River at Schuylerville, NY, and Hudson river near Fort Miller, NY.

2. Suspended-sediment data are being collected on a quarterly basis at Hudson River at Green Island, NY, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Esopus Creek at Shandaken, NY, as a part of the National Hydrologic Benchmark Network.

Lower Hudson-Long Island Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Passaic River at Little Falls, NJ, and quarterly at Raritan River at Queens Bridge at Bound Brook, NJ, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Nissequoque River near Smithtown, NY, and Carmans River at Yaphank, NY, as part of NASQAN.

Delaware Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Toms River near Toms River, NJ, Maurice River at Norma, NJ, and West Branch Wading River at Maxwell, NJ, and on a quarterly basis at Delaware River at Trenton, NJ, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at McDonalds Branch in Lebanon State Forest, NJ, as a part of the National Hydrologic Benchmark Network.

3. Bottom material data (carbon, metals, organochlorine pesticides) are being collected at about 16 subregion sites in New Jersey on a yearly schedule.

Susquehanna Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Raystown Branch Juniata River at Saxton and Susquehanna River at Harrisburg, and on a quarterly basis at Susquehanna River at Danville, West Branch Susquehanna River at Lewisburg, and Young Womans Creek near Renovo, as a part of the NASQAN and Hydrologic Benchmark programs.

2. Daily suspended-sediment data are being collected at Juniata River at Newport, PA, as a Federal sediment index station.

3. Suspended-sediment data are being collected on a bimonthly basis at Susquehanna River at Conowingo, MD, as a part of NASQAN and on a daily basis, beginning July 1984, as part of the Chesapeake Bay River-Input Monitoring project.

Upper Chesapeake Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Choptank River near Greensboro, MD, as part of NASQAN, and on a daily basis as part of the Chesapeake Bay River-Input Monitoring project.

2. Suspended-sediment data are being collected on a bimonthly basis at Patuxent River near Bowie, MD, as a part of NASQAN and on a daily basis, beginning October 1984, as part of the Chesapeake Bay River-Input Monitoring project.

Potomac Subregion

1. Suspended-sediment data are being collected on a daily basis at Monocacy River at Reichs Ford Bridge near Frederick, MD, as part of the Federal CBR program.

2. Suspended-sediment data are being collected on a daily basis at Potomac River at Point of Rocks, MD, as a part of the Federal CBR program.

3. Suspended-sediment data are being collected on a bimonthly basis at Potomac River at Shepherdstown, WV, Potomac River at Chain Bridge, Washington, D.C., and Shenandoah River at Millville, WV, as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Monocacy River at Bridgeport, MD, in cooperation with the Interstate Commission on the Potomac River basin as part of a study looking at nutrient loadings.

Lower Chesapeake Subregion

1. Suspended-sediment data are being collected on a daily basis on Rappahanock River at Remington, VA, as a part of the Federal CBR program.

2. Suspended-sediment data are being collected bimonthly at Rappahanock River near Fredericksburg, VA, Mattaponi River near Beulahville, VA, Pamunkey River near Hanover, VA, Appomattox River at Matoaca, VA, and James River at Cartersville, VA, as part of NASQAN.

3. Suspended-sediment data are being collected quarterly at Holiday Creek near Andersonville, VA, as part of the National Hydrologic Benchmark Network.

4. Suspended-solids data are being collected daily at Rappahanock River near Fredricksburg, James River at Cartersville, VA, Pamunkey River near Hanover, VA, Mattaponi River near Beulahville, VA, and Appomattox River at Matoaca, VA, in cooperation with the Virginia Water Control Board.

Special Studies

1. A study of agricultural best management practices in the carbonate region of southeastern Pennsylvania was started in the Conestoga River basin in Lancaster County, PA, during 1982. Suspended-sediment and nutrient data were

collected from the Little Conestoga Creek near Morgantown and near Churchtown using automatic samplers.

2. Suspended-sediment data are being collected using an automatic sampler from the Conestoga River at Conestoga, PA, as part of a study of nutrient discharges. Base-flow samples are collected monthly.

3. Samples of reservoir bottom materials and the "slurries" at the water-sediment interface were collected as part of a project to evaluate nutrient and other chemical loads associated with resuspendable sediment in reservoirs on the lower Susquehanna River.

4. Suspended-sediment data are being collected with automatic samplers from Brush Run, a 200-acre agricultural basin in the noncarbonate region of southeastern Pennsylvania. Base-flow samples are collected monthly using manual samplers and storm-event samples are collected using automatic samplers. The study is designed to evaluate the effects of best management practices on sediment and nutrient discharge.

5. Suspended-solids data are being collected daily at Rappahanock River near Fredricksburg, VA, Mattaponi River near Beulahville, VA, Pamunkey River near Hanover, VA, James River at Cartersville, VA, and Appomattox River at Matoaca, VA, in cooperation with the Virginia Water Control Board. These data are being used to improve the understanding of input of suspended solids into Cheaspeake Bay.

6. Suspended-solids data are being collected during storms at Upham Brook at Richmond, VA, Chickahominy River near Atlee, VA, Chickahominy River at Richmond, VA, and Chickahominy River near Providence Forge, VA, as part of a cooperative study with the City of Newport News to assess the sources and sinks of trace metals, nutrients, and selected contaminants in the Chickahominy River basin.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
208 Carroll Building
8600 LaSalle Road
Towson, MD 21204

District Chief, WRD
U.S. Geological Survey
P.O. Box 1669
Albany, NY 12201

District Chief, WRD
U.S. Geological Survey
810 Bears Tavern Road
Suite 206
West Trenton, NJ 08628

District Chief, WRD
U.S. Geological Survey
603 Morris Street
Charleston, WV 25301

District Chief, WRD
U.S. Geological Survey
P.O. Box 1107
Harrisburg, PA 17108

District Chief, WRD
U.S. Geological Survey
3600 West Broad Street, Room 606
Richmond, VA 23230

MID-ATLANTIC REGION (02)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Hudson River	Cayadutta	Cayadutta & Hale Ck	Fulton	NY
Juniata River	Yellow Ck	Yellow Ck	Bedford & Blair	PA
Susquehanna River	Deer Ck	Deer Ck	Harford	MD
Shenandoah River	Christian Ck	Christian Ck	Augusta	VA
Rappahannok	Washington & Lee	Unnamed	Westmor-land, Richmond & Northumberland	VA

b. River Basin Studies

Major Drainage	Watershed	County	State
Potomac River	Rock & Marsh Cks	Adams	PA
Potomac River	Conococheague & Antietam Cks	Franklin & Adams	PA

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Goldsboro Lake	Caroline	MD

3. Special Studies

Comprehensive monitoring and evaluation projects are continuing in the LaPlatte River Watershed, Chittenden County, Vermont and in the St. Albans Bay Watershed, Franklin County, Vermont. These are long term projects to evaluate the effect of installing Best Management conservation practices on sediment yield and nutrient yields.

SOUTH ATLANTIC-GULF REGION

GEOLOGICAL SURVEY

Chowan-Roanoke Subregion

1. Suspended-sediment data are collected bimonthly at Dan River at Paces, VA, and quarterly at Nottoway River near Sebrell, VA, Meherrin River at Emporia, VA, and Blackwater River near Franklin, VA, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are collected quarterly at Roanoke River at Roanoke Rapids, NC, as part of NASQAN.

Neuse-Pamlico Subregion

1. Suspended-sediment data are collected bimonthly at Neuse River at Kinston, and Contentnea Creek at Hookerton, NC, and quarterly at Tar River at Tarboro, NC as a part of NASQAN.

2. Suspended-sediment data are being collected on each site visit and during flood events at Dial Creek near Bahama, NC, as part of a reservoir sedimentation study being conducted at Lake Michle, Durham County, NC, in cooperation with the City of Durham.

Cape Fear Subregion

1. Suspended-sediment data are collected quarterly on the Cape Fear River at Lock 1 near Kelly, NC, as part of the NASQAN program.

2. Suspended-sediment data was collected on a bimonthly basis and during floods at five sites in the Grove Creek basin, near Kenansville, NC, to define hydrology due to effects of channel modifications in cooperation with the North Carolina Department of Human Resources. In October 1990, project was suspended since proposed channel modifications were not completed.

Pee Dee Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Scape Ore Swamp near Bishopville, SC, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Lynches River at Effingham, SC, Black River at Kingstree, SC, Rocky River near Norwood, NC, and at Pee Dee River at Pee Dee, SC, as a part of NASQAN.

3. Suspended-sediment data are being collected daily and more frequently during flood events at the Yadkin River at Yadkin College, NC, as part of the Federal Collection of Basic Records (CBR) program.

4. Suspended-sediment data are being collected on a bimonthly basis at Rocky River near Norwood, NC, as part of NASQAN.

Santee-Edisto Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Edisto River near Givhans, SC, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Crawl Creek near Pineville, SC, Santee River below St. Stephens, SC. This is being done in cooperation with the COE.

Ogeechee-Savannah Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Upper Three Runs near New Ellenton, SC, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a quarterly basis at Savannah River near Clyo, GA, and bimonthly at Ogeechee River near Eden, GA, as a part of NASQAN.

Altamaha-St. Marys Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Falling Creek near Juliette, GA, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Altamaha River near Everett City, GA, and quarterly at Satilla River at Atkinson, GA, as a part of NASQAN.

St. Johns Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at four sites in Florida as a part of NASQAN.

Southern Florida Subregion

1. Suspended-sediment data are being collected on a bimonthly or quarterly basis at five sites in Florida as a part of NASQAN.

Peace-Tampa Bay Subregion

1. Suspended-sediment data are being collected on a quarterly basis at two sites in Florida as a part of NASQAN.

Suwannee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at two sites in Florida as a part of NASQAN.

Ochlockonee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at one site in Florida as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at one site in Florida as a part of the National Hydrologic Benchmark Network.

Apalachicola Subregion

1. Suspended-sediment data are being collected on a quarterly basis at two sites in Florida as a part of NASQAN. Suspended-sediment data are being collected periodically at two sites in the Apalachicola River basin in cooperation with the COE.

2. Suspended-sediment data are being collected on a bimonthly basis at Flint River at Newton, GA, and Chattahoochee River near Columbia, AL, as part of NASQAN.

Choctawhatchee-Escambia Subregion

1. Suspended-sediment data are being collected on a quarterly basis at four sites in Florida as a part of NASQAN.

Alabama Subregion

1. Suspended-sediment data are being collected 10 times per year and quarterly at Alabama River near Montgomery, AL, in cooperation with the COE, as a part of NASQAN, respectively, and bimonthly at Alabama River at Claiborne, AL, as a part of NASQAN.

Mobile-Tombigbee Subregion

1. Suspended-sediment data are being collected 10 times per year at Tombigbee River at Gainesville, AL, and at Black Warrior River at Northport, AL, in cooperation with the COE, monthly at Tombigbee River at Gainesville, bimonthly at Black Warrior River below Warrior Dam near Eutaw, AL, and quarterly at Tombigbee River at Coffeeville lock and dam, AL, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Blackwater River near Bradley and Sipsey Fork near Grayson, AL, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis in cooperation with the COE at the following sites:

Tombigbee River near Marrietta, MS
Twentymile Creek near Guntown, MS
Twentymile Creek near Mantachie, MS
Tombigbee River near Fulton, MS
Mantachie Creek below Dorsey, MS
Tombigbee River at Bigbee, MS
Tombigbee River near Amory, MS
Tombigbee River at Aberdeen, MS
Buttahatchie River near Aberdeen, MS
Tombigbee River near Columbus, MS
Luxapallila Creek near Columbus, MS
Town Creek at Nettleton, MS
Noxubee River at Macon, MS

Additional data are being collected on two storm events per year at the following sites:

Tombigbee River near Fulton, MS
Mantachie Creek below Dorsey, MS
Tombigbee River at Aberdeen, MS
Town Creek at Nettleton, MS
Noxubee River at Macon, MS

Pascagoula Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Pascagoula River near Benndale, MS, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Cypress Creek near Janice, MS, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a quarterly basis at Escatawpa River near Agricola, MS, as part of NASQAN.

Pearl Subregion

1. Suspended-sediment data are being collected on a daily basis at Pearl River near Bogulusa, LA, as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a bimonthly basis at Bogue Chitto River near Bush, LA, as a part of NASQAN.

Special Studies

1. Suspended-sediment and bed-material data are being collected periodically and during two storm events per year at five sites in order to gage sediment deposition in certain Georgia reservoirs as part of a cooperative program with the COE.

2. Suspended-sediment data was collected at 5-minute intervals during storm runoff from two 6-acre farm tracts used to evaluate land-management practices in northern Guilford County, NC. Sediment data was also collected at a 660-acre multiuse site and a 44-acre forested site in conjunction with the program, conducted in cooperation with the Guilford County Soil and Water Conservation District. Data collection was terminated in September 1990, at the end of the 1990 water year.

3. Suspended-sediment data are collected monthly at 14 sites as part of the surface-water quality assessment for the Triangle J COG Region located in the central Piedmont of North Carolina. The data are collected in cooperation with the Triangle Area Water-Supply Monitoring Project Steering Committee.

4. Suspended-sediment data are collected bimonthly and more frequently during runoff conditions at four sites in the Treyburn Project, a large-scale development in the upper Neuse River basin in cooperation with the city of Durham. This data is needed to assess impacts of various land-use development on surface-water quality.

5. The effect on downstream receiving waters of water-control structures located on artificial drainage canals in eastern North Carolina is largely unknown. To address this question in part, water-quality samples are being collected from three canals that drain agricultural land in Beaufort County and three similar canals in Hyde County.

Samples are collected biweekly; samples are also automatically collected during high-flow events at approximately hourly intervals. The samples are analyzed for nutrient concentrations as well as for sediment concentrations. This work is being done cooperatively with the North Carolina Department of Environment, Health, and Natural Resources (EHNR), with additional assistance from the Beaufort and Hyde County Soil and Water Conservation Districts.

6. A bathymetric study to determine the extent of sediment deposition in Lake Michie, a water supply for the city of Durham, was conducted in February 1990. Lake Michie is located in northern Durham County, NC, and was built in 1926 and has been surveyed three times in the past (1926, 1935, 1970). Development of a lake-bottom contour map and corresponding area-capacity tables will take place in early 1991.

7. The South Carolina District continued sediment data collection associated with NASQAN and Benchmark stations.

8. Changes in channel bathymetry were measured over a tide cycle in February at Altamaha River at Interstate 95 as part of a bridge scour study being done in cooperation with the Federal Highway Administration.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
520 19th Avenue
Tuscaloosa, AL 35401

District Chief, WRD
U.S. Geological Survey
6481 Peachtree Industrial Blvd.
Suite B
Doraville, GA 30360

District Chief, WRD
U.S. Geological Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
Stephenson Center
720 Gracern Road
Suite 129
Columbia, SC 29210

District Chief, WRD
U.S. Geological Survey
227 N. Bronough Street, Suite 3015
Tallahassee, FL 32301

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
3916 Sunset Ridge Road
Raleigh, NC 27606

Chief, Virginia Office, WRD
U.S. Geological Survey
3600 West Broad Street, Room 606
Richmond, VA 23230

SOUTH ATLANTIC-GULF REGION (03)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Pee Dee	Ararat	Ararat	Carrol Patrick	VA
Choctawhatchee-Escambia	Northeast Yellow River	Yellow R Covington Crenshaw	Coffee	AL
Choctawhatchee-Escambia	Whitewater Creek	Trib to Pea River	Coffee Pike	AL
Tobigbee	Memphis-Noxubee	Tribs to Tombigbee R	Sumter Pickens	AL
Alabama	Little Catoma Ck	Trib to Catoma Ck	Montgomery Bullock	AL
Middle Tennessee-Elk	Scarham Creek	Trib to Tennessee	DeKalb Marshall	AL
Middle Tennessee-Elk	South Sauty Creek	Trib to River	DeKalb Marshall	AL
Alabama	Choccolocco Creek (continuation)	Trib to Coosa R	Calhoun Clay Cleburne Talladega	AL
Apalachicola	Little Kolomoki-Factory Creeks (continuation)	Tribs to the Chatt-choochee R	Early	GA
	Chickasawhatee Ck (continuation)	Flint R	Terrell	GA
Ogeechee	Upper Lotts Creek (continuation)	Lotts Ck	Bullock	GA
	Ogeechee Area (continutation)	Ogeechee R Tribs	Screven	GA
Withlacoochee	Piscola Creek (continuation)	Piscola Ck	Thomas Brooks	GS

Oconee (continuation)	Upper Oconee Basin	N. Oconee Middle Oconee R Apalachee River	Barrow Clark Greene Gwinnett Hall Jackson Morgan Oconee Walton	GA
Leaf River	Big Creek	Big Ck Jasper Smith Counties	Jones	MS
Pearl River	Town Creek	Town Ck	Leake	MS
Strong River	Sellers Creek	Sellers Ck	Simpson	MS
Savannah River Basin	Tokeena	Beaverdam Ck & Coneross Ck Tribs to Seneca & Tugaloo River	Anderson	SC

b. 639 Study

Major Drainage	Watershed	Stream	County	State
Mobile-Tombigbee	Tombigbee River Basin	Tombigbee & Black Warrior R	25 Counties 17 Counties	AL MS

2. Special Studies

a. Sediment Survey

Reservior	State	County	Drainage Area (Sq. Mi.)
Hazel Creek #12	GA	Habersham	2.86
North Fork Broad River #1	GA	Stephens	3.75

GREAT LAKES REGION

GEOLOGICAL SURVEY

Western Lake Superior Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis at Bad River near Odanah, WI, on a quarterly basis at Baptism River near Beaver Bay, MN, and on a bimonthly basis at St. Louis River at Scanlon, MN, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended and bedload (Helley-Smith) sediment and bed-material data are being collected at three sites on North Fish Creek near Ashland, WI, in cooperation with Wisconsin Department of Natural Resources.

Southern Lake Superior-Lake Superior Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Washington Creek at Windigo (Isle Royale), MI, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a quarterly basis at Ontonagon River near Rockland, MI, and at Tahquamenon River near Tahquamenon Paradise, MI, as a part of NASQAN.

Northwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on an intermittent basis at Popple River near Fence, WI, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Fox River at Wrightstown, WI, and Escanaba River at Cornell, MI, and on a quarterly basis at Ford River near Hyde, MI, as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic and storm-event basis at White Creek at Forest Glen Beach, Silver Creek and Green Lake Inlet near Green Lake, WI, in cooperation with the Green Lake Sanitary District.

4. Suspended-sediment data are being collected on a periodic and storm-event basis at the Fox River at Appleton, WI, and intermittently at the Fox River outlets from Lake Winnebago at Neenah, WI, at Menasha, WI, at Fox River at Kaukauna, WI, and at Fox River at Little Rapids, WI. These data are being collected in cooperation with the Wisconsin Department of Natural Resources.

5. Suspended-sediment data were collected on a daily basis at the following sites, as part of a study to determine PCB loading to Green Bay. This study is being conducted in cooperation with the Wisconsin Department of Natural Resources and the U.S. Environmental Protection Agency.

    Fox River at Green Bay, WI
    Fox River at Depere, WI
    Oconto River at Oconto, WI
    Pestigo River at Oconto, WI
    Menominee River at Marinette, WI
    Escanaba River at Escanaba, MI

Data collection ended June 30, 1990, at all sites except Fox River at Depere, WI, which was discontinued September 30, 1990.

Southwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Milwaukee River at Milwaukee, WI, and at Manitowac River at Manitowac, WI, as a part of NASQAN.

2. Suspended-sediment data are being collected every 5 days at Trail Creek at Michigan City, IN, at a fixed sampling location by an observer. USGS personnel samples sediment over the cross section of the creek every 3 to 4 weeks.

Southeastern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Grand River at Eastmanville, MI, St. Joseph River at Niles, MI, and Kalamazoo River near Fennville, MI, as a part of NASQAN.

Northeastern Lake Michigan-Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Manistee River at Manistee, MI, and on a quarterly basis at Muskegon River near Bridgeton, MI, as a part of NASQAN.

Northwestern Lake Huron Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Thunder Bay River at Alpena, MI, and Au Sable River near Au Sable, MI, as a part of NASQAN.

Southwestern Lake Huron-Lake Huron Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Pigeon River near Caseville, MI, Rifle River near Sterling, MI, and bimonthly at Tittabawassee River near Midland, MI, as a part of NASQAN. Suspended-sediment data are being collected on a quarterly basis at Saginaw River at Saginaw, MI, in cooperation with the Detroit District Corps of Engineers.

St. Clair-Detroit River Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Clinton River at Mount Clemens, MI, as a part of NASQAN.

Western Lake Erie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Maumee River at Waterville, OH, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Sandusky River near Fremont, OH, Maumee River at Waterville, OH, and Huron River at Milan, OH, in cooperation with the Ohio Department of Natural Resources.

3. Suspended-sediment data are being collected on a quarterly basis at River Raisin near Monroe, MI, as a part of NASQAN.

Southern Lake Erie Subregion

1. Suspended-sediment data are being collected on a daily basis at Cuyahoga River at Independence, OH, and at Grand River at Painesville, OH, in cooperation with the Ohio Department of Natural Resources.

Eastern Lake Erie-Lake Erie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Cattaraugas Creek at Gowanda, NY, and Niagara River (Lake Ontario) at Fort Niagara, NY, as a part of NASQAN.

Southwestern Lake Ontario Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Genesee River at Charlotte Docks at Rochester, NY, as a part of NASQAN.

Southeastern Lake Ontario Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Oswego River at Lock 7 at Oswego, NY, and on a bimonthly basis at Sandy Creek at Adams, NY, as a part of NASQAN.

Northeastern Lake Ontario-Lake Ontario-St. Lawrence Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Black River at Watertown, NY, and on a quarterly basis at Raquette River at Raymondville, NY, St. Regis River at Brasher Center, NY, and St. Lawrence River at Cornwall, Ontario, near Massena, NY, as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Champaign County Bank Plaza
102 East Main St., 4th Floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
702 Post Office Building
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
975 West Third Avenue
Columbus, OH 43212

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46254

District Chief, WRD
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911

District Chief, WRD
U.S. Geological Survey
P.O. Box 1669
Albany, NY 12201

District Chief, WRD
U. S. Geological Survey
6417 Normandy Lane
Madison, WI 53719

GREAT LAKES REGION (04)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

   a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Thornapple River	Mud Creek	Mud Creek	Barry, Easton, Ionia	MI

2. Special Studies

SCS in Ohio published "Impact of Nonpoint Source Pollution on Lakes in Ohio", in August, 1990. The report presents physical and chemical sediment data from sedimentation surveys on 50 lakes (25,000 surface acres). Bottom profiles for each lake show the original bottom, present bottom, and projected future bottom profiles.

OHIO REGION

GEOLOGICAL SURVEY

Upper Ohio Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Allegheny River at New Kensington, PA, Monangahela River at Braddock, PA, Beaver River at Beaver Falls, PA, and on a bimonthly basis at Ohio River at Benwood, near Wheeling, WV, and at Little Kanawha River at Palestine, WV, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis at Wheeling Creek near Blaine, OH, in cooperation with the Ohio Department of Natural Resources.

Muskingum Subregion

1. Suspended-sediment data are being collected on a daily basis at Muskingum River at McConnelsville, OH, in cooperation with the Ohio Department of Natural Resources.

Hocking Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Kanawha River at Winfield, WV, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Hocking River below Athens, OH, as a part of NASQAN.

Kanawha Subregion

1. Suspended-sediment data are being collected on a bimonthly basis as part of NASQAN on the New River at Glen Lyn, VA.

Scioto Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Scioto River at Higby, OH, as a part of NASQAN.

Big Sandy-Guyandotte Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Guyandotte River at Branchland, WV, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Big Sandy River at Louisa, KY, as part of NASQAN.

Great Miami Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Whitewater River near Alpine, IN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Great Miami River at New Baltimore, OH, as a part of NASQAN.

Middle Ohio Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Upper Twin Creek at McGaw, OH, and at South Hogan Creek near Dillsboro, IN, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at Little Miami River at Milford, OH, in cooperation with the Ohio Department of Natural Resources.

Kentucky-Licking Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Licking River at Butler, KY, and on a bimonthly basis at Kentucky River at Lock 2 at Lockport, KY, as a part of NASQAN.

Green Subregion

1. Suspended-sediment data are being collected on a daily basis at Green River at Munfordville, KY, as a part of the Federal Sediment Index Network, and on a bimonthly basis as part of NASQAN.

Wabash Subregion

1. Suspended-sediment data are being collected on a monthly basis at White River near Centerton, IN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Little Eagle Creek at 52nd Street at Indianapolis, IN, Little Eagle Creek at Speedway, IN, Little Buck Creek near Southport, IN, and Little Buck Creek near Indianapolis, IN.

2. Suspended-sediment data are being collected on a bimonthly basis at Little Wabash River at Main Street at Carmi, IL, and Embarras River at Sainte Marie, IL, as a part of NASQAN.

Cumberland Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at South Fork Cumberland River near Stearns, KY, and Cumberland River at Carthage, TN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily and storm-event basis in cooperation with the COE, Nashville District, at the following stations:

Clover Fork at Harlan, KY
Yellow Creek near Middlesboro, KY
Cumberland River at Barbourville, KY
Cumberland River near Pineville, KY (discontinued September 1990)
Cumberland River at Cumberland Falls, KY (discontinued September 1990)
Cumberland River at Williamsburg, KY
South Fork Cumberland River near Stearns, KY (discontinued September 1990)

Lower Ohio Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Rolling Fork near Lebanon Junction, KY, and on a bimonthly basis at Ohio River at Lock and Dam 53 near Grand Chain, IL, Whitewater River near Alpine, IN, and Salt River at Shepherdsville, KY, as part of NASQAN.

2. Suspended-sediment data are being collected quarterly at South Hogan Creek near Dillsboro, IN, as part of the National Hydrologic Benchmark Network.

Special Studies

1. Suspended-sediment data were collected with an automatic sampler from a tributary site in the Big Sandy Creek basin in Fayette County, PA, during 1987. The data were collected as part of a study to evaluate the effects of surface mining on the Big Sandy Creek basin of southwestern Pennsylvania.

2. Suspended-sediment data were collected with automatic samplers at one site in the Indian Creek basin in Westmoreland and Fayette Counties, PA. The data were collected as part of a study to evaluate the impacts of surface mining on Indian Creek.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Busey County Bank Plaza
102 East Main Street, 4th Floor
Urbana, IL 61801

District Chief, WRD
U. S. Geological Survey
208 Carroll Building
8600 La Salle Road
Towson, MD 21204

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN 37203

District Chief, WRD
U.S. Geological Survey
2301 Bradley Avenue
Louisville, KY 40217

District Chief, WRD
U.S. Geological Survey
603 Morris Street
Charleston, WV 25301

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46278

District Chief, WRD
U.S. Geological Survey
P.O. Box 1107
Harrisburg, PA 17108

Chief, Virginia Office, WRD
U.S. Geological Survey
3600 West Broad Street, Rm. 606
Richmond, VA 23230

District Chief, WRD
U.S. Geological Survey
975 West Third Avenue
Columbus, OH 43212

OHIO REGION (05)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Ohio River	Hughes R.	Hughes	Tyler	WV
Green River	Cane Valley	Caney Fork	Adair Green Taylor	KY
Rockcastle River	Pigeon Roost	Bill's Ranch	Jackson	KY

b. Floodplain Management Study

Major Drainage	Watershed	Stream	County	State
Cumberland	Laurel River Reservoir	Lynn Camp Creek	Knox Laurel Whitley	KY

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Walker Creek #2	Wood	WV

3. Special Studies

West Virginia - A study of sediment damages and critical sediment producing areas was made for Mountwood Park and Walker Creek Dam Site No. 2.

SCS in Ohio published "Impact of Nonpoint Source Pollution on Lakes in Ohio", in August, 1990. The report presents physical and chemical sediment data from sedimentation surveys on 50 lakes (25,000 surface acres). Bottom profiles for each lake show the original bottom, present bottom, and projected future bottom profiles.

Also published by SCS, Ohio, was the Darby Creek Hydrologic Unit Proposal. This study presents an analysis of the impact of erosion and sedimentation on endangered aquatic species.

Erosion rates and sediment delivery calculations are complete for a 25-county area in west-central Indiana. The "Ephemeral Gully Erosion Model" was used to determine land voided or depreciated in each county.

TENNESSEE REGION

GEOLOGICAL SURVEY

Upper Tennessee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at French Broad River at Marshall, NC, and bimonthly at Clinch River at Melton Hill Dam, TN, and Holston River near Knoxville, TN, as part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are collected on a bimonthly basis at Little River above Townsend, TN, and quarterly at Cataloochee Creek near Cataloochee, NC, as a part of the National Hydrologic Benchmark program.

Middle Tennessee-Hiwassee Subregion

1. Suspended-sediment data are being collected in the Tennessee River basin in Georgia at 3 sites on a monthly basis and at 13 sites on a semiannual basis as part of the Office of Surface Mining Coal Hydrology program.

Lower Tennessee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Tennessee River at Pickwick Landing Dam, TN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Buffalo River near Flat Woods, TN, as part of the National Hydrologic Benchmark Network.

Special Studies

1. Suspended-sediment data are being collected four times per year at three sites along Carters Creek, Maury County, TN, as part of a monitoring program designed to assess effects of large-scale construction activities.

2. Suspended-sediment data are being collected monthly and on a stormevent basis by the U.S.Geological Survey at 2 sites on the Clinch River, TN, and 2 sites on the Powell River, TN, as part of a study to define the variability in suspended sediment and nutrients in the two basins. One site on each river is equipped with an automatic pump-sampler.

3. Suspended-sediment data are being collected on a stormevent basis at 5 sites in the Metropolitan Nashville, TN, area as part of the Urban Stormwater Quality Project.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
6481 Peachtree Industrial Boulevard
Suite B
Doraville, GA 30360

District Chief, WRD
U.S. Geological Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
3916 Sunset Ridge Road
Raleigh, NC 27606

District Chief, WRD
U.S. Geological Survey
2301 Bradley Avenue
Louisville, KY 40202

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN 37203

TENNESSEE REGION (06)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Clinch River	Lick Creek	Lick Ck. and Tribs	Wise, Russel & Dickenson	VA
Hiwassee River-Tennessee River	Nottely River	Nottely R	Cherokee	NC

UPPER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Mississippi Headwaters Subregion

1. Suspended-sediment data are being collected on a daily basis during open water at Mississippi River near Anoka, MN, in cooperation with the U.S. Army Corps of Engineers (COE).

2. Suspended-sediment data are being collected on a bimonthly basis at Mississippi River near Royalton, MN, and on a quarterly basis at Mississippi River at Nininger, MN, as a part of the National Stream Quality Accounting Network (NASQAN).

Minnesota Subregion

1. Suspended-sediment data are being collected on a daily basis during open water at Minnesota River at Mankato, MN in cooperation with the COE.

2. Suspended-sediment data are being collected on a quarterly basis at Minnesota River near Jordon, MN, as a part of NASQAN.

Chippewa Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Chippewa River near Durand, WI, as a part of NASQAN.

Upper Mississippi-Black-Whitewater Subregion

1. Suspended-sediment data are being collected during high-flow events and on a bimonthly basis at North Fork Whitewater River near Elba, MN, in cooperation with the U.S. Fish and Wildlife Service as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected during high-flow events at Middle Fork Whitewater River near St. Charles, MN, in cooperation with the U.S. Fish and Wildlife Service.

3. Suspended and bedload (Helley-Smith) sediment and bed material are being collected on an intermittent basis at Joos Valley Creek, Eagle Creek at Schaffner Road, and Eagle Creek at CTH G near Fountain City, WI. These data are being collected in cooperation with the Wisconsin Department of Natural Resources.

4. Suspended-sediment data are being collected periodically at Mississippi River at Winona, MN, in cooperation with the COE.

5. Suspended-sediment data are being collected on a bimonthly basis at Black River at Galesville, WI, as a part of NASQAN.

Upper Mississippi-Maquoketa-Plum Subregion

1. Suspended-sediment data are being collected on a daily basis at Mississippi River at McGregor, IA, in cooperation with the COE, St. Paul District.

2. Suspended-sediment data are being collected on a periodic and storm-event basis to determine monthly suspended-sediment loads for the COE at the Grant River at Burton, WI.

Wisconsin Subregion

1. Suspended-sediment and bed-material data are being collected on a bimonthly basis at Ten Mile Creek near Nekoosa and Wisconsin River at Muscoda, WI, as part of NASQAN.

Upper Mississippi-Turkey Subregion

Suspended-sediment data are being collected weekly and on an event basis in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau at Roberts Creek above Saint Olaf, Iowa and at Big Spring near Elkader, Iowa.

Upper Mississippi-Iowa-Skunk-Wapsipinicon Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cedar River at Cedar Falls, IA, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at the following in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau:

Iowa River at Marshalltown, IA
South Skunk River at Colfax, IA
Skunk River at Augusta, IA

3. Suspended-sediment data are also being collected on a bimonthly basis at Skunk River at Augusta, IA, as part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Iowa River at Wapello, IA, in cooperation with COE, Rock Island District. Suspended-sediment data are also being collected on a bimonthly basis as part of NASQAN.

Rock Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis at:

Jackson Creek at County Hwy H near Elkhorn, WI
Jackson Creek tributary near Elkhorn, WI
Delavan Lake tributary at South Shore Drive at Delavan Lake, WI

These data are being collected in cooperation with the Delavan Lake Sanitary District.

2. Suspended-sediment data are being collected on a storm-event basis in cooperation with Dane County, WI, at:

Pheasant Branch Creek at Middleton, WI, at U.S. Highway 12
Spring Harbor Storm Sewer at Madison, WI

3. Suspended-sediment data are being collected on a quarterly basis at Rock River near Joslin, IL, as part of NASQAN.

Des Moines Subregion

1. Suspended-sediment data are being collected on a daily basis at Des Moines River near Saylorville, IA, in cooperation with the COE, Rock Island District.

2. Suspended-sediment data are being collected on a bimonthly basis at Raccoon River at Van Meter, IA, as a part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis at Des Moines River at St. Francisville, MO, in cooperation with the COE, Rock Island District, and bimonthly as part of NASQAN.

Upper Mississippi-Salt-Subregion

1. Suspended-sediment data are being collected on a daily basis and particle-size data collected on a intermittent basis in cooperation with the COE at the following stations:

   North Fork Salt River near Shelbina, MO
   Middle Fork Salt River at Paris, MO
   Salt River near New London, MO

2. Suspended-sediment data are being collected on a daily basis at Mississippi River at Grafton, IL, in cooperation with the COE, St. Louis District, and on a bimonthly basis at Alton, IL, as part of NASQAN.

3. Suspended-sediment data are being collected eight times a year at Cuivre River near Troy, MO, as part of NASQAN and in cooperation with the Missouri Department of Natural Resources.

Upper Illinois Subregion

1. Suspended-sediment data were collected monthly and more frequently during high flows as part of NAWQA at the following stations:

   Illinois River at Marseilles, IL
   Kankakee River at Momence, IL
   Iroquois River at Chebanse, IL
   Des Plaines River at Riverside, IL
   Du Page River at Shorewood, IL
   Fox River at Algonquin, IL
   Fox River at Dayton, IL
   Chicago Sanitary and Ship Canal at Romeoville, IL

2. Suspended-sediment data are being collected on a monthly basis at Illinois River at Marseilles, IL, as a part of NASQAN and NAWQA.

Lower Illinois Subregion

1. Suspended-sediment data were being collected weekly and more frequently during high flows, at Illinois River at Valley City, IL, in cooperation with the COE, St. Louis District. Additional samples are collected on a bimonthly basis at Sangamon River near Oakford, IL, and Spoon River at Seville, IL, as part of the NASQAN program.

Upper Mississippi-Kaskaskia-Meramec Subregion

1. Suspended-sediment data are being collected weekly and more often during high flows, in cooperation with the COE, St. Louis District at the following sites:

    Kaskaskia River at Cooks Mills, IL
    Kaskaskia River at Venedy Station, IL
    Big Muddy River at Murphysboro, IL

Suspended-sediment samples are also collected on a bimonthly basis at Big Muddy River at Murphysboro, IL, as part of the NASQAN program.

2. Suspended-sediment data are being collected on a daily basis at Mississippi River at St. Louis, MO, in cooperation with the COE, St. Louis District.

3. Suspended-sediment data are being collected on a bimonthly basis at Meramac River near Eureka, MO, as part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Mississippi River at Chester, IL, in cooperation with the COE, St. Louis District.

5. Suspended-sediment data are being collected on a daily basis at Mississippi River at Thebes, IL, in cooperation with the COE, St. Louis District. Suspended-sediment data also are being collected on a monthly basis in cooperation with the Missouri Department of Natural Resources.

Special Studies

1. Suspended-sediment data are being collected on a daily basis at Blue Earth River near Rapidan, MN, and on a periodic basis at 21 other sites on and tributary to the Minnesota River. Some bed material also is being collected. The study is a non-point source study within the Minnesota River basin that is being done in cooperation with the Minnesota Pollution Control Agency.

2. Suspended-sediment data were collected every other day, and more frequently during high flows at Big Creek near Bryant, IL, in cooperation with the Metropolitan Sanitary District of Greater Chicago (discontinued December 1986). The sediment data collected were used to monitor changes in sediment transport during the reclamation of a strip-mined area by irrigating with digested sludge from sewage treatment facilities.

3. Historical sediment data from 17 sites in Missouri are being reviewed and analyzed to assess the contribution of sediment by Missouri tributaries into the Mississippi River. The study is being conducted in cooperation with the St. Louis District Corps of Engineers.

Laboratory Activities

The Geological Survey laboratory in Iowa City, IA, analyzed suspended-sediment samples collected by the COE at:

Bay Creek at Nebo, IL
Turkey River at Garbor, IL
Crow Creek at Beltendort, IA
Green River at Geneseo, IL
Wapsipinicon River at DeWitt, IA
Iowa River at Marengo, IA
Iowa River at Coralville Dam, IA
Mississippi River at Burlington, IA
Mississippi River at Keokuk, IA
Des Moines River near Stratford, IA
Raccoon River at Van Meter, IA
North River near Norwalk, IA
Middle River near Indianola, IA
South River near Ackworth, IA
Des Moines River near Tracy, IA
Des Moines River at Keosauqua, IA
Mississippi River at East Dubuque, IL

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Busey County Bank Plaza
102 East Main Street, 4th floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Iowa City, IA 52244

District Chief, WRD
U.S. Geological Survey
1400 Independence Road
Mail Stop 200
Rolla, MO 65401

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46254

District Chief, WRD
U.S. Geological Survey
702 Post Office Building
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
6417 Normandy Lane
Madison, WI 53719

UPPER MISSISSIPPI REGION (07)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Cache River	Ullin/Mill Creek	Mill Creek	Pulaski	IL
Fox River	Shabbona Lake	Indian Ck	DeKalb	IL
Lamoine River	Argyle Lake	Unnamed	McDonough	IL
Sangamon River	Lake Decatur	Sangamon	Macon	IL
Sangamon River	Lake Taylorville	S. Fork	Christian	IL
Sangamon River	SangChris Lake	Clear Ck	Christian	IL
Root River	Upper North North Branch of Root River	North Br Root River	Olmsted	MN
Whitewater River	Whitewater	Whitewater Beaver Ck	Olmsted Winona Wabasha	MN

b. River Basin Studies

Major Drainage	Watershed	State
Sauk River Basin	Sauk Lake	MN

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Plum Grove Upper Salt Creek Site 2	Cook	IL
Lake Pana	Shelby	IL
Argyle Lake	McDonough	IL

LOWER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Lower Mississippi-Hatchie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Mississippi River at Memphis, TN, Obion River near Obion, TN, and at Hatchie River at Bolivar, TN, as a part of the National Stream Quality Accounting Network (NASQAN).

Lower Mississippi-St. Francis Subregion

1. Suspended-sediment data are being collected on a daily basis at St. Francis River, Saco, MO.

2. Suspended-sediment data are being collected on a bimonthly basis at St. Francis River at Parkin, AR, and at St. Francis Bay at Riverfront, AR, as a part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at L'Anguille River near Colt, AR, as part of a State Coop Program.

Lower Mississippi-Yazoo Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Yazoo River at Redwood, MS, and on a quarterly basis at Mississippi River near Arkansas City, AR, as a part of NASQAN.

2. Suspended-sediment data are being collected by an automatic PS-69 pumping sampler at the following sites in cooperation with the Interagency Demonstration Erosion Control Task Force:

Hotopha Creek near Batesville, MS
Otoucalofa Creek near Water Valley, MS
Hickahala Creek near Senatobia, MS
Batupan Bogue at Grenada, MS
Peters (Long) Creek near Pope, MS
Harland Creek near Howard, MS

Lower Red-Ouachita Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Ouachita River at Columbia, LA, and on a quarterly basis at Ouachita River at Camden, AR, as a part of NASQAN. Sediment data are being collected on a quarterly basis at Big Creek at Pollock, LA, as a part of the National Hydrologic Benchmark Network.

Boeuf-Tensas Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Tensas River at Tendal, LA, as a part of NASQAN.

Lower Mississippi-Big Black Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Big Black River at Bovina, MS, and quarterly at Homochitto Creek at Rosetta, MS, and Mississippi River at Vicksburg, MS, as part of NASQAN.

Lower Mississippi-Lake Maurepas Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Amite River at Port Vincent LA, Tangipahoa River at Robert, LA, and at Tchefuncta River near Covington, LA, as a part of NASQAN.

Louisiana Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bayou Teche at Keystone Lock and Dam below St. Martinville, LA, Mermentau River at Mermentau, LA, and at Calcasieu River near Kinder, LA, and bimonthly at Atchafalaya River at Melville, LA, as a part of NASQAN and in cooperation with the U.S. Army Corps of Engineers (COE).

2. Suspended-sediment data are being collected on a bimonthly basis at the following sites as a part of NASQAN.

Mississippi River at Belle Chasse, LA

3. Suspended-sediment and bed-material data are collected at the following sites on a monthly basis in cooperation with the COE:

Lower Atchafalaya River at Morgan City, LA
Wax Lake Outlet at Calumet, LA, as part of NASQAN and in cooperation with the U.S. Army Corps of Engineers (COE).

Sampling frequency modified in June 1990 with beds collected twice a month and suspended sediment once a month.

4. Suspended-sediment and bed-material data are collected weekly by the COE in the Atchafalaya Basin at Bayou Chene above Bayou Crook Chene, East Access Channel above Lake Chicot, Lake Long below Bayou LaRompe, and Little Tensas Cut.

Special Studies

1. Suspended-sediment data are being collected on a stormevent basis at 6 sites in Shelby, Fayette, and Tipton Counties as part of a pre- and post-best-management-practices comparison study.

Laboratory Activities

The Geological Survey sediment laboratory located in Baton Rouge, LA, analyzed suspended-sediment and bed-material samples collected by the COE at the following locations:

Old River Outflow near Knox Landing
Red River above Old River Outflow
Mississippi River at Coochie
Mississippi River at Tarbert Landing
Atchafalaya River at Simmesport
Bayou Chene above Bayou Crook Chene
East Access Channel above Lake Chicot
Lake Long below Bayou LaRompe
Little Tensas below Blind Tensas Cut
Old River Low Sill Structure Outflow Channel
Old River Auxillary Structure Outflow Channel
Amite River at selected sites.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Office Building
Room 2301
700 West Capitol Avenue
Little Rock, AR 72201

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN, 37203

LOWER MISSISSIPPI REGION (08)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

   a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Homochitto River	Second Creek	Town Creek	Adams	MS

SOURIS-RED-RAINY REGION

GEOLOGICAL SURVEY

Souris Subregion

1. Suspended-sediment data are being collected on a periodic basis at Souris River near Westhope, ND, as part of the National Stream Quality Accounting Network (NASQAN).

Red Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Sheyenne River at Kindred, ND, and Red River at the north at Halstad, MN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Beaver Creek near Finley, ND, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a bimonthly basis at the Red River of the North at Emerson, Manitoba, Canada, as part of NASQAN. The Water Survey of Canada provides daily sediment concentrations information at this site.

4. Suspended-sediment data are being collected on a bimonthly basis at the Red Lake River at Crookston, MN, and quarterly at Roseau River below State Ditch 51 near Caribou, MN, as a part of NASQAN.

Rainy Subregion

1. Suspended-sediment data were collected on a quarterly basis at Kawishiwi River near Ely, MN, as part of the National Hydrologic Benchmark Network, and on a bimonthly basis at Rainy River at Manitou Rapids, MN, as part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
702 Post Office Building
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
821 East Interstate Avenue
Bismarck, ND 58501

SOURIS-RED-RAINY REGION (09)

SOIL CONSERVATION SERVICE

1. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	State
Renwick Lake	ND

MISSOURI

BUREAU OF RECLAMATION

Evansville/Brookhurst Water Intake - Cross section data and bed-material samples were obtained and analyzed to be used in the design of the Evansville Water Treatment Plant Intake. Water surface profiles were developed for discharges ranging from 200 to 3500 ft^3/s. The respective elevations in the vicinity where the intake is expected to be installed range from 5087.9 to 5094.3 feet. With limited data, analysis for sand transport showed it could vary from 1 to 100 tons/day at a discharge of 1,000 ft^3/s. Sand concentrations, having particle size less than 2 mm for the respective discharges range from 2 to 116 mg/l. The sand concentration is used in sizing of screens for the intake. A threshold velocity of 1.3 ft/s is needed in the pipeline to reinitiate the movement of sediment with a particle size of 2 mm or finer.

A scour study was completed to aid in the design of the intake pier to support the water screens. Water surface profiles were developed for discharges of 520 (calibrated) and 10,000 (design) ft^3/s. The computed water surface elevations at the proposed intake location are 5089.2 and 5100.2 feet for respective discharges. The final recommended scour depth is 9.0 feet for the 6.0 foot wide intake pier.

Island and Shoreline Erosion–Audubon National Wildlife Refuge - A literature review and annotated bibliography relative to island and shoreline erosion on large lakes was done. The final document provides a common knowledge base for the participants in the ongoing studies of shoreline erosion and to identify methodologies for evaluating and analyzing ongoing shoreline erosion and recession at Lake Audubon (Audubon National Wildlife Refuge) near Cole Harbor, North Dakota. The document is one of the requirements identified in the Plan of Study for the project.

Fullerton Canal and Pipelines - Scour estimates were made for sections 2 and 3 of the Fullerton Canal and Pipelines. There are 45 locations (siphons, pipelines, and laterals) in sections 2 and 3 where scour estimates were made. Estimates ranged from 2 to 14 feet with about 75 percent being at or less than 7 feet. Both scour and degradation was computed at seven locations (siphons, pipe canals, and laterals); the degradation ranged from 0 to 16 feet, the scour was either 11 or 12 feet.

MISSOURI REGION

GEOLOGICAL SURVEY

Saskatchewan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at St. Mary's River at Montana, USA-Alberta, Canada, border, as a part of the National Stream Quality Accounting Network (NASQAN).

Missouri-Marias Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Missouri River at Toston, MT, and bimonthly at Sun River near Vaughn, MT, as a part of NASQAN.

Missouri-Musselshell Subregion

1. Suspended-sediment data are being collected on a daily basis at Missouri River near Landusky, MT, and at Musselshell River at Mosby, MT, in cooperation with the U.S. Army Corps of Engineers (COE).

2. Suspended-sediment data are being collected on a bimonthly basis at Musselshell River at Harlowton and at Musselshell, MT, as part of the Federal Collection of Basic Records (CBR) program.

Milk Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Milk River at Nashua, MT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Rock Creek below Horse Creek near the international boundary, as a part of the National Hydrologic Benchmark Network.

Missouri-Poplar Subregion

1. Suspended-sediment data are being collected on a monthly basis in cooperation with Montana Department of Natural Resources at the following sites to define water-quality characteristics of the Poplar River basin:

    Poplar River at international boundary
    East Poplar River at international boundary
    East Fork Poplar River near Scobey, MT

2. Suspended-sediment data are being collected on a bimonthly basis at Poplar River near Poplar, MT, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Beaver Creek at international boundary as part of the Water Ways Treaty Program.

Upper Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis in cooperation with the National Park Service at the Yellowstone River at Corwin Springs, MT, and at the Lamar River near Tower Falls Ranger Station, Yellowstone National Park.

2. Suspended-sediment data are being collected on a bimonthly basis at Yellowstone River near Livingston, MT, and quarterly at Yellowstone River at Billings, MT, as part of NASQAN.

Big Horn Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Bighorn River at Bighorn, MT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a 6-week and storm-event basis at Bighorn River at Kane, WY, as a part of the Missouri River basin program.

3. Suspended-sediment data and bed-load are being collected on an event basis for the nonwinter season at Wind River above Bull Lake Creek near Crowheart, Wind River near Crowheart, and Wind River near Kinnear, WY, as part of the Missouri River basin program.

4. Suspended-sediment data are being collected on a bimonthly and storm-event basis at Wind River at Riverton, WY, as part of NASQAN.

5. Suspended-sediment data are being collected on a quarterly and storm-event basis at Baldwin Creek below Dickinson Creek at Lander, WY, Beaver Creek near Arapahoe, WY, Little Wind River near Arapahoe, WY, Five mile Creek above Wyoming Canal, near Pavillion, WY, near Bighorn River at Lucerne, WY, Bighorn River at Basin, WY, Shoshone River near Lovell and Greybull River near Basin, and on a 6-week and storm-event basis at Fifteen mile Creek near Lovell, WY, in cooperation with the Wyoming Department of Environmental Quality.

6. Suspended-sediment data are being collected on a daily basis for the non-winter season at Jones Creek at mouth, near Pahaska, WY, and Crow Creek at mouth, at Pahaska, WY, in cooperation with the U.S. Forest Service and the Wyoming Department of Environmental Quality, and as part of the Federal program.

Powder-Tongue Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Tongue River at Miles City, MT, and a bimonthly basis at Powder River at Locate, MT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis March through September at Powder River at Moorhead, MT, and at Powder River at Broadus, MT, as part of the National Research Program.

3. Suspended-sediment data are being collected on a quarterly and storm-event basis at Big Goose Creek near Sheridan, WY, Little Goose Creek at Sheridan, WY, Goose Creek below Sheridan, WY and Crazy Woman Creek at upper station, near Arvada, WY, in cooperation with the Wyoming Department of Environmental Quality.

4. Suspended-sediment data are being collected on a monthly basis at Tongue River at Tongue River Dam and quarterly at Hanging Woman Creek near Birney, MT, and Otter Creek at Ashland, MT in cooperation with the U.S. Bureau of Land Management.

Lower Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis at Yellowstone River near Sidney, MT, in cooperation with the COE.

2. Suspended-sediment data are being collected on a quarterly basis at Armells Creek near Forsyth, MT, and Rosebud Creek at mouth near Rosebud, MT, in cooperation with the U.S. Bureau of Land Management.

Missouri-Little Missouri Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Bear Den Creek near Mandaree, ND, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a periodic basis at Little Missouri River near Watford City, ND, as part of NASQAN.

Missouri-Oahe Subregion

1. Suspended-sediment data are being collected on a periodic basis at Knife River at Hazen, ND, at Heart River near Mandan, ND, and at Cannonball River at Breien, ND, as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Grand River at Little Eagle, SD, and Moreau River near Whitehorse, SD, as a part of NASQAN.

3. The U.S. Geological Survey in cooperation with the COE, Omaha District, has begun a study to describe the characteristics of suspended-sediment movement and changes in concentration in the reach of the Missouri River between Garrison Dam and the headwaters of Oahe Reservoir. Suspended-sediment data are being collected at 20 sites on the Missouri River during a range of steady-state discharges.

Missouri-Cheyenne Subregion

1. Suspended-sediment data are being collected on a periodic basis at Belle Fourche River near Elm Springs, SD, and at Cheyenne River at Cherry Creek, SD, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly and storm-event basis at Little Thunder Creek near Hampshire, WY, as part of the Missouri River basin program.

3. Suspended-sediment data are being collected on a 6-week and storm-event basis in cooperation with the city of Gillette, WY, at Stonepile Creek at Gillette, WY.

4. Suspended-sediment data are being collected on a quarterly basis at Castle Creek above Deerfield Dam, near Hill City, SD, as a part of the National Hydrologic Benchmark Network.

Missouri-White Subregion

1. Suspended-sediment data are being collected on a daily basis at South Fork, Bad River near Cottonwood, SD, Plum Creek below Hayes, SD, Willow Creek near Fort Pierre, SD, and White River near Oacoma, SD, in cooperation with North Central RC&D and the COE.

2. Suspended-sediment data are being collected on a monthly basis at Little White River above Rosebud, SD, in cooperation with the U.S. Bureau of Reclamation (USBR).

3. Bedload-sediment data are being collected on a periodic basis at South Fork Bad River near Cottonwood, SD, Plum Creek below Hayes, SD, Willow Creek near Fort Pierre, SD, and Bad River near Fort Pierre, SD, in cooperation with North Central RC&D.

Missouri-Andes Creek Subregion

1. Suspended-sediment data are being collected on a monthly basis at Andes Creek near Armour, SD, Lake Andes Tributary No. 1 near Lake Andes, SD, Lake Andes Tributary No. 2 near Lake Andes, SD, and Lake Andes Tributary No. 3 near Armour, SD, in cooperation with the USBR and as part of the Missouri River basin program.

Missouri-Choteau Creek Subregion

1. Suspended-sediment data are being collected on a monthly basis at Choteau Creek near Wagner, SD, and Choteau Creek near Dante, SD, in cooperation with the USBR.

Niobrara Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Niobrara River near Verdel, NE, as a part of NASQAN.

Missouri-James Subregion

1. Suspended-sediment data are being collected on a periodic basis at James River at LaMoure, ND, James River at Pingree, ND, and James River near Ludden, ND, as part of the Missouri River Basin program.

2. Suspended-sediment data are being collected on a periodic basis at James River near Manfred, ND, James River near Grace City, ND, James River above Arrowhead Lake near Kensal, ND, James River at Jamestown, ND, James River at Oakes, ND, and James River near Hecla, SD, as part of the Garrison Diversion Refuge Monitoring Program.

3. Suspended-sediment data are being collected on a bimonthly basis at James River near Columbia, SD, as a part of NASQAN, and the Missouri River basin program.

4. Suspended-sediment data are being collected on a quarterly basis at, James River near Scotland, SD, as part of NASQAN.

5. Suspended-sediment data are being collected on a periodic basis at James River at Columbia, SD, James River at Ashton, SD, James River at Huron, SD, and James River near Scotland, SD, in cooperation with the USBR.

Missouri-Big Sioux Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Big Sioux River at Akron, IA, as a part of NASQAN.

North Platte Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at North Platte River near Lisco, NE, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Encampment River above Hog Park Creek near Encampment, WY, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a 6-week and storm-event basis at Deer Creek in canyon near Glenrock, WY.

4. Suspended-sediment data are being collected on a bimonthly and storm-event basis at North Platte River above Seminoe Reservoir, near Sinclair, WY, as part of NASQAN.

5. Suspended-sediment data are being collected on a quarterly and storm-event basis at Laramie River near Bosler, WY, in cooperation with the Wyoming Department of Environmental Quality.

6. Suspended-sediment data are being collected on a flow-event basis at North Platte River at North Platte, NE, in cooperation with the U.S. Bureau of Reclamation (USBR).

South Platte Subregion

1. Suspended-sediment data are being collected on a quarterly basis at South Platte River at Julesburg, CO, and bimonthly at South Platte at Henderson, CO, as a part of NASQAN.

2. Suspended-sediment data are being collected monthly at North Fork Cache La Poudre River at Livermore, CO.

3. Suspended-sediment data are being collected on a storm-event basis at South Platte River at Roscoe, NE, in cooperation with the USBR.

Platte Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Platte River at Louisville, NE, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Platte River near Duncan, NE, as part of NASQAN.

3. Suspended-sediment data are being collected on a flow-event basis at Platte River at Brady, NE, in cooperation with the USBR.

4. Suspended-sediment data are being collected on a flow-event basis at Platte River near Overton, NE, in cooperation with the USBR.

5. Suspended-sediment data are being collected on a flow-event basis at Platte River near Grand Island, NE, in cooperation with the USBR.

Loup Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cedar River near Fullerton, NE, as part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Dismal River near Thedford, NE, as part of the National Hydrologic Benchmark Network.

Elkhorn Subregion

1. Suspended-sediment data are being collected at Elkhorn River at Waterloo, NE, on a bimonthly basis as a part of NASQAN.

Missouri-Little Sioux Subregion

1. Suspended-sediment data which includes bed material, suspended-sediment samples, and velocities at several points in a vertical are being collected at the following stations in cooperation with the COE, Omaha District:

Missouri River at Sioux City, IA
Missouri River at Omaha, NE
Missouri River at Nebraska City, NE

Missouri-Nishnabotna Subregion

1. Suspended-sediment data are being collected on a daily basis at Nodaway River at Clarinda, IA, in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau.

2. Suspended-sediment data are being collected on a quarterly basis at Nishnabotna River above Hamburg, IA, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Platte River at Sharps Station, MO, as a part of NASQAN.

4. Suspended-sediment data are being collected on a monthly basis at Missouri River at St. Joseph, MO, in cooperation with the Missouri Department of Natural Resources.

Republican Subregion

1. Suspended-sediment data are being collected on a 6-week basis at Prairie Dog Creek above Keith Sebelius Lake, KS, and White Rock Creek near Burr Oak, KS, in cooperation with the Kansas Water Office.

2. Suspended-sediment data are being collected on a bimonthly basis at Republican River near Clay Center, KS, as part of NASQAN.

Smoky Hill Subregion

1. Suspended-sediment data are being collected on a 6-week basis at Smoky Hill River at Enterprise, KS, Big Creek near Hays, KS, Saline River near Russell, KS, North Fork Solomon River at Glade, KS, and South Fork Solomon River above Webster Reservoir, KS, in cooperation with the Kansas Water Office.

2. Suspended-sediment data are being collected on a bimonthly basis at South Fork Solomon River at Osborne, KS, as part of NASQAN.

Kansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Big Blue River at Barneston, NE, as part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at West Fork Big Blue River near Dorchester, NE, as part of the Federal CBR program.

3. Suspended-sediment data are being collected on a monthly basis and on a storm-event basis as part of the Lower Kansas River basin NAWQA study at the following sites:

West Fork Big Blue River near Dorchester, NE
Kansas River at DeSoto, KS
Delaware River near Muscotah, KS

4. Data was collected for the first four months during 1990 at the following locations. Data will not be collected at these 10 locations in 1991:

Big Blue River at Barneston, NE
Little Blue River at Hollenberg, KS
Kansas River at Fort Riley, KS
Kings Creek near Manhattan, KS
Black Vermillion River near Frankfort, KS
Big Blue River near Manhattan, KS
Wakarusa River near Lawrence, KS
Mill Creek near Paxico, KS
Kansas River at Topeka, KS
Delaware River below Perry Dam, KS

5. Suspended-sediment data are being collected on a 6-week basis at Little Blue River near Barnes, KS, in cooperation with the Kansas Water Office.

6. Suspended-sediment data are being collected on a quarterly basis at Kings Creek near Manhattan, KS, as part of the National Hydrologic Benchmark Network.

Chariton-Grand Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Elk Creek near Decatur City, IA, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Grand River near Summer, MO, as a part of NASQAN, and in cooperation with the Missouri Department of Natural Resources.

Gasconade-Osage Subregion

1. Suspended-sediment data are being collected on a 6-week basis at Dragoon Creek near Burlingame, KS, and Pottawatomie Creek near Garnett, KS, in cooperation with the Kansas Water Office.

2. Suspended-sediment data are being collected on a monthly basis at Osage River below St. Thomas, MO, and at Osage River above Schell City, MO, as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Gasconade River near Jerome, MO, as a part of NASQAN, and in cooperation with the Missouri Department of Natural Resources.

Lower Missouri Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River at Hermann, MO, as a part of NASQAN, and in cooperation with the Missouri Department of Natural Resources and the Kansas City District Corps of Engineers.

Special Studies

1. PS-69 pumping sediment samplers are operating at Lower Hay Creek Tributary near Wilbaux, MT, discontinued September 30, 1981, and at West Branch Antelope Creek Tributary No. 4 near Zap, ND, as part of EMERIA studies. Sediment data are collected at these and several other sites in the study basins.

2. Historical sediment data collected from 1948 until the current year on three Missouri River sites (St. Joseph, MO, Kansas City, MO, and Hermann, MO) are being entered into a computerized data base. This project is being undertaken in cooperation with the Kansas City District Corps of Engineers.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Iowa City, IA 52244

District Chief, WRD
U.S. Geological Survey
4821 Quail Crest Place
Lawrence, KS 66049

District Chief, WRD
U.S. Geological Survey
1400 Independence Road
Mail Stop 200
Rolla, MO 65401

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 428
301 South Park Ave., Drawer 10076
Helena, MT 59626

District Chief, WRD
U.S. Geological Survey
Room 406, Federal Building
100 Centennial Mall, North
Lincoln, NE 68508

District Chief, WRD
U.S. Geological Survey
821 East Interstate Avenue
Bismarck, ND 58501

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 317
200 4th Street, S.W.
Huron, SD 57350

District Chief, WRD
U.S. Geological Survey
2617 Lincolnway, Suite B
Cheyenne, WY 82001

MISSOURI REGION (10)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Missouri River	Bowman/Haley	N. Fork Grand River	Bowman Harding	ND SD
Little Nemaha	Upper Little Nemaha	L. Nemaha River	Cass Lancaster Otoe	NE
Arkansas River	Hickory Creek	Hickory Ck	Newton	MO
Missouri River	Moniteau Creek	Moniteau Ck	Boone Howard	MO
Missouri River	West Fork Grand	West Fork	Andrew Gentry Nodway Worth	MO
Missouri River	East Fork Grand	East Fork	Harrison Worth Ringgold Union	MO IA

b. River Basin Studies

Major Drainage	Watershed	State
Republican	Elm Creek (AGNPS)	NE
Elkhorn	Taylor Creek (AGNPS)	NE
Statewide	Nebraska Watershed Evaluation Cooperative River Basin Study	

c. Resource Conservation and Development

Project Name	County	State
Forney Water Control Structure	Sheridan	NE

d. Flood Plain Management

Project Name	County	State
Wahoo Creek	Saunders	NE

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Hayes Lake	Stanley	SD

3. Special Studies

The West Missouri River Basin Study was initiated including ephemeral and classic gully erosion estimates on PSU's throughout the study area.

Quantitative geomorphology of ephemeral gullies in Western Iowa with applications in the SCS (using Ephemeral Gully Erosion Model).

ARKANSAS-WHITE-RED REGION

GEOLOGICAL SURVEY

Upper White Subregion

1. Suspended-sediment data are being collected bimonthly at White River at Calico Rock, AR, as part of the State Coop Program.

2. Suspended-sediment data are being collected on a bimonthly basis at North Sylamore Creek near Fifty Six, AR, as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a bimonthly basis at White River at Newport, AR, as a part of the National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected bimonthly at Black River at Black Rock, AR, as part of the State Coop Program.

Upper Arkansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Arkansas River at Portland, CO, as part of NASQAN. In addition, suspended sediment and sediment chemistry data are being collected depending on stage for the period May through September at this station.

2. Suspended-sediment data are being collected on a bimonthly basis at Halfmoon Creek near Malta, CO, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a daily basis at the following stations, in cooperation with the U.S. Army, Fort Carson, CO:

   Purgatoire River near Thatcher, CO
   Taylor Arroyo below Rock Crossing near Thatcher, CO
   Chacauco Creek at mouth near Timpas, CO
   Purgatoire River at Rock Crossing near Timpas, CO

4. Suspended-sediment data are being collected on a daily basis, approximately 6 months of the year, at Badger Creek upper station near Howard, CO, and Badger Creek lower station near Howard, CO, in cooperation with the U.S. Bureau of Land Management.

5. Suspended-sediment data are being collected on a periodic basis at the following stations, in cooperation with the city of Colorado Springs:

   Fountain Creek near Colorado Springs, CO
   Fountain Creek at Colorado Springs, CO
   Fountain Creek at Secrity, CO

6. Study is being performed to determine what metals are being transported on the sediments and in solution in the Leadville, CO, area.

7. Suspended-sediment data and trace metal samples are being collected on a periodic basis in cooperation with National Stream Quality Accounting Network (NASQAN) at Arkansas River at Portland, CO, in order to determine cross-section variability and the adequacy of sampling procedures.

Middle Arkansas Subregion

1. Suspended-sediment data are being collected on a 6-week basis at the following sites in cooperation with the Kansas Water Office:

Cow Creek near Lyons, KS
North Fork Ninnescah River above Cheney Reservoir, KS
South Fork Ninnescah River near Murdock, KS

2. Suspended-sediment data are being collected on a quarterly basis at Arkansas River near Coolidge, KS, as part of NASQAN.

3. Suspended-sediment data are being collected on a 6-month basis at Little Arkansas River at Valley Center, KS, Arkansas River at Arkansas City, KS, Whitewater River at Towanda, KS, and Walnut River at Winfield, KS, in cooperation with the U.S. Army Corps of Engineers (COE).

Upper Cimarron Subregion

1. Suspended-sediment data are being collected at Cimarron River near Forgan, OK, in cooperation with the U.S. Bureau of Reclamation (USBR).

Lower Cimarron Subregion

1. Suspended-sediment data are being collected at Cimarron River near Buffalo, OK, as a part of NASQAN.

2. Suspended-sediment data are being collected at Cimarron River at Perkins, OK, in cooperation with the COE and as a part of NASQAN.

Arkansas-Keystone Subregion

1. Suspended-sediment data are being collected at Arkansas River near Ponca City, OK, Salt Fork Arkansas River Near Jet, OK, Salt Fork Arkansas River at Alva, OK, Black Bear Creek at Pawnee, OK, and Arkansas River near Haskell, OK, in cooperation with the COE.

2. Suspended-sediment data are being collected at Arkansas River at Ralston, OK, as a part of NASQAN and in cooperation with the COE.

Neosho-Verdigris Subregion

1. Suspended-sediment data are being collected on a 6-week basis at Lightning Creek near McCune, KS, and at Neosho River near Parsons, KS, in cooperation with the Kansas Water Office.

2. Suspended-sediment data are being collected on a 6-week or periodic basis at the following sites in cooperation with the COE:

Otter Creek at Climax, KS
Elk River at Elk Falls, KS
Big Hill Creek near Cherryvale, KS
Neosho River at Council Grove, KS
Neosho River near Americus, KS
Cottonwood River below Marion Lake, KS
Cottonwood River near Plymouth, KS

3. Suspended-sediment data are being collected at Neosho River below Fort Gibson Lake near Fort Gibson, OK, as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the COE:

Verdigris River near Lenapah, OK
Little Caney River near Copan Lake, OK
Sand Creek at Okesa, OK
Verdigris River near Claremore, OK
Birch Creek below Birch Lake near Barnsdall, OK
Hominy Creek below Skiatook Lake near Skiatook, OK
Bird Creek near Sperry, OK
Neosho River near Commerce, OK

5. Suspended-sediment data are being collected at Caney River near Ramona, OK, as a part of NASQAN and in cooperation with the COE.

Upper Canadian Subregion

1. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the New Mexico Interstate Stream Commission:

Cimarron River near Cimarron, NM (semiannual)
Ponil Creek near Cimarron, NM (bimonthly)
Rayado Creek near Cimarron, NM (bimonthly)
Mora River at La Cueva, NM (bimonthly)
Ute Reservoir near Logan, NM (annual)

2. Suspended-Sediment data are being collected on a bimonthly basis at the Canadian River near Sanchez, NM, in conjunction with the Water Quality Surveillance Program in cooperation with the New Mexico Interstate Stream Commission and as part of NASQAN.

Lower Canadian Subregion

1. Suspended-sediment data are being collected at Canadian River near Canadian, TX, as part of NASQAN.

2. Suspended-sediment are being collected at Canadian River at Calvin, OK, as a part of NASQAN and in cooperation with the COE.

North Canadian Subregion

1. Suspended-sediment data are being collected at North Canadian River at Woodward, OK, and at Beaver River at Beaver, OK, as a part of NASQAN.

2. Suspended-sediment data are being collected at North Canadian River near Wetumka, Ok, as a part of NASQAN.

3. Suspended-sediment data are being collected at the following sites in cooperation with the COE:

Beaver River near Guymon, OK
North Canadian River near Seiling, OK
North Canadian River below Lake Overholser near Oklahoma City, OK
Deep Fork near Arcadia, OK
Deep Fork near Warwick, OK

4. Suspended-sediment data are being collected at Deep Fork near Beggs, OK, for NASQAN and in cooperation with the COE.

5. Suspended-sediment data are being collected at North Canadian River near Harrah, OK, in cooperation with the Oklahoma Water Resources Board.

Lower White Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cache River at Patterson, AR, as part of a State Coop Program.

2. Suspended-sediment data are being collected bimonthly at Bayou DeView at Morton, AR, as part of the State Coop Program.

Lower Arkansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Arkansas River at James W. Trimble Lock and Dam near Van Buren, AR, and at Arkansas River at David D. Terry Lock and Dam below Little Rock, AR, as a part of NASQAN.

2. Suspended-sediment data are being collected at Illinois River near Tahlequah, OK, in cooperation with the COE.

3. Suspended-sediment data are being collected at Arkansas River at Tulsa, OK, in cooperation with the COE and as a part of NASQAN.

Red Headwaters Subregions

1. Suspended-sediment data are being collected periodically at North Fork Red River near Headrick, OK, at Salt Fork Red River near Elmer, OK, and at Prairie Dog Town Red River near Wayside, TX, as a part of NASQAN.

Red-Washita Subregion

1. Suspended-sediment data are being collected periodically at Red River near Burkburnett, TX, at Red River at Denison Dam near Denison, TX (discontinued September 1986), and at Red River near Gainesville, TX (discontinued September 1986), as a part of NASQAN.

2. Suspended-sediment data are being collected at Washita River near Dickson, OK, in cooperation with the COE and as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the COE:

Red River near Quanah, TX (Discontinued 12/31/90)
North Wichita River near Truscott, TX (Discontinued 12/31/90)
Red River near DeKalb, TX
Beaver Creek near Waurika, OK

4. Suspended-sediment data are being collected at Blue Beaver Creek near Cache, OK, as part of the National Hydrologic Benchmark Network.

Red-Sulphur Subregion

1. Suspended-sediment data are being collected at Kiamichi River near Big Cedar, OK, as a part of the National Hydrologic Benchmark Network and in cooperation with the COE.

2. Suspended-sediment data are being collected bimonthly at Red River at Index, AR, as a part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at Cossatot River near Vandervoort, AR, as part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected on a quarterly basis at Twelve-mile Bayou near Dixie, LA, and Red River at Alexandria, LA, as a part of NASQAN.

Special Studies

Suspended sediment, bed-material samples, and channel bathymetry data was collected on Red River at the highway crossings of U.S. 71, Interstate 30 and State Road 3032, as part of a bridge-scour investigation being conducted in cooperation with the Federal Highway Administration.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Office Building
Room 2301
700 West Capitol Avenue
Little Rock, AR 72201

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
215 Dean A. McGee Avenue
Room 621
Oklahoma City, OK 73102

District Chief, WRD
U.S. Geological Survey
Building 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
4821 Quail Crest Place
Lawrence, KS 66049

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U. S. Geological Survey
8011 Cameron Road
Austin, TX 78753

ARKANSAS-WHITE-RED REGION (11)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Red River	Little Beaver	L. Beaver Buckhorn Hell Rock Morton	Grady Stephens Cotton	OK
Red River	Cow Creek	Cow	Stephens	OK
Red River	Lugert-Altus	Bitter Stinking	Jackson Greer	OK
Red River	Middle Deep Red Run	Deep Red	Tillman Cotton	OK
Red River	Lower Deep Red Run	Deep Red	Cotton	OK
Red River	Upper Elk	Upper Elk	Beckham	OK
Arkansas River	Brazil Creek	Brazil Owl Wild Horse Rock Jefferson	LeFlore Latimer Haskell	OK
Cimarron River	Wild Horse	Wild Horse	Payne	OK
N. Canadian River	Six Mile	Six Mile	Canadian	OK
N. Canadian River	North Rock	North Rock	Pottawa-tomie	OK
Deep Fork Canadian	Dry	Dry	Lincoln	OK
Deep Fork Canadian	Camp Salt	Camp Salt	Creek	OK

b. Watershed Investigation Studies - Public Law 534

Major Basin	Study Area	State
Washita River	Ft. Cobb	OK

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Ramah	El Paso	CO
Trinidad	Las Animas	CO
Only preliminary data collection completed.		
Fort Carson #2	El Paso	CO
Fort Carson #5	El Paso	CO
Only preliminary data collection completed.		

TEXAS-GULF REGION

GEOLOGICAL SURVEY

Sabine Subregion

1. Suspended-sediment data are being collected at Sabine River near Ruliff, TX, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis at Big Sandy Creek near Big Sandy, TX, in cooperation with the U.S. Bureau of Reclamation (USBR) beginning October 1, 1984 (discontinued September 1986).

Neches Subregion

1. Suspended-sediment data are being collected on a periodic basis at Neches River at Evadale, TX, as a part of NASQAN.

Trinity Subregion

1. Suspended-sediment data are being collected on a periodic basis at Mountain Creek near Cedar Hill, TX, Duck Creek near Garland, TX, and at Kings Creek near Kaufman, TX, as a part of the Federal Collection of Basic Records (CBR) program (discontinued September 30, 1982).

2. Suspended-sediment data are being collected on a periodic basis at Trinity River at Trinidad, TX, as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Trinity River at Romayor, TX, and at Chocolate Bayou near Alvin, TX (discontinued September 1986), as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Bedias Creek near Madisonville, TX, in cooperation with the USBR (discontinued September 1986).

Galveston Bay-San Jacinto Subregion

1. Suspended-sediment data are being collected on a periodic basis at West Fork San Jacinto River near Conroe, TX, and at Buffalo Bayou at West Belt Dr., Houston, TX (discontinued September 1986), as part of NASQAN.

2. Suspended-sediment data are being collected on a storm-event basis at Cypress Creek near Westfield, TX, in cooperation with the U.S. Army Corps of Engineers, Galveston, beginning October 1, 1986.

Middle Brazos Subregion

1. Suspended-sediment data are being collected on a periodic basis at Salt Fork Brazos River near Aspermont, TX, Double Mountain Fork Brazos River near Aspermont, TX, Brazos River near Highbank, TX, and at Brazos River near South Bend, TX, as a part of NASQAN.

Lower Brazos Subregion

1. Suspended-sediment data are being collected on a daily and periodic basis at Brazos River at Richmond, TX, as part of the Federal CBR program and also as part of NASQAN (daily sampling discontinued September 1986).

2. Suspended-sediment data are being collected four times a year at South Fork Rocky Creek near Briggs, TX, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at Little River near Cameron, TX, as a part of NASQAN.

Upper Colorado Subregion

1. Suspended-sediment data were being collected on a periodic basis at Colorado River above Silver, TX, as a part of NASQAN.

Lower Colorado-San Bernard Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Colorado River at Austin, TX, Colorado River at Wharton, TX, Colorado River near San Saba, TX, and at San Bernard River near Boling, TX (discontinued September 1986), as a part of NASQAN. The collection of suspended-sediment data at Llano River at Llano, TX (discontinued September 1986) began April 1, 1979, as part of NASQAN.

2. Suspended-sediment data for total-load determination is being collected on a periodic basis at Colorado River above Columbus, TX, in cooperation with the Lower Colorado River Authority beginning October 1, 1982 (discontinued September 1986).

Central Texas Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Guadalupe River at Victoria, TX, San Antonio River at Goliad, TX, Lavaca River near Edna, TX, and at Mission River at Refugio, TX, as a part of NASQAN.

Nueces-Southwestern Texas Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Nueces River near Three Rivers, TX, as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
8011 Cameron Road
Austin, TX 78753

TEXAS-GULF REGION (12)

SOIL CONSERVATION SERVICE

1. Special Studies

Major Drainage	Study Area	State
Colordo River	11 Subwatersheds	TX

RIO GRANDE

BUREAU OF RECLAMATION

Middle Rio Grande - A literature review on the design of groins was completed and is presented in a report. The bank stabilization studies at Santa Clara and Abeytas Heading were completed and presented in a report. Conclusions in the report are as follows:

1. Santa Clara river maintenance site is located upstream of Albuquerque in a narrow reach of the river. Groins were located along the south bank of the river to protect the bank from erosion. Backwater computations were obtained for discharges of 7,600 ft^3/s, 13,000 ft^3/s and 16,000 ft^3/s in order to estimate river hydraulic data for scour computations. Bed material data averaged 15 mm for the particle size D_{50}. The average scour predicted at the site was 8.1 ft. Groins were located at the site with a spacing of 1.5 times the length.
2. An economic analysis was completed at Santa Clara for two river maintenance alternatives: groins or revetment. The groins were chosen as the least expensive alternative.
3. Abeytas Heading is located downstream of Albuquerque where a severe bend has formed because of a canal turnout. Eight groins were located within the reach to provide bank protection. Average scour predicted at the site is 8.4 ft. Twelve feet of scour was used to estimate groin riprap quantities in the bend.

Lake Sumner Resurvey - A bathymetric resurvey of Lake Sumner was completed between elevations 4210 and 4250 feet during May 1989. Area-capacity data between 4252.3 and 4297 feet were obtained from topographic maps developed by aerial photography in January 1989. Underwater topography and contour areas were developed from bathymetric survey data using a computer graphics mapping system. Operating area-capacity tables were computed utilizing these data.

RIO GRANDE REGION

GEOLOGICAL SURVEY

Rio Grande Headwaters Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Rio Grande near Lobatos, CO, as a part of the National Stream Quality Accounting Network (NASQAN).

Rio Grande-Elephant Butte Subregion

1. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the New Mexico Interstate Stream Commission:

Rio Pueblo De Taos below Los Cordovas, NM (bimonthly)
Rio Chama near La Puente, NM (bimonthly)

Rio Grande below Taos Junction Bridge near Taos, NM (quarterly)

2. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the Bureau of Indian Affairs:

Rio Chama near Chamita, NM (quarterly)
Rio Grande at Santa Clara, NM (quarterly)

3. Suspended-sediment data are being collected on a daily basis at Rio Grande at Otowi Bridge near San Ildefonso, NM, and at Rio Grande near Albuquerque, NM, as a part of the Federal Collection of Basic Records (CBR) program.

4. Suspended-sediment data are being collected on a daily basis at Rio Puerco above Arroyo Chico near Guadalupe, NM, and at Rio Puerco near Bernardo, NM, in cooperation with the U.S. Bureau of Land Management (BLM), NMISC, and U.S. Army Corps of Engineers (COE).

5. Suspended-sediment data are being collected on a bimonthly basis at Rio Grande at San Felipe, NM, Rio San Jose near Grants, NM, and at Rio Grande at Isleta, NM, in conjunction with the Water Quality Surveillance Program and financed cooperatively by NMISC.

6. Suspended-sediment data are being collected at Santa Fe River above Cochiti Dam, NM (semiannually), Cochiti Lake, NM (annually), and Jemez River near Jemez, NM (semiannually), in cooperation with the NMISC.

7. Suspended-sediment data are being collected on a daily basis at Rio Grande near Bernardo, NM, at Rio Grande at San Acacia, NM, and at Rio Grande at San Marcial, NM, in cooperation with NMISC.

8. Suspended-sediment data for total-load determinations are being collected on a monthly basis at Rio Grande at Albuquerque, NM, at Rio Grande near Bernardo, NM, at Rio Grande at San Acacia, NM, and Rio Grande at San Marcial, NM, in cooperation with NMISC and U.S. Bureau of Reclamation (USBR).

9. Suspended-sediment data are being collected on a quarterly and storm-event basis at Rio Mora near Terrero, NM, as a part of the National Hydrologic Benchmark Network.

10. Suspended-sediment data are being collected on a bimonthly basis at Pecos River above Santa Rosa Lake, NM, and Pecos River near Acme, NM, in cooperation with NMISC.

11. Suspended-sediment data are being collected on a daily basis at Pecos River near Artesia, NM, as part of the Federal CBR program.

12. Suspended-sediment data were collected on a bimonthly basis at Pecos River near Puerto de Luna, NM, in conjunction with the Water Quality Surveillance Program and in cooperation with NMISC.

13. Suspended-sediment data are being collected on a bimonthly basis at Pecos River at Red Bluff, NM, at Rio Grande at El Paso, TX, and at Rio Grande at Fort Quitman, TX, as a part of NASQAN.

Rio Grande-Amistad Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rio Grande at Foster Ranch, near Langtry, TX, and at Devils River at Pafford Crossing, near Comstock, TX, as a part of NASQAN and was changed to a Hydrologic Benchmark Station on October 1, 1986.

Rio Grande Closed Basins Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Rio Tularosa near Bent, NM, as a part of NASQAN.

Lower Pecos Subregion

1. Suspended-sediment data are being collected on a periodic basis at Pecos River near Langtry, TX, as a part of NASQAN.

Lower Rio Grande Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rio Grande River near Brownsville, TX, and at Arroyo Colorado at Harlingen, TX (started October 1, 1986), as part of NASQAN.

2. Suspended-sediment data are being collected on a weekly or more frequent basis at North Floodway near Sebastion, TX, and at Arroyo Colorado Floodway at El Fuste Siphon, south of Mercedes, TX, as part of the Federal CBR program (discontinued September 30, 1983).

Special Studies

A water-quality monitoring plan for the Rio Grande and Red River in Taos County, NM, was initiated in October 1978 by the BLM. The study objectives are to monitor long-term changes in water quality (chemical and sediment) at 12 selected sampling sites. BLM personnel collect monthly samples and the Geological Survey analyzes the samples and publishes the data.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
8011 Cameron Road
Austin, TX 78753

UPPER COLORADO

BUREAU OF RECLAMATION

Rocky Ford Laterals - Scour depths and water surface elevations for flood conditions at lateral stream crossings were computed for the 25-year and 100-year frequency level. There are 12 crossings; nine will have siphon crossings, one will have an overchute, and two will have some other means of protection. The 100-year design discharge, computed water surface elevation, and recommended scour are shown in the following table (for sites 1-10).

Site Number	Lateral Number	100-year Discharge	Water Elevation	Scour Depth
1	13.7	590 ft^3/s	6049.8 ft	2.4 ft
2	13.7 - 0.2	438	6140.4	3.4
3	13.7 - 0.2	557	6050.3	3.0
4	13.7 - 0.2	44	6011.7	2.1
5	13.7 - 0.2	631	5992.5	3.0
6	13.7 - 0.6	641	6085.6	3.0
7	18.8	414	6057.9	2.1
8	18.8 - 0.5	606	5999.3	3.6
9	21.2	250	5951.2	5.6
10	22.0	428	5857.6	--

A sizing analysis for a sediment settling basin was done for the Durango Pumping Plant located near the Animas River. An average size settling basin for the conditions was assumed 720 feet long, 90 feet wide at bottom and side slopes of 2:1. Results for a 12-month simulation period indicated accumulated sediment volume and depth were 9.7 acre-feet and 5.8 feet, respectively. All of the incoming gravel and 93 percent of the incoming sand were trapped in the basin.

Glen Canyon Environmental Studies - Fifteen range lines from Glen Canyon Dam to Lee's Ferry were resurveyed in September 1990. Cross sections resulting from this data were compared to those from surveys of 1975 and 1983 to assess the channel changes. The 1990 data was also used to develop a contour map of the tailrace area just below the dam.

Channel Monitoring of Green River near Vernal, Utah - Channel monitoring has been done on the Green River at Ouray National Wildlife Refuge, Utah since 1986 to determine changes in scour, fill, and other hydraulic characteristics as compared to results of past monitorings. Such changes are used to assess impacts on flora and fauna in the channel and riparian. Data collected during 1990 indicated no detectable trends for the reach of the river in the refuge. Local scour and fill was apparent in individual transects, but only a slight increase in channel size was found for the entire reach.

Sixth Water Creek - An update was made on a scour study for the Sixth Water Aqueduct at Sixth Water Creek. The update included evaluating what effect the change in tunnel portal design would have on natural streamflow. The recommended depth for local scour was 4.5 feet for the 100-year flood and no further degradation was anticipated because the stream has carried transbasin diversions for many years.

Lake Powell, San Juan River Arm - A sedimentation estimate was done on the Copper Canyon and Neskahi Wash marina sites on the San Juan River Area of Lake Powell. These estimates will be used to determine the potential life of the sites. Results from the analysis indicated the delta pivot point would reach the Copper Canyon site in 10 years, the Neskahi site in 120 years.

UPPER COLORADO REGION

GEOLOGICAL SURVEY

Colorado Headwaters Subregion

1. Suspended-sediment data are being collected on a once-a-week basis at Colorado River near Cameo, CO, in cooperation with the Colorado River Water Conservation District.

2. Suspended-sediment data are being collected on a bimonthly basis at Colorado River near Colorado-Utah State line as a part of the National Stream Quality Accounting Network (NASQAN).

3. Suspended-sediment and bedload data are being collected throughout the year at Muddy Creek at Kremmling, CO, in cooperation with Colorado River Water Conservation District.

Gunnison Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Gunnison River near Grand Junction, CO, as a part of NASQAN.

Upper Colorado-Dolores Subregion

1. Suspended-sediment data are being collected on a bimonthly basis level at Colorado River near Cisco, UT, as part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Dolores River near Cisco, UT, as a part of NASQAN.

Great Divide-Upper Green Subregion

1. Suspended-sediment data are being collected on a bimonthly and storm-event basis at Green River near La Barge, WY, as part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Green River near Green River, WY, as a part of the Federal Collection of Basic Records Program.

3. Suspended-sediment data are being collected on a quarterly and storm-event basis at Dry Piney Creek near Big Piney, WY, Big Sandy River at Gasson bridge near Eden, WY, and Bitter Creek above Killpecker Creek near Rock Springs, WY, in cooperation with the Wyoming Department of Environmental Quality.

White-Yampa Subregion

1. Suspended-sediment data were obtained once a week at Yampa River near Maybell, CO, in cooperation with the Colorado River Water Conservation District.

2. Suspended-sediment data are being collected on a 6-week and storm-event basis at Savery Creek near Savery, WY, in cooperation with the Wyoming Water Department Commission.

3. Suspended-sediment data are being collected on a daily basis for the nonwinter season at Muddy Creek near Baggs in cooperation with the Wyoming Water Research Center.

4. Suspended-sediment data are being collected on a quarterly and storm-event basis at Little Snake River below Baggs, WY, in cooperation with the Wyoming Department of Environmental Quality.

5. Suspended-sediment data are being collected quarterly at Williams Fork River at mouth near Hamilton, CO, in cooperation with Moffat County.

6. Suspended-sediment and bedload data are being collected six times per year in the coal mining region of the Yampa River basin in cooperation with the Upper Yampa Water Conservancy District.

7. Suspended-sediment data are being collected quarterly at several stations in the Piceance Creek basin to monitor the potential impact of oil shale development.

Piceance Creek above Hunter Creek near Rio Blanco, CO
Piceance Creek below Rio Blanco, CO
Piceance Creek tributary near Rio Blanco, CO
Piceance Creek above Ryan Gulch, CO
Stewart Gulch above West Fork near Rio Blanco, CO
Willow Creek near Rio Blanco, CO
Piceance Creek near White River, CO
Corral Gulch near Rangely, CO
Yellow Creek at White River, CO

These stations are operated in cooperation with Rio Blanco County.

8. Suspended-sediment data are being collected on a comprehensive level at White River near Watson, UT, in cooperation with the Utah Department of Natural Resources.

9. Suspended-sediment data are being collected periodically during spring, summer, and fall at Yampa River near Oak Creek, CO, in cooperation with the Upper Yampa Conservancy District.

10. Suspended-sediment data are collected periodically at the following sites in the Yampa River basin:

Yampa River at Steamboat, CO
Elk River near Milner, CO
Yampa River below Craig, CO
Williams Fork at mouth near Craig, CO

11. Suspended sediment data are collected periodically at Sand Wash near Sunbeam, CO, in cooperation with the Bureau of Land Management.

12. Suspended-sediment data are collected periodically at the following sites in the White River basin:

North Fork White River at Buford, CO
South Fork White River near Buford, CO
White River above Coal Creek near Meeker, CO
White River below Meeker, CO

13. Suspended-sediment data are collected on a periodic basis at White River below Boise Creek near Rangely, CO.

Upper Colorado Subregion

1. Suspended-sediment data are being collected on a comprehensive level primarily during the runoff season at West Divide Creek near Raven, CO, in cooperation with the Colorado River Water Conservation District.

Lower Green Subregion

1. Suspended-sediment data are being collected on a monthly basis at San Rafael River near Green River, UT, in cooperation with the U.S. Bureau of Reclamation (USBR).

2. Suspended-sediment data are being collected on a bimonthly basis at Green River at Green River, UT, as part of NASQAN.

Upper Colorado-Dirty Devil Subregion

1. Suspended-sediment data are being collected on a monthly basis at Colorado River at Lees Ferry, AZ, as part of NASQAN and Arizona Department of Environmental Quality.

2. Suspended-sediment data are being collected on a monthly basis at Bull Creek near Hanksville, UT, in cooperation with the U.S. Bureau of Land Management.

San Juan Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Vallecito Creek near Bayfield, CO, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at Animas River at Farmington, NM, as a part of NASQAN, and Animas River at Cedar Hill, NM on a quarterly basis, in cooperation with NMISC.

3. Suspended-sediment data are being collected on a quarterly basis at San Juan River at Shiprock, NM, as a part of NASQAN.

4. Bedload data are being collected on a comprehensive level at East Fork San Juan River above Sandy Creek near Pagosa Springs, CO.

5. Suspended-sediment data are being collected on a quarterly basis at San Juan River near Bluff, UT, as part of NASQAN.

6. Suspended-sediment data are being collected on a monthly basis at Montezuma Creek near Bluff, UT, in cooperation with the U.S. Bureau of Land Management and the Soil Conservation Service.

Special Studies

1. A study in cooperation with the Yellowjacket Water Conservancy District to define the sediment characteristics in the White River will entail collecting suspended-sediment data 10 to 12 times per year at the following sites:

North Fork White River at Buford, CO
South Fork White River at Buford, CO
White River above Coal Creek near Meeker, CO
White River below Meeker, CO
White River above Crooked Wash near Rangely, CO
Boise Creek near Rangely, CO

2. Two studies continue in the analysis phase to determine total sediment load at potential reservoir sites.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building, FB-44
300 West Congress
Tucson, AZ 85701

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
Room 1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

UPPER COLORADO REGION (14)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	County	State
Muddy Creek	Muddy Creek	Kane	UT

b. Resource Conservation & Development

Reservoir	County	State
Little Bear River Hydrologic Unit	Cache	UT
Otter Creek Hydrolgic Unit	Sevier/Piute	UT

2. Special Studies

Upper Colorado River Rangeland Salinity Control Project - This ongoing project involves an interdisciplinary team of experienced professionals headed up by Bob Rasely, Utah SCS State Geologist. The team members are from various government agencies.

The purpose of this project is to evaluate the nonpoint sediment and salt pollution problems. This evaluation will target the source of the problems on rangeland within individual watersheds with regard to erosion rates, sediment yield rates, salt yield rates, rangeland conditions, hydrologic conditions and potential treatment opportunities.

The project will determine the present condition, future without condition and future with project condition in watersheds for salt yield, sedimentation, erosion, rangeland condition, hydrology and other pertinent resource parameters.

LOWER COLORADO

BUREAU OF RECLAMATION

Black Mountain Operating Reservoir - Scour Depths for 50 year flood peaks in the interceptor drain on the south side of the Black Mountain Operating Reservoir (BMOR) were estimated. Because the drainage basin is poorly defined due to the potential of another basin contributing to the runoff if erosion continues, scour depths were estimated for two conditions. The discharges and depths for each condition are summarized below.

Condition	Discharge	Recommended Scour depth
1	940 ft^3/s	7.0 feet
2	1875 ft^3/s	10.5 feet

Hayden-Rhodes Aqueduct - This aqueduct conveys Colorado River water from the Havasu Pumping plant to Phoenix, Reach 11 Flood Detention Dikes, consisting of 4 separate compacted earth embankments totaling about 15 miles in length and paralleling the aqueduct, protect the canal from sheet flow storm runoff. Since 1972, when the original sedimentation estimates were made, various revisions to the estimates have been made. Also, previous studies limited the sediment concentration in the incoming flow to 20 percent. Since the intended operation of the dikes is to retain the entire floods, the present analysis considers containing all the sediment. The revised sediment inflow estimates to the Reach 11 dikes are shown in the following table.

Dike Number	Sediment (acre feet)
1	840
2	1190
3	630
4	1080

LOWER COLORADO REGION

GEOLOGICAL SURVEY

Lower Colorado-Lake Mead Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at the following sites as part of the National Stream Quality Accounting Network (NASQAN):

   Virgin River at Littlefield, AZ
   Muddy River above Lake Mead near Overton, NV

2. Suspended-sediment data are being collected monthly on a flow event basis, in cooperation with the U.S. Bureau of Land Management, at the following sites:

   Pahranagot Wash near Moapa, NV
   Meadow Valley Wash near Rox, NV
   Las Vegas Wash above detention basin near N. Las Vegas, NV

Little Colorado Subregion

1. Suspended-sediment data are being collected when instantaneous discharge exceed 500 cubic feet per second in cooperation with the U.S. Corps of Engineers (COE) at Little Colorado River near Joseph City, AZ.

2. Suspended-sediment data are being collected on a flow-event basis at Leroux Wash near Holbrook, AZ, in cooperation with the COE.

3. Suspended-sediment data are being collected on a bimonthly basis at Zuni River above Black Rock Res., NM, and Rio Nutria near Ramah, NM, in cooperation with the U.S. Bureau of Indian Affairs (BIA).

Lower Colorado Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bill Williams near Planet, AZ, in cooperation with the U.S. Bureau of Reclamation (USBR), the COE, and the city of Scottsdale, AZ.

2. Suspended-sediment data are being collected on a bimonthly basis as part of NASQAN at Colorado River below Hoover Dam, AZ.

3. Suspended-sediment data are being collected on a monthly basis at Colorado River below Parker Dam, AZ, in cooperation with the Arizona Department of Environmental Quality.

4. Suspended-sediment data are being collected monthly at Colorado River at NIB above Morelos Dam near Andrade, CA, as part of NASQAN and Arizona Department of Environmental Quality.

Upper Gila Subregion

1. Suspended-sediment data are being collected on a quarterly and storm-event basis at Mongollon Creek near Cliff, NM, as a part of the National Hydrologic Benchwork Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Gila River near Redrock, NM, as part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at Gila River at head of Safford Valley, near Solomon, AZ, in cooperation with the Arizona Department of Environmental Quality.

4. Suspended-sediment data are being collected on a monthly basis at Gila River at Calva, AZ, as a part of NASQAN and Arizona Department of Environmental Quality.

Middle Gila Subregion

1. Suspended-sediment data are being collected on a bimonthly basis as a part of NASQAN at the San Pedro River at Charleston, AZ.

2. Suspended-sediment and bed-material data are being collected on a bimonthly basis at Gila River at Kelvin, AZ, and on a monthly basis at San Pedro River below Aravaipa Creek near Mammoth, AZ, in cooperation with the USBR. Bedload data are also collected twice annually at San Pedro River below Aravaipa Creek near Mammoth, AZ under this program.

Lower Gila Subregion

1. Suspended-sediment data are being collected on a monthly basis in cooperation with the USBR at:

    Agua Fria River near Rock Springs, AZ
    Agua Fria River below Lake Pleasant, AZ (during releases from Waddell Dam).

2. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN and in cooperation with the Arizona Department of Environmental Quality at Gila River above diversions at Gillespie Dam, AZ.

Salt Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Wet Bottom Creek near Childs, AZ, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN and the Arizona Department of Environmental Quality at:

    Salt River near Roosevelt, AZ
    Verde River below Tangle Creek, AZ

3. Suspended-sediment data are being collected on a bimonthly basis at East Verde River near Childs, AZ, in cooperation with the Arizona Department of Environmental Quality at:

Pinal Creek near Globe, AZ
Verde River near Clarkdale, AZ
Oak Creek at Redrock Crossing, AZ
Salt River below Stewart Mountain Dam, AZ
Verde River below Bartlett Dam, AZ

Special Studies

1. A 5-year study of the mobility of radionuclides and other selected trace elements in the Little Colorado River basin of Arizona and New Mexico started in July 1988. Suspended-sediment data are collected on a flow-event basis at the following stations:

Puerco River at Church Rock, NM
Puerco River near Manuellito, NM
Black Creek below West Fork near Houck, AZ
Puerco River at Chambers, AZ
Zuni River above Black Rock Reservoir, NM
Little Colorado River at Woodruff, AZ
Little Colorado River near Joseph City, AZ
Little Colorado River at Grand Falls, AZ
Little Colorado River near Cameron, AZ

2. A long-term, ongoing statewide program in Nevada of investigations of sediment and debris transported by flash floods continued during 1989.

For additional information about U.S. Geological Survey activities within this region, contact the following offices:

3. Suspended-sediment, bedload, and bed material data are collected intensively on an intermittent basis in cooperation with USBR Glen Canyon Environmental Studies II at the Colorado River above National Canyon near Supai, AZ. Suspended-sediment data are collected approximately bimonthly at the following stations:

Colorado ÅRiver at Compact Point, near Lees Ferry, AZ
Colorado River above Little Colorado River near Grand Canyon, AZ
Colorado River near Grand Canyon, AZ
Colorado River above National Canyon near Supai, AZ
Colorado River above Diamond Creek near Peach Springs, AZ

4. Suspended-sediment data are collected bimonthly under the auspices of the U.S. Geological Survey Toxics Waste Program at the following stations:

Pinal Creek at Setka Ranch near Globe, AZ
Pinal Creek at Inspiration Dam near Globe, AZ

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
Federal Building
301 West Congress Street, FB-44
Tucson, AZ 85701

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 224
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
Room 1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

LOWER COLORADO REGION (15)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

   a. River Basin Studies

Major Drainage	Stream	County	State
Santa Cruz	Brawley Wash	Pima	AZ

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Lyman	Apache	AZ

GREAT BASIN REGION

GEOLOGICAL SURVEY

Bear Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bear River near Corinne, UT, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a comprehensive level in cooperation with the Utah Department of Natural Resources at:

Bear River at Idaho-Utah State line
Little Bear River below Davenport Creek near Avon, UT
Bear River near Collinston, UT

3. Suspended-sediment data are being collected on a quarterly basis at Bear River at Border, WY as part of the National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected on a quarterly and storm-event basis at Bear River above reservoir, near Woodruff, UT, and Smith's Fork near Cokeville, WY, and on a 6-week and storm-event basis at Twin Creek at Sage, WY, in cooperation with the Wyoming Department of Environmental Quality.

Great Salt Lake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Red Butte Creek at Fort Douglas, near Salt Lake City, UT, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a quarterly basis at Weber River near Plain City, UT, and at Jordan River at Salt Lake City, UT, on a bimonthly basis as a part of NASQAN.

Escalante - Sevier Lake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Sevier River near Lynndyl, UT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a comprehensive level at Sevier River at Hatch, UT, in cooperation with the Utah Department of Natural Resources.

Black Rock Desert-Humboldt Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Humboldt River near Carlin, NV, as part of NASQAN.

Central Lahontan Subregion

1. Suspended-sediment data are being collected at the following sites as part of NASQAN:

Walker River near Wabuska, NV (bimonthly)
Carson River near Fort Churchill, NV (quarterly)
Truckee River near Nixon, NV (quarterly)

2. Suspended-sediment data are collected monthly or more frequently during runoff events at the following sites as part of the Lake Tahoe Stream Monitoring Program (in cooperation with the Tahoe Regional Planning Agency):

Third Creek near Crystal Bay, NV
Incline Creek near Crystal Bay, NV
Glenbrook Creek near Glenbrook, NV
Logan House Creek near Glenbrook, NV
Edgewood Creek near Stateline, NV

3. Suspended-sediment data are being collected twice-yearly at the following sites in cooperation with the U.S. Army Corps of Engineers:

Martis Creek at Highway 267 near Truckee, CA
Martis Creek Lake near Truckee, CA
Martis Creek near Truckee, CA

4. As part of the Tahoe Monitoring Program, suspended-sediment data are being collected from five streams that drain into Lake Tahoe. The relation of sediment discharge to algae growth in the lake is being studied by the University of California at Davis. The sediment data collection program is in cooperation with the California Department of Water Resources and the University of California at Davis, and includes the following daily sediment stations:

Upper Truckee River at South Lake Tahoe
General Creek near Meeks Bay
Blackwood Creek near Tahoe City
Ward Creek at Highway 89
Trout Creek near Tahoe Valley

5. Suspended-sediment data are being collected on a periodic basis at Sagehen Creek near Truckee, in cooperation with the University of California at Davis.

Central Nevada Desert Basins Subregion

1. Suspended-sediment data are being collected quarterly at Steptoe Creek near Ely, NV, and South Twin River near Round Mountain, NV, as part of the National Hydrologic Benchmark Network.

Special Studies

1. A long-term, ongoing statewide program of investigations of sediment and debris transport by flash floods continued during 1989.

2. A long-term investigation of sediment and debris hazards related to flooding is in the sixth investigative year at the Nevada Test Site.

For additional information about U.S. Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 224
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

District Chief, WRD
U.S. Geological Survey
Room W-2234, Federal Building
2800 Cottage Way
Sacramento, CA 95825

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
230 Collins Road
Boise, ID 83702

GREAT BASIN REGION (16)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

    a. Public Law 566

Major Drainage	Watershed	County	State
Goose Lake Basin	Deadman Creek	Lake	OR
Goose Lake Basin	Bullard Creek	Lake	OR

PACIFIC NORTHWEST REGION

GEOLOGICAL SURVEY

Kootenai-Pend Oreille-Spokane Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at South Fork Coeur d'Alene River at Cataldo, ID, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis by a PS-69 at Kootenai River at Porthill, ID, as part of the U.S. Geological Survey waterways-treaty program.

3. Suspended-sediment data are being collected on a quarterly basis at Hayden Creek below North Fork, near Hayden Lake, ID, as part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Clark Fork near Cabinet, ID
Priest River near Priest River, ID
Coeur d'Alene River at Enauille, ID
South Fork Coeur d'Alene River near Pinehurst, ID
St. Joe River at Calder, ID
Spokane River near Post Falls, ID

Upper Columbia Subregion

1. Suspended-sediment data are being collected in cooperation with the U.S. Environmental Protection Agency on a daily basis at:

Clark Fork at Deer Lodge, MT
Clark Fork at Turah Bridge near Bonner, MT
Blackfoot River near Bonner, MT
Clark Fork above Missoula, MT

and on a periodic basis at:

Clark Fork near Galen, MT
Little Blackfoot River near Garrison, MT
Flint Creek near Drummond, MT
Rock Creek near Clinton, MT

2. Suspended-sediment data are being collected on a bimonthly basis in cooperation with the Bureau of Indian Affairs at the following stations:

Little Bitterroot River near Camas Prairie, MT
Crow Creek at mouth near Ronan, MT
Mission Creek at National Bison Range at Moiese, MT
Jocko River at Dixon, MT
Flathead River at Perma, MT

3. Suspended-sediment data are being collected at the following sites as part of NASQAN:

Clark Fork below Missoula, MT (bimonthly)
Flathead River at Columbia Falls, MT (quarterly)

4. Suspended-sediment data are being collected on a daily basis at Flathead River at Flathead, British Columbia, in cooperation with the Environment Canada as part of the U.S. Geological Survey watersheds-treaty program.

5. Suspended-sediment data are being collected on a periodic basis at Columbia River at Northport, WA, at Columbia River at Vernita Bridge, near Priest Rapids Dam, WA, and at Okanogan River at Malott, WA, as a part of NASQAN.

6. Suspended-sediment data are being collected on a periodic basis at Andrews Creek near Mazama, WA, as a part of the National Hydrologic Benchmark Network.

7. Suspended-sediment data are being collected on a quarterly basis at Columbia River at Richland, WA, in cooperation with the U.S. Department of Energy.

Yakima Subregion

1. Suspended-sediment data are being collected periodically at Yakima River near Union Gap, WA, and at Yakima River at Kiona, WA, as part of NASQAN and NAWQA.

2. Suspended-sediment data are being collected on a periodic basis at Yakima River at Cle Elum, WA, Yakima River at Umtanum, WA, Naches River at North Yakima, WA, Sulphur Creek Wasteway near Sunnyside, WA, and Yakima River near Grandview, WA, as a part of NAWQA.

Upper Snake Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Cache Creek near Jackson, WY, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment and bedload data are collected weekly during spring runoff at Granite Creek and Little Granite Creek near Bondurant, WY, and Pacific Creek at Moran, WY, as part of a special research project.

3. Suspended-sediment data are being collected on a bimonthly basis at Snake River near Heise, ID, as a part of NASQAN.

4. Suspended-sediment data are being collected on a bimonthly basis and bedload data during spring runoff at Snake River above Jackson Lake at Flagg Ranch, WY, in cooperation with Grand Teton National Park.

5. Suspended-sediment data are being collected on a quarterly and storm-event basis at Salt River above reservoir, near Etna, WY, in cooperation with the Wyoming Department of Environmental Quality.

6. Suspended-sediment and bedload data are being collected on an event basis during the non-winter period at 3 sites on Spread Creek near Elk, WY, in cooperation with the Federal Highway Administration.

7. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Snake River at Lorenzo, ID
Teton River near St. Anthony, ID
Henrys Fork near Rexburg, ID
Willow Creek near Pirie, ID
Blackfoot River near Blackfoot, ID
Snake River near Blackfoot, ID
Portneuf River near Tyhee, ID

Middle Snake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Snake River at King Hill, ID, and Boise River near Parma, ID, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Big Jacks Creek near Bruneau, ID, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Snake River near Minidoka, ID
Salmon Falls Creek near Hagerman, ID
Big Wood River near Bellevue, ID
Silver Creek near Picabo, ID
Malad River near Gooding, ID
Boise River at Glenwood Bridge near Boise, ID
Snake River at Nyssa, OR
North Fork Payette River at Cascade, ID
Payette River near Payette, ID
Weiser River near Weiser, ID
Snake River near Weiser, ID

Lower Snake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Salmon River near White Bird, ID, and Clearwater River at Spalding, ID, as part of NASQAN.

2. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at South Fork Clearwater River at Stites, ID.

3. Suspended-sediment data are being collected periodically at Snake River at Burbank, WA, as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic basis from Minam River at Minam, OR, as a part of the National Hydrologic Benchmark Network.

Middle Columbia Subregion

1. Suspended-sediment samples are being collected on a periodic basis at John Day River near McDonald Ferry, OR, and at Deschutes River near Biggs, OR, as a part of NASQAN.

Lower Columbia Subregion

1. Suspended-sediment data are being collected on a periodic basis at Columbia River at Warrendale, OR, as a part of NASQAN.

Willamette Subregion

1. Suspended-sediment data are being collected on a periodic basis from Tualatin River at West Linn, OR, and at Willamette River at Portland, OR, as a part of NASQAN.

Oregon-Washington Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rogue River near Agness, OR, Siuslaw River near Mapleton, OR, Nehalam River near Foss, OR, Chehalis River at Porter, WA, and at Queets River near Clearwater, WA, as a part of NASQAN, and at South Umpqua River at Roseberg, OR, in cooperation with Douglas County and as a part of NASQAN.

Puget Sound Subregion

1. Suspended-sediment data are being collected on a periodic basis at Skagit River near Mount Vernon, WA, and at Puyallup River at Puyallup, WA, as a part of NASQAN.

Special Studies

1. Suspended-sediment, bed-material, and bedload data are being collected on a periodic basis at the following stations:

   Green River above Beaver Creek near Kid Valley, WA
   South Fork Toutle River at Camp 12 near Toutle, WA
   North Fork Toutle River at Kid Valley, WA
   Toutle River at Tower Road near Silver Lake, WA
   Muddy River below Clear Creek near Cougar, WA

Automatic pumping sediment samplers are also operated at most sites. The goal is to compute daily sediment discharges and to continue evaluation of the sediment systems of streams affected by the 1980 eruption of Mount St. Helens. Instrumentation research is an ongoing part of the sediment-transport studies in the Toutle River. In situ suspended-sediment analyzers are installed at both the North Fork Toutle River near Kid Valley and Toutle River at Tower Road sites. Data from these instruments are being compared to traditional laboratory analysis of suspended-sediment samples. Depth sounding of the mobile streambed continued at the North Fork Toutle River at Kid Valley. Observations of dune migration in fine gravel were summarized in a technical paper. Measurements of dune celerity throughout a storm-runoff event were made with the use of dual depth sounders.

2. Channel geometry data are being collected at 30 sites to support research on erosional processes and evolution of the drainage system.

Sediment-transport and hydraulic data are being collected at stations in the Toutle River basin to describe vertical and horizontal profiles of suspended sediment and velocity. Bedload samples are being collected with enlarged Helley-Smith samplers at several sites. These samples are being compared with samples from several other bedload samplers, including two Helley-Smith configurations, two Chinese bedload samplers, and the VUV sampler. Results of these comparisons should result in suggested bedload samplers for a variety of stream environments. A compilation report containing hydraulic, sediment-transport, and bed-material data for 1980-84 for the Toutle River system was published. Several bedload equations are being tested for use on steep streams. Two reports on these comparisons are in preparation. Methods are continuing to be developed for understanding variations in sediment discharge in time and space. To improve the control of measuring and sampling equipment, stayline are used at the cableways at North Fork Toutle River above Bear Creek, North Fork Toutle River at Kid Valley, Toutle River at Tower Road gaging stations, and Muddy River below Clear Creek near Cougar, WA.

Hydrologic hazard research in volcanic terrain centered around understanding the mechanics, frequency, and magnitude of debris flows originating on the volcanos. Debris flows transport vast amounts of sediment and are only now starting to be recognized and understood. The project office hosted an interdivisional workshop on debris-flow modeling at St. Anthony Falls Hydraulics Lab, Minneapolis, MN. The study on Mount Rainier was in full operation during 1987 and will culminate in a major professional paper and several journal articles that are in the review stage.

The sedimentation activities covered in the hydrologic hazards of the Mount Hood project fall into two main categories:

(1) Mapping of deposits emplaced through both volcanic (lahars, pyroclastic flows) and nonvolcanic (jokulhlaups, avalanches) means. Deposits are being mapped to provide volume and inundation information and are being stratigraphically located to provide frequency of event information.

(2) Investigation of areas of hydrothermal alteration high on the edifice. Areas of intense alteration are considered to be weak areas of the mountain and subject to collapse and subsequent initiation of clay-rich mass movements. Areas of alteration are being located, mapped, and sampled.

Debris flow monitoring and landslide initiation research are planned for field studies in China under cooperative arrangements between research colleagues at the WRD project office at the Cascades Volcano Observatory in Vancouver, WA, and colleagues in China. Laboratory research on debris-flow rheology was started at the project office by testing rotational shear vane viscometers. Several reports on mass-movement and debris flow rheology are in various stages of completion.

A study to define the sediment sources and processes causing turbidity in the Bull Run watershed was planned in 1987 and started in April 1988. Recent forest management activities have caused concern of possible water supply degradation. Turbidity is a parameter of key importance. Following thorough analysis of existing data, an enhanced monitoring effort using battery-operated continuous turbidimeters will begin. Magnetic minerals from soil profiles, stream channels, and reservoir deposits will be analyzed to determine possible turbidity sources.

3. The Cascades Volcano Observatory, Vancouver, WA, conducts a training activity on sediment-sampling field techniques each year in October. The training is conducted on behalf of the Water Resources Division, but a few slots are reserved for cooperator and other Federal agency personnel to attend. The total attendance at each training session is limited to 24 students.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
230 Collins Road
Boise, ID 83702

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 428
301 So. Park Avenue, Drawer 10076
Helena, MT 59626-0076

State Chief, WRD
U.S. Geological Survey
847 NE 19th Avenue
Suite 300
Portland, OR 97232

State Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

PACIFIC NORTHWEST REGION (17)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. River Basin Studies

Major Drainage	Watershed	County	State
Snake River	Raft River	Cassia, Oneida, Power	ID
		Box Elder	UT
Snake River	Teton River	Madison & Teton	ID
		Teton	WY
Puget Sound	Dungeness River	Clallam	WA

b. Idaho State Agricultural Water Quality Program

Major Drainage	Watershed	Stream	County	State
Snake River	Teton River	Teton Canyon	Fremont, Teton & Madison	ID
Snake River	Big Wood River	Rock Ck	Blaine	ID
Snake River	North Fork Payette River	Cascade Reservoir	Valley	ID
Snake River	St. Joe River	Plummer Ck	Benewah	ID
Snake River	Coeur d'Alene Lk	Lake Creek	Kootenai	ID

c. Conservation Operations

Major Drainage	Watershed	County	State
Columbia River	Squaw Creek	Kittitas	WA
Columbia River	Weber Coulee	Crant	WA

2. Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Howard Sediment Basin	Columbia	WA
Howard Sediment Basin	Columbia	WA

These two desilting basins are located on two major side drainages of the Tucannon River. They were constructed as water quality demonstration projects in cooperation with Washington State Department of Ecology, local agencies and land owners.

CALIFORNIA

BUREAU OF RECLAMATION

Lake Cachuma Survey - Cachuma Reservoir near Santa Barbara, California was surveyed in March 1989. Area-capacity tables for this reservoir were completed in June 1990. The above water areas were obtained from other contour maps; that below water from the hydrographic survey. Area-capacity tables were generated by using a special computer program.

Spring Creek Diversion - Water surface profile, flood inundation, channel capacity and stability analyses were completed for diversions from the Upper Spring Creek Diversion Dam to the Flat Creek Drainage, Average Flat Creek channel slopes ranged from 3 to 9 percent working upstream in the drainage. Flood peaks ranged from 150 to 610 ft^3/s for the natural drainage and from 630 to 1710 ft^3/s with the added diversions from the Upper Spring Creek drainage. Computed velocities ranged from about 2 ft/s to 10 ft/s and showed an increase of about 1 to 2 ft/s for the added diversions. Top widths ranged from about 30 to 100 ft and increased by 10 to 20 ft due to the added diversions. The channel stability analysis showed that the 6- to 10-inch cobble should remain stable in the lower reaches of Flat Creek, but the upper most 1600 feet of channel would require an armor layer of about 1.5 foot cobbles without an energy dissipation structure. Selected sites were recommended for bank protection.

CALIFORNIA REGION

GEOLOGICAL SURVEY

North Coastal Subregion

1. Suspended-sediment and bedload data are being collected in Redwood National Park to evaluate the sediment transport rates caused by both natural processes and logging activities within the park. Data collection began in 1973 in cooperation with the National Park Service. The Park Service is using this data to develop management practices that will reduce erosion rates. The current sampling network includes the following stations:

   Redwood Creek near Blue Lake (daily)
   Lacks Creek near Orick (monthly)
   Panther Creek near Orick (monthly)
   Redwood Creek at Orick (daily)

2. Suspended-sediment data are being collected on a daily basis and bedload data on a periodic basis at Grass Valley Creek at Fawn Lodge near Lewiston and at Trinity River below Limekiln Gulch near Douglas City, in cooperation with the U.S. Bureau of Reclamation (USBR).

3. Suspended-sediment data are being collected on a quarterly basis at Elder Creek near Branscomb, as part of the National Hydrologic Benchmark Network, and at Smith River near Crescent City, as part of National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected on a bimonthly basis at Klamath River near Klamath, Russian River near Guerneville, and at Eel River at Scotia, as part of NASQAN.

5. Suspended-sediment and bedload data are being collected on a periodic basis at Little Grass Valley Creek near Lewiston in cooperation with the USBR.

6. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with Mendocino County Water Agency, at Russian River near Hopland.

7. Suspended-sediment data are being collected on a daily basis, in cooperation with the San Francisco State University Foundation, at Lagunitas Creek near Point Reyes Station.

Sacramento Basin Subregion

1. Suspended-sediment data are being collected on a daily basis at Feather River near Gridley and at Sacramento River at Freeport, in cooperation with the California Department of Water Resources.

2. Suspended-sediment data are being collected on a bimonthly basis at Sacramento River at Keswick, as part of NASQAN.

North Lahontan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Susan River at Susanville, as part of NASQAN.

San Francisco Bay Subregion

1. Suspended-sediment and bedload data are being collected in the Cull Creek and San Lorenzo Creek Basins to document sediment transported into Cull Creek and Don Castro Reservoirs, respectively, and to test erosion control procedures. Data collection began in the 1979 water year, in cooperation with Alameda Country Flood Control and Water Conservation District, and includes the following stations:

San Lorenzo Creek at San Lorenzo (daily)
San Lorenzo Creek above Don Castro Reservoir near Castro Valley (daily)
Cull Creek above Cull Creek Reservoir near Castro Valley (daily)
Cull Creek Tributary No. 4 above CC Reservoir (storm event)

2. Suspended-sediment data are being collected on a bimonthly basis at Napa River near Napa, as part of NASQAN.

3. Bed-material data are being collected once per year at 7 stations in the Guadelupe River basin, as part of the Santa Clara County Water Quality Study. Data collection began in 1982, in cooperation with the Santa Clara Valley Water District.

San Joaquin Basin Subregion

1. Suspended-sediment data are being collected on a daily basis at San Joaquin River at Vernalis, in cooperation with the California Department of Water Resources.

2. Suspended-sediment data are being collected on a quarterly basis at Mokelumne River at Woodbridge, as part of NASQAN, and at Merced River at Happy Isles Bridge near Yosemite, as part of the National Hydrologic Benchmark Network.

Central Coastal Subregion

1. Suspended-sediment and bedload data are being collected on a periodic basis at San Antonio River near Lockwood, and at Nacimiento River near Bryson, in cooperation with Monterey County Flood Control and Water Conservation District.

2. Suspended-sediment data are being collected on a bimonthly basis at Salinas River near Chular and on a quarterly basis at Pajaro River at Chittenden, as part of NASQAN.

3. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with the California Department of Boating and Waterways, at the following stations:

Soquel Creek at Soquel
San Lorenzo River at Big Trees
Pescadero Creek near Pescadero
San Gregorio Creek at San Gregorio

Tulare Basin and South Lahontan Subregions

1. Suspended-sediment data are being collected on a bimonthly basis at Kings River below NF near Trimmer and Kern River at Kernville, as part of NASQAN.

South Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Santa Ana River near San Bernardino and Santa Ana River at Santa Ana, in cooperation with the COE.

2. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with the California Department of Boating and Waterways and the COE, at the following stations:

San Juan Creek at San Juan Capistrano
Arroyo Trabuco at San Juan Capistrano
San Luis Rey River at Oceanside

3. Suspended-sediment data are being collected on a bimonthly and storm-event basis at Santa Ana River below Prado Dam, in cooperation with Orange County Environmental Management Agency.

4. Suspended-sediment data are being collected on a periodic basis at Ventura River near Ventura and Santa Clara River at Montalvo in cooperation with California Department of Boating and Waterways and Ventura County Public Works Agency.

5. Suspended-sediment data are being collected on a quarterly basis at Los Angeles River at Long Beach as part of NASQAN.

Colorado Desert Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Alamo River near Calipatria as part of NASQAN.

For additional information about U.S. Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
2800 Cottage Way
Sacramento, CA 95825

CALIFORNIA REGION (18)

SOIL CONSERVATION SERVICE

1. A study of sediment damages and determinations of sediment yields were made for work plans in the following watersheds.

a. Public Law 566

Major Drainage	Watershed	County	State
East Fork of the Russian	Lake Mendocino	Mendocino (<5% Lk City)	CA

This investigation is part of the Potter Valley-Cold Creek Preauthorization Study/Local Implementation Plan (at the request of the sponsors, the report is to serve in both capacities). The investigation entailed quantifying erosion and sediment yield rates from major sources in the Lake Mendocino watershed. Lake Mendocino is accumulating sediment at a rate that is 49 percent greater than estimates made when the reservoir was designed.

b. River Basin Studies

Major Drainage	Watershed	County	State
San Joaquin River	Oristimba Creek Del Puerto Creek Ingram Creek Hospital Creek Various Agricultural Drains	Stanislaus	CA

This Local Implementation Plan project incorporates an erosion/sedimentation study on all irrigated land west of the San Joaquin River in Stanislaus County. Furrow Erosion from Irrigated land is a source of DDT and its derivatives to the San Joaquin River. A furrow erosion model based on Haywood's sediment transport equation was used.

c.

Major Drainage	Watershed	County	State
Salt River	Salt River	Humboldt	CA

This investigation is part of the Salt River Local Implementation Study. It is a joint effort of USDA-SCS and the California State Coastal Conservancy. The investigation entailed quantifying erosion and sediment yield rates from major sources in the upper watershed, which is located in the Wildcat Hills. This information will be used to help determined the major source(s) of sediment as well as identifying major sedimentation events that have led to aggradation in the Salt River channel.

ALASKA REGION

GEOLOGICAL SURVEY

Yukon Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Yukon River at Pilot Station, AK, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected periodically at the Tanana River at Nenana, AK, as part of NASQAN.

3. Suspended-sediment data and bedload data are being collected on a periodic basis at Lignite Creek above mouth near Healy, AK, as part of a cooperative study with the Alaska Division of Geological and Geophysical Surveys.

4. A cooperative study with the Denali National Park, initiated July 1988 to collect periodic suspended-sediment and bedload data, and to test the use of radio transmitters in tracking coarse bed material on the Toklat River at Toklat, AK, in Denali National Park, was continued through 1990.

Southwest Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Kuskokwim River at Crooked Creek, AK, as part of NASQAN.

South-Central Region

1. A cooperative program with the Municipality of Anchorage, Department of Health and Human Services, initiated in 1988 to collect suspended-sediment data at Little Campbell Creek at Nathan Drive near Anchorage, AK, and Chester Creek at Arctic Boulevard, AK, as part of a long-term sediment monitoring study, was continued in 1990.

2. Suspended-sediment data are being collected on a periodic basis at Talkeetna River near Talkeetna, AK, as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at the Copper River at Million Dollar Bridge near Cordova, AK, as a part of NASQAN.

Southeast Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Stikine River near Wrangell, AK, as part of NASQAN.

For additional information about U.S. Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
4230 University Drive, Suite 201
Anchorage, AK 99508-4664

ALASKA REGION (19)

SOIL CONSERVATION SERVICE

1. Special Studies

A special study of streambank erosion was made of 14 streambank miles along the Kenai River, through Soldotna, Alaska. A draft report dated December, 1990 has been prepared.

HAWAII REGION

GEOLOGICAL SURVEY

Hawaii Subregion

1. Suspended-sediment data are being collected bimonthly at Honolii Stream near Papaikou, Hawaii, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected bimonthly at Wailuku River at Hilo, Hawaii, as a part of National Stream Quality Accounting Network (NASQAN).

Maui Subregion

1. Suspended-sediment data are being collected bimonthly at Kahakuloa Stream near Honokohau, Maui, as a part of NASQAN.

Molokai Subregion

1. Suspended-sediment data are being collected bimonthly at Halawa Stream near Halawa, Molokai, as a part of NASQAN.

Oahu Subregion

1. Suspended-sediment data are being collected at the following sites:

Waikele Stream, Waipahu, Oahu, on a daily basis as part of the Federal CBR program.

Kalihi Stream, at Kalihi, Oahu, quarterly as a part of NASQAN.

Kamooalii Stream near Kaneohe, Oahu, on a daily basis in cooperation with the U.S. Army Corps of Engineers.

2. In cooperation with Hawaii State Department of Transportation, daily suspended-sediment data are being collected at the following stations on Oahu:

North Halawa Stream near Aiea
Right Branch of Kamooalii Stream near Kaneoha
Luluku Stream near Kaneohe
South Fork Kapunahala Stream at Kaneoha
Haiku Stream near Heeia

Kauai Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Waimea River at Waimea, Hawaii, as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
677 Ala Moana Boulevard
Suite 415
Honolulu, HI 96813-5412

CARIBBEAN REGION

GEOLOGICAL SURVEY

Puerto Rico Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at the following sites as a part of the National Stream Quality Accounting Network (NASQAN):

Rio de la Plata at Toa Alta, Puerto Rico
Rio Grande de Manati near Manati, Puerto Rico
Rio Grande de Anasco near San Sebastian, Puerto Rico
Rio Grande de Patillas near Patillas, Puerto Rico

2. Suspended-sediment data are being collected on a weekly basis and during high flows at Rio Tanama near Utuado, Puerto Rico, in cooperation with PREQB. The samples from low and high flow was collected by the observer. Automatic sampler was used for samples at middle and high stages at different intervals of time. The data collected was used for developing sediment transport curves and computing daily sediment records.

3. Suspended-sediment data are being collected on a daily basis and during high flows at the following stations in cooperation with the U.S. Army Corps of Engineers (COE):

Rio Piedras at Rio Piedras, Puerto Rico
Rio Piedras at El Senorial, Puerto Rico
Rio Rosario near Hormigueros, Puerto Rico

The data was collected by observers and technicians at low and high stages. Automatic samplers were used for collected data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

Special Studies

1. Suspended-sediment data are being collected on a weekly basis and during high flows at the following sites in cooperation with PRASA and PRDNR to determine total sediment input from Rio Grande de Loiza Basin to Lago Loiza reservoir:

Rio Grande de Loiza at Caguas, Puerto Rico
Rio Gurabo at Gurabo, Puerto Rico
Rio Canas at Canas, Puerto Rico

The data was collected by observers and technicians at low and high stages. Automatic samplers were used for collected data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

2. Suspended-sediment data are being collected on a weekly basis, biweekly, and during high flows at the following sites in cooperation with PRASA to determine the amount of suspended-sediment entering and leaving several reservoirs which are used for water supplies:

Lago La Plata, Puerto Rico
Rio de La Plata at Comerio, Puerto Rico
Rio Guadiana at Guadiana, Puerto Rico
Rio de La Plata below Lago Cidra, Puerto Rico

Lago Cidra, Puerto Rico
Rio Bayamon below Cidra Dam, Puerto Rico

Lago Toa Vaca, Puerto Rico
Rio Toa Vaca above Lago Toa Vaca, Puerto Rico

Lago Loiza, Puerto Rico
Rio Grande de Loiza below Damsite, Puerto Rico

The data was collected by observer and technicians at low and high stages. Automatic samplers were used for collected data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

3. Suspended-sediment data are being collected on a weekly basis and during high flows at the following sites in cooperation with PRASA to determine the load suspended-sediment at different sties with different land uses:

Quebrada Blanca at Jagual, Puerto Rico
Quebrada Salvatierra near San Lorenzo, Puerto Rico
Rio Grande de Loiza at Highway 183 near San Lorenzo, Puerto Rico
Rio Gurabo below El Mango, Puerto Rico
Rio Valenciano near Juncos, Puerto Rico

The data was collected by observers and technicians at low and high stages. Automatic samplers were used for collected data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

4. Reservoir sedimentation surveys were done at the following reservoirs in cooperation with PRASA and PREPA, for determining the actual capacity of the reservoirs:

Lago Loiza, Puerto Rico
Lago Vivi, Puerto Rico
Lago Yahuecas, Puerto Rico

For additional information about U.S. Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
G.P.O. Box 4424
San Juan, Puerto Rico 00936

ARIZONA

Research activities at the Aridland Watershed Management Research Unit in Tucson, Arizona include the following:

1. Eight small watersheds in southeastern Arizona on the Santa Rita Experimental Range were instrumented in 1975 and 1976 to quantify the impact of mesquite control on runoff and sediment yield. Four pairs of contiguous watersheds, one treated and one for control, under four grazing practices were equipped with raingages, precalibrated supercritical runoff measuring devices and automatic sediment sampling equipment as a part of the experiments. Brush control was accomplished by girdling individual mesquite plants with diesel fuel in one of each pair of watersheds. Vegetation, runoff, and sediment yield changes were measured and analyzed as a result of the experiments on one pair of the watersheds. A procedure to synthesize the sedigraphs and annual yield was developed for watersheds 1 (control) and 2 treated.

2. A sagebrush/juniper community was burned at different fire intensities to determine runoff and sediment yields. Runoff was similar between unburned and low intensity burns but almost four times greater from high intensity burns. Low intensity burns produced twice the sediment of the unburned. High intensity burning produced five times the sediment of the unburned.

3. The Universal Soil Loss Equation (USLE) has been revised to more accurately estimate soil loss from both crop and rangeland areas. Major revisions affecting rangeland soil loss estimates include new 'R' factors for the western United States, a subfactor approach to determine the 'C' factor and a 'LS' table for rangeland. Measured soil losses from erosion simulation plot studies on rangelands throughout the western U.S. were compared to soil losses estimated by the Revised Universal Soil Loss Equation (RUSLE). Correlations between measured and predicted soil loss varied among the 17 sites tested. The RUSLE factor values have been examined and related to special conditions found on rangelands.

4. A history of the Walnut Gulch Experimental Watershed describes how it was selected, what led to its success, and gives examples of accomplishments. The hydrologic study was conducted using a parallel effort of field, laboratory and analytical experiments which contributed to the success of the research. The findings have been numerous, involving data base development, instrumentation, quantifications of infiltration losses and water quality quantification on rangelands. The results of this work will assist administrators of research programs in determining what the ingredients for a successful watershed demonstration project are.

5. A subfactor based regression technique for estimating hydraulic roughness coefficients for shallow overland flow has been developed from runoff plot data originally collected from erosion studies. The data were collected from 14 different native rangeland areas in the western United States by applying a constant rainfall intensity of 65 mm/hr from a rainfall simulator. The derived roughness equations predict an "effective roughness, rocks, litter, and canopy and basal plant cover; and the erosion and transport of sediment. A reference table of "effective roughness" coefficients

for shallow overland flow is presented with a description of plant biomass. Surfaces evaluated ranged from smooth bare soil to rough bare soil and sparsely to densely vegetated rangeland areas.

6. The Water Erosion Prediction Project (WEPP) is a new water erosion prediction technology being developed by the USDA-Agricultural Research Service to replace the Universal Soil Loss Equation. Rangeland field experiments were designed to parameterize the WEPP rangeland erosion model. Included in the field experiments were plot treatments designed to separate direct from indirect effects of vegetation canopy on runoff and soil erosion. Nine rangeland sites from a wide range of soil and vegetation types were evaluated using rainfall simulation techniques. Natural versus clipped treatment surface characteristics and runoff and erosion responses were compared using regression analyses. These analyses showed that there were no significant differences between natural and clipped plot surface characteristics, runoff ratios, final infiltration rates, or initial rainfall abstractions. Erosion rates were different between treatments with the clipped plots having slightly less erosion than the natural plots. Results indicated that, under the rainfall conditions simulated, canopy cover was not directly contributing to initial abstractions through rainfall interception loss or significantly affecting runoff or erosion.

Continuous simulation erosion models, like those in WEPP, require that key plant growth and litter variables be predicted on a daily basis. Plant growth and decomposition subroutines were developed and used for the application of the WEPP hillslope profile model on rangelands. The plant growth subroutines of WEPP have been validated for two plant communities by comparing simulated values of total standing biomass, live standing biomass, dead standing biomass, and leaf area index to experimentally measured values. Initial validation results indicate that the basic governing equations and approaches used in the model are effective for modeling the influence of plants on soil erosion for rangelands. Correlation coefficients between simulated and measured values for both locations were greater than 0.85 for all variables evaluated.

An evaluation of the effects of formulating the unsteady state sediment continuity equation by assuming quasi-steady state conditions is presented. A methodology was developed to study soil erosion process in rainfall simulator plots treated as a microwatershed. This was achieved by explicitly separating interrill and rill areas in the rainfall simulator plots using areal photographs and microtopographic data. A detailed analysis on the model structure was conducted using response surface plots. The shape of the response surface plots were used as a tool to determine whether the structure of the soil erosion model was such that its parameters were successfully identified. As an additional information, the sediment concentration graphs and the total sediment yield were used to determine major differences between the two formulations of the sediment continuity equation.

The unsteady state approach yielded lower values of the objective function than the quasi-steady state formulation. Using the unsteady state approach, physical interpretation may be associated with the soil erosion parameter values Kr, τcr, and Ve. The quasi-steady state soil erosion estimates showed a weak and unclear physical association. The shape of the sediment concentration graphs were similar for both formulations of the sediment continuity equation. The benefit obtained by using the more complicated unsteady state approach was a more accurate estimation of the peak, or sediment concentration. Total sediment yield estimates from both formulations were similar. Thus, insignificant benefit was obtained from using the unsteady state approach. In this study hydrographs reached equilibrium due to the long duration of simulated rainfall. The two model formulations might perform far differently under experimental

7. The WEPP watershed model is a distributed continuous simulation model developed to compute the spatial and temporal distribution of erosion and deposition within small agricultural watersheds. Hillslope infiltration is calculated by the Green and Ampt equation, peak runoff rate by a method based on the kinematic wave equation, interrill erosion as a function of soil detachment by raindrop impact, and rill erosion as a function of the flow's ability to detach sediment, sediment transport capacity, and the existing sediment load in the flow. Channel infiltration is calculated by the Green and Ampt equation and watershed peak discharge rate by a method based on the kinematic wave equation. Channel flow depth and hydraulic shear stress are computed based on the steady state spatially varied flow equation. Detachment, transport, and deposition within channels are calculated by a steady state solution to the sediment continuity equation. The impoundment component computes deposition within terrace impoundments and stock tanks, and sediment delivery through spillways. The major features of the model are the ability to 1) delineate areas of detachment and deposition on a hillslope or along a channel reach, 2) account for the effects of management and land use on the erosion process, and 3) account for the effects of backwater on detachment, transport, and deposition processes within channels.

For additional information contact Leonard J. Lane, Research Leader, USDA-ARS, Aridland Watershed Management Research Unit, Pacific West Area, 2000 E. Allen Rd., Tucson, AZ 85719.

GEORGIA

Research activities at the Southeast Watershed Research Laboratory in Athens and Tifton, Georgia include the following:

1. Eroded materials from cropped upland areas are deposited in low-lying floodplains along Coastal Plain drainage networks, forming rather extensive stream-channel alluvial aquifer systems. Projections of future rates of alluvial deposition for several conservation practice scenarios indicate that a gradual, but eventually significant area and volumetric expansion of stream-channel aquifer systems will occur. Continued high rates of erosion on cropped uplands will impact floodplain riparian zones, gradually altering not only the present hydrologic response characteristics, but potentially the dynamics of the current environmental role of these seasonal wetlands as well. Changes in hydrologic response characteristics would be most pronounced for the low to no-flow summer and fall months, when available storage within the alluvial aquifer system is typically at or near the annual maximum.

2. Calculation of rainfall EI (Erosion Index) for use in soil erosion modeling was examined for fixed time-depth recording device data. Results indicate that unique combinations of rainfall time and depth resolutions allow accurate EI determinations from non-breakpoint rainfall records. Criteria for selection of optimum time and depth resolution combinations for fixed time-depth recording devices were developed. Rain gages with rainfall depth resolution of 2.5mm and a 5-minute time resolution should provide near optimum estimates of storm EI.

3. Probability distributions of soil loss as expressions of erosion risk were computed for different crops and tillage practices for different seasons on three Southern Piedmont field watersheds. The following conclusions from this work provide implications for erosion control: (a) With conventional tillage, soil erosion risk is greater for the summer crop season than for the winter crop season. (b) Conservation tillage following conventional tillage cropping has an immediate effect in reducing soil erosion risk for both summer and winter crop seasons; however, the effect is greater for the summer crop season than for the winter crop season. (c) Continued conservation tillage cropping has an effect in further reducing soil erosion risk for both summer and winter crop seasons; the effect is greater for the summer crop season than for the winter crop season. (d) Conservation tillage cropping prior to conventional tillage cropping has a residual effect in reducing soil erosion risk for both summer and winter crop seasons; the residual effect is greater for the summer crop season than for the winter crop season.

For additional information contact Adrian W. Thomas, Director, USDA-ARS, Southeast Watershed Research Laboratory, South Atlantic Area, P. O. Box 946, Tifton, GA 31793.

GEORGIA

AGRICULTURAL RESEARCH SERVICE

Research activities at the Southern Piedmont Conservation Research Center in Watkinsville, Georgia include the following:

Sampling of selected runoff events from four small watersheds was continued in 1990. Two high intensity storms crossed the watersheds on March 16 and July 20. These storms had a frequency of return of between 2 and 10 years, over 100 mm of rain, and an EI of about 1,000 MJ.mm/ha.h. There was less than 0.05 Mg/ha of sediment loss because of the high residue conservation tillage systems that have been in place for several years.

For additional information, contact George W. Langdale, USDA-ARS, Southern Piedmont Conservation Research Center, P. O. Box 555, Watkinsville, GA 30677.

INDIANA

AGRICULTURAL RESEARCH SERVICE

The National Soil Erosion Research Laboratory in West Lafayette, Indiana has considerable research related to:

1. Fundamental processes related to the detachment and transport of soils by raindrops and flowing water. Activities are related to the micro-topography of soil surfaces, surface chemistry, erodibility of soils, and the fate of crop residues and their decomposition effects on erodibility. Additionally, work is underway related to the effect of buried residue on rill erosion processes.

2. Erosion prediction technology development. Work is underway related to the Revised Universal Soil Loss Equation, with primary responsibility for the cropping management factor, and programming. Work is also underway in developing WEPP, the Water Erosion Prediction Project for replacement of the Universal Soil Loss Equation. WEPP is a fundamental process model that uses our best understanding of hydrology, crop growth, climate, residue, and erosion in a daily simulation model to estimate erosion from the nations lands. WEPP includes three versions, hillslope (the direct replacement of the USLE), watershed, and grid versions. WEPP will be ready for public use in late 1992. WEPP related activities include the programming, testing and the development and evaluation of various components of WEPP. Additionally, work is under way to validate WEPP.

For additional information contact John M. Laflen, Laboratory Director, National Soil Erosion Research Laboratory, Bldg SOIL, Purdue, W. Lafayette, IN 47907

MARYLAND

ARS

Research activities at the Hydrology Laboratory, Natural Resource Institute in Beltsville, Maryland include the following:

1. Studies were made at 2 rangeland areas in South Texas to measure canopy cover and distribution using an airborne laser profiler. At the Yturria area, laser measurements of canopy cover ranged from 3 to 89% for vegetation greater than 0.5-m tall for eighteen 30.5-m segments and was correlated significantly (r^2=0.89) with ground measurements (2 to 88%) on the same eighteen 30.5-m segments. At the La Joya area, canopy cover from laser measurements ranged from 17 and 42% for vegetation greater that 0.5-m tall for 940-m segments, while canopy cover for 21 ground measurements along the 6,580-m flightline ranged from 19 to 43%. Laser measurements also provided data on topography, vegetation height and spatial distribution of canopy cover for 6- to 7-km flightlines. This study shows that airborne laser measurements of land surface features can provide quick and accurate measurements of canopy cover and distribution for large areas of rangeland. More accurate and timely data on the amount and distribution of plant cover will be valuable for making decisions for controlling erosion.

2. Digital data were extracted from sixteen Landsat Multispectral Scanner (MSS) scenes collected between March 1987 and August 1988 over Enid Reservoir in North Central Mississippi. These data were converted to radiance and reflectance data for comparison with field measurements of surface suspended sediment concentrations which ranged from 2 to 168 mg/l during the study with only four greater than 100 mg/l. Linear and polynomial regression analyses were used to relate the surface suspended sediment concentrations with radiance, and reflectance. Reflectance in MSS band 2 (0.6 to 0.7 μm) and MSS band 3 (0.7 to 0.8 μm) were best related to the surface suspended sediment concentrations with coefficients of determination accounting for 71 and 68% of the variation in the data, respectively. Regressions with radiance data accounted for 36% (band 2) or less of the variation. Logarithmic transformations of either reflectance or sediment concentrations increase the coefficients of determination for MSS band 2 reflectance data to 80%. Regressions between the ratio of MSS band 1 to MSS band 2 reflectances and concentrations also accounted for 80% of the variation. An equation
$$\text{Log SS (mg/l)} = -9.21R_{\frac{1}{2}} + 2.71R_{\frac{1}{2}}^{2} + 8.45,$$
where SS is surface suspended sediment concentrations and $R_{\frac{1}{2}}$ is the ratio of MSS band 1 to MSS band 2 reflectances, provided the best fit to the data with a coefficient of determination of 0.82. This equation for Enid Reservoir suggest that it may be possible to develop an algorithm for widespread use for estimating surface suspended sediments.

For additional information contact A. Rango, Research Leader, USDA-ARS Hydrology Laboratory, Building 265, BARC-W, Beltsville, Maryland 20705

MINNESOTA

AGRICULTURAL RESEARCH SERVICE

Research activities at the North Central Soil Conservation Research Laboratory in Morris, MN, include the following:

1. Data collection was completed for evaluating changes in erodibility of a Hattie clay during various stages of soil thawing and at complete thaw. Simulated rainfall was applied on fall plow and fall chisel plots with and without residue. Results were compared with previous years' results. Lab work is continuing to determine freeze-thaw effects at "field capacity" water contents on soil physical properties. Additional work is underway to determine the effect of cyclic freezing and thawing in conjunction with freeze drying on the aggregate stability of surface soil and to relate these effects to wind erosion during winter and early spring. Data collection of surface soil properties as affected by tillage and cropping continues at the Crookston and Morris locations for the SOILS Submodel of WERM. A wind erosion validation site was continued at Crookston. Only slight soil movement by wind was observed during 1990. Soil movement data by moldboard plowing was analyzed and a model was developed to show long-term soil movement as affected by slope gradient. Soil losses of up to 20 T/a/yr on ridge tops were shown to be completely attributable to moldboard plowing.

2. Development of additional algorithms and software for the continuous simulation version of the AGNPS model is continuing. A set of winter routines to model the effects of frost and snowmelt has been developed and is being incorporated into the annualized version of the model. Procedures for calculating C factors for the continuous simulation routine are nearly complete. A watershed in West Central Minnesota continues to be monitored to collect data for validating the annualized version of the model. Airborne gamma radiation soil moisture and snow survey techniques are being used in cooperation with the National Remote Sensing Hydrology Program of the National Weather Service, NOAA, to obtain background soil moisture and/or snow moisture data on the watershed. In addition, snow depths and frost depths were read weekly during the winter and twice weekly during the snowmelt period along four 300 foot long snow courses. Daily weather data was monitored and collected with a portable weather station. Approximately 1100 runoff samples were collected during the year from runoff events. A color weather radar unit was used to monitor speed and severity of storms occurring over the watershed. A network of 65 rain gauges was established over the watershed to obtain data which will be correlated with the radar information to determine storm patterns over the watershed. Validation of the model is also underway using a complete data set from a watershed in Idaho.

For additional information contact Mr. W. B. Voorhees, Research Leader, USDA-ARS, North Central Soil Conservation Research Lab., Morris, MN 56267.

MISSISSIPPI

AGRICULTURAL RESEARCH SERVICE

Research activities at the USDA National Sedimentation Laboratory in Oxford, Mississippi include the following:

1. The watershed database development program is progressing on schedule. The transfer of Pigeon Roost and Goodwin Creek Watershed data from magnetic tape to magneto-optical disk cartridges is essentially completed.

   The data types included are precipitation, runoff, sediment yield, flow duration and land use. Access to the data is considerably eased in that anyone possessing a CD-ROM reader will be in a position to access the entirety of the database. All that is required of user agencies or individuals to use the database on CD-ROM is an IBM-Compatible personal computer equipped with a CD-ROM reader that can read disks formatted according to the ISO 9660 standard.

2. The significance of stream bank and gully erosion as a source of sediment has been documented for Goodwin Creek Experimental Watershed. About 75% of the fines load and 85% of the total load are estimated to have originated from channel and gully erosion. Two primary sources of channel and gully erosion were identified, one in the trunk channel downstream of Gaging Station 2, and the second in the headwater areas. Although the occurrence of this type of valley trenching in headwater areas has been qualitatively described, it has not been quantified sufficiently for comparison with present results. Results are comparable with findings for other trunk channels in northern Mississippi. Annual channel erosion rates of about 3,900 tons per channel mile were reported for a 6-year period from 1971 to 1976 for gaging sites at the lower end of Pigeon Roost Creek. The 5-year annual average for the Goodwin Creek channel between Gaging Sites 1 and 2 was about 5,200 tons per mile, 33% greater than from the lower end of Pigeon Roost Creek. Due to the larger sediment yield from upland sources in the Pigeon Roost Creek Watershed, the percentage of total sediment yield attributable to bank erosion was 32% in contrast to the estimated 85% of Goodwin Creek. Annual channel erosion for an 18-year period from 1958 to 1976 for Hotophia Creek, however, averaged about 11,300 tons per mile, (about 2.2 times greater than that for Goodwin and 2.9 times that for Pigeon Roost Creek). This relatively high rate for Hotophia was associated with progressive entrenchment of the system. In contrast, the trunk channels for Pigeon Roost and Goodwin Creeks had previously entrenched and their erosion rates reflected channel widening at relatively constant channel depth.

3. Field evaluation of studies on the use of vegetative and structural materials for stabilizing eroding streambanks was completed through the 1990 growing season. A report giving results of the research is scheduled to be completed for publication by December 1991.

4. Selective removal of woody vegetation and large woody debris from a sand-bed river channel produced only a modest increase in channel conveyance. However, debris removed caused sharp decreases in channel hydraulic roughness and aquatic habitat heterogeneity at base flow. A 74 percent reduction in woody debris density produced only a 32 percent reduction in

Darcy-Weisbach friction factor at mid- to near bank full stages, but a 62 percent reduction in debris produced a 73 percent reduction in Darcy's f at base flow. Physical habitat diversity at base flow was reduced 30 to 50 percent, flow heterogeneity as measured by travel time variance was reduced by 65 percent, and the area with velocity less than 1 fps (0.3 mps) was reduced by about 50 percent.

5. Frequency functions for the transport of sands were used to calculate the annual sand loads for Goodwin Creek, Mississippi. The annual loads differ by a factor of nine (9) and reflect the dominant contribution by extreme flow events. Temporal variability of the concentration of sand in transport gives standard deviations on the order of the mean concentration for all stage ranges in Goodwin Creek. Short-period variations are apparently related to the migration of bed forms; whereas long-period variations are evident and probably reflect the migration of long sediment bars and/or residual effects of past flow events. A deviation factor from the average sediment ratings is being used to quantify the stochastic characteristics of sand transport rates.

6. A model for the transport of bed material is applicable over the entire depth of flow - including the previously elusive near-bed zone. Incorporation of this model into a process-based method for computing the bed material load is being accomplished. The concentration of bed material in transport at the bed of a stream is one of the parameters of the model. For significant transport rates, the bed concentration is the bed concentration of the deposited bed material. However, for low transport rates, an incomplete bed layer is in motion and the bed concentration will approach zero at and below flow conditions giving incipient motion of the bed material. A means is being sought to define this bed concentration for low transport rates.

7. Flume experiments were performed on fine sediment suspensions ranging from zero up to capacity suspension at a Reynolds number of 130,000. This is comparable to the Reynolds number of a small upland stream. Fine sediment was studied because it comprises the wash load of upland streams and because its clay and silt particles (as well as somewhat larger aggregate soil particles) carry sorbed agricultural chemicals and play an important part in surface water quality. Experiments indicated that, at the moderate Reynolds numbers maintained fine sediment has no effect on the time-mean streamflow velocity profile or on the streamflow turbulence intensity. This means that mixing calculations and coarse sediment transport calculations for small streams need not include any adjustment for fine sediment washload at moderate capacity concentrations.

8. The size distribution of the bed load was found to be finer than the bed subsurface size distribution at low flows and to approach the size of the bed subsurface at higher flows on Goodwin Creek. A two part transport relation which calculates the sand and gravel fractions separately was found to have potential as an improved way of calculating the transport of bed load in streams in which the bed material has a bimodal size distribution.

9. The rate of transport of bed load was found to be greater for most flows on the rising limb than on the falling limb of the hydrograph for two tributaries of Goodwin Creek. On one of the streams the opposite trend was found for low flows. The cause of these differences in rates of bed load transport is not known, but may be related to lags in the formation and destruction of bed forms in the channels.

10. Two streams in the uplands of the Yazoo Basin in Mississippi were sampled weekly for two years to determine water quality before construction of land and channel erosion control measures. In spite of differences in land use, temperature and suspended solids were not significantly different in the two streams. There were significant differences for pH, dissolved oxygen, dissolved solids, conductivity, phosphorus and nitrogen between creeks and between sites within each creek. One urban site was significantly higher than all other sites in nutrients, and resulting stimulation of phytophankton attracted large numbers of fish. Coliform contamination from wildlife and cattle exceeded clean water standards. Storm flows flushed low concentrations of residual pesticides, arsenic, and mercury from agricultural lands. Suspended sediment from storm related runoff produced maximum concentrations of less than 6000 mg/L. Except for coliforms and brief runoff-associated declines, water quality was considered good in the two streams.

11. Bank protection measures that limit channel or shore-line habitat adversely affect fish populations. However, those measures that promote the creation of scour holes provide refuge in a habitat-limited environment and thus benefit fish. As a part of the Demonstration Erosion Control (DEC) Project in the Yazoo Basin, stream bank protection techniques were evaluated for their habitat impact on fishes. Old lateral dike sections, new lateral dike sections, transverse dike sections and natural bank reaches were examined. Catch per unit of effort was higher along transverse dikes than along either type of lateral dike but was not different from the natural bank controls. Total catch in both numbers and weight was greater around the transverse dikes. Poorest catches were associated with old lateral dikes. Scour holes associated with transverse dikes provide additional areas capable of supporting both larger fish and greater numbers of fish. If not for these scour holes, larger fish would have to seek deeper water downstream, particularly during periods of low flow. Since costs for transverse dikes and lateral dikes are the same, transverse dikes provide an environmentally-sound, economical way to protect and stabilize stream banks.

12. Diversion of storm flows from a lake can significantly improve water quality. Patterns of suspended sediments, biological productivity, and water quality were measured routinely over a fourteen year period in Lake Chicot, Arkansas (1) to determine the effects of runoff from intensive agriculture and (2) to measure recovery after diversion of storm flows. Following massive flooding and watershed enlargement in 1927, a dike which isolated the northern third of the lake basin was constructed above Connerly Bayou, the major inflowing stream. Catchment area of the larger south basin was channelized and converted from hardwoods to rowcrop agriculture while catchment for the north basin was also farmed. Water quality steadily declined in the south basin until algal density was limited seasonally by turbidity. In comparison, algal density in the

isolated north basin was significantly higher because of lower turbidity levels. In 1985, an active/passive bypass was completed on Connerly Bayou, allowing diversion of storm flows with large concentrations of suspended sediments into the Mississippi River. The operational plan for storm diversion also stabilized the lake level and allowed for greater shoreline development. Without excessive suspended sediment loading, water quality in the south basin rapidly improved and chlorophyll *a* concentrations increased. Significant differences in productivity between the two basins disappeared as physical/chemical water quality parameters became more closely aligned.

13. Ecosystem contamination by pesticides continues to present water quality problems. All major components (soil, deposited sediments, water and fish) of a small agricultural watershed were contaminated by pesticides or metals even though cultivation was limited to the valley floor. Residual pesticides were major contaminants almost two decades following their banning. Current-use pesticides also accumulated in fish but at significantly lower concentrations than residual pesticides.

14. Construction of grade control structures in stream channels damaged by channelization and channel incision can improve fish habitats. Comparison of fish populations and habitats in streams with and without grade control structures revealed that the structures fostered habitat recovery by creating relatively deep pools, allowing woody vegetation to invade stabilized banks, and fostering development of a deeper, narrower base flow channel. Fish species richness and diversity were 77 and 29 percent higher, respectively, for the stream with grade control structures. Physical habitat diversity indices for reaches adjacent to grade control structures were 58 percent higher than elsewhere.

15. Preliminary studies showed that pesticides decreased rapidly in both surface and ground water in conservation tillage plots. Metribuzin (0.42 kg/ha) and metolachor (2.24 kg/ha) were applied in early May 1990 for preemerge weed control to a 2.13-ha no-till soybean watershed on the Nelson Farm in Tate County, Mississippi. Concentrations of metribuzin and metolachlor in the water phase of runoff 6 days after application were 110 and 535 ug/L (ppb), respectively. By 85 days after application (last runoff event), these values had decreased to 0.3 and 1.2 ug/L. No metribuzin and metolachlor residues were found in the sediment phase of runoff. Total seasonal losses of metribuzin and metolachor in runoff were 0.017 and 0.085 kg/ha, respectively, or about 4% each of that applied. Mean concentrations of metribuzin and metolachlor in shallow (0.15 to 1.52 m) ground water 6 days after application were 23 and 67 ug/L, respectively; and were 1 and 3 ug/L 27 days after application (last ground water-producing rainfall).

16. Under no-till soybeans nitrates appear to move readily in shallow ground water (less than or equal to 5 feet) of loessial soils in north Mississippi. Ground water nitrate-nitrogen concentrations for some storms exceeded the U. S. Drinking Water Standard by as much as a factor of 2.7, although no N fertilizers were applied. The annual mean phosphate-phosphorus, ammonium nitrogen and nitrate-nitrogen concentrations for shallow ground water sites were 0.05, 0.08, and 11.56 mg/1, respectively.

In surface runoff, the annual mean phosphate-phosphorus, ammonium nitrogen and nitrate-nitrogen concentrations were 0.63, 0.25, and 0.40 mg/l, respectively. This 1-yr study suggests that no-till soybeans are nondetrimental to surface water quality.

17. Plot data continue to show that conservation tillage practices reduce soil erosion. The 1987-90 average annual soil loss from no-till grain sorghum on 5% slopes was 0.2 and 1.8 t/acre for 0.02-acre plots with no-till cropping history and conventional-till cropping history, respectively; average annual runoff was 6 and 16 inches, respectively. The 4-year average annual rainfall was 52 inches. Average annual soil loss for reduced-till and conventional-till grain sorghum during the same period was 2.7 and 4.4 t/acre, respectively; average annual runoff was 10 and 12 inches, respectively. The 1985-90 average annual soil loss and runoff from ridge-till grain sorghum on 5% sloping 0.02-acre plots was 2.8 t/acre and 12 inches, respectively. Runoff and soil loss data from 0.01-acre corn plots are being collected for the second year to determine the effects of corn residue placement on rill development and soil erosion.

18. Twelve paired, 150-feet long plots (no-till and conventional-till soybeans) are being used to study the long-term effects of no-till on soil loss and crop productivity. The 7-year (1984-1990) average crop yields averaged 27 and 24 bushels per acre from no-till and conventional-till soybeans, respectively. No-till soybean crop yields exceeded those from conventional-till by an average of seven bushels per acre per year during the last four years. In 1986, 1987, and 1990, the lower one-third of one of the paired plots (a different pair each year) received two diskings and harrowing immediately preceding rainfall simulator runs. Even though tillage immediately preceding tests were identical, runoff in 1986, 1987, and 1990 from plots with a no-till history was 10, 6, and 22% less, respectively, than those with a conventional-till history; soil loss was 36, 18, and 77 less, respectively.

19. First-year results from standard erosion plots at the Nelson Farm showed a reduction in soil loss of 85% and 73% from no-till soybean and ridge-till soybean as compared with conventional-tilled soybean, with no difference in soybean yield. Storm runoff from no-till grain sorghum plots with vetch winter and spring cover was 5 inches less than runoff from adjacent no-till grain sorghum having volunteer winter cover, and soil loss was less than half.

20. Sediment yield was measured from three adjacent Nelson Farm watersheds during CY 1990: two were cropped to no-till soybean and the third was managed as a conventional-tilled soybean. The results showed a major effect of no-till on reducing sediment yield and a slight effect on volume of runoff. During this year when little of the rainfall occurred during the more erodible periods, the two no-till watersheds averaged less than 1 T/A as compared to 4+ T/A for the conventional-tilled watershed.

21. Laboratory experiments were conducted in a laboratory flume to study the transportation of sediment by shallow surface runoff using glass beads of various size groups. Both uniform-sized beads and a mixture of sizes were studied. The uniform-size study provided basic equations for the transportation of each size group of sediment, whereas the mixture study

investigated the mechanisms involved in the transport of mixed-size sediment and the way that surface runoff adjusts its capability to transport nonuniform sediment. Experiments have been completed and data are currently being analyzed. This study will provide a new understanding of shallow water sediment transport and better transport equations for use in the prediction of sediment transport by overland flow.

22. Vetiver grass (Vetiveria zizanoides) for control of soil erosion from runoff is being studied in the field and laboratory. Vetiver grass planted in 1989 did not survive the 1989-90 winter. The winter of 1990-91 was much milder, but only a small amount of vetiver regrowth was evident in north Mississippi by May 1991. In a related study, vetiver grass was established with either conventional or no-tillage prior to transplanting.

    The results indicated that vetiver growth was enhanced with no-till planting and that herbicide application increased growth by reducing weed competition. Future studies will include field observations of the hedge-forming and water-retarding characteristics of several other cold-hardy grasses including: switchgrass (Panicum virgatum), enlalia or silvergrass (Miscanthus sinensis), and weeping lovegrass (Eragrostis curvulva). A controlled flume study of the water flow resistance of some of these stiff-grass species has just begun.

23. Field studies of experimental 3.0- and 6.1-m wide Serecia lespedeza, Bahiagrass, and Bermudagrass filter strips showed that up to 60% of the incoming sediment could be trapped. Trapping effectiveness varied with plant (stalk) density and ground litter for shallow flow conditions, but the type of grass had negligible effect for grasses with similar densities.

24. Research has demonstrated the feasibility of acoustical techniques for monitoring surface air porosity (total porosity minus volumetric water content), air permeability, pore structure, and the variation of these properties with depth. Test plots prepared using masonry sand, Grenada silt loam (fine-silty, mixed, thermic, Glossic Fragiudalf) or Catalpa silty clay (fine, montmorillonitic, thermic Fluvaquentic Hapludoll), were tested. Variation in water content and compaction of each soil material were considered. Both acoustic reflection and transmission measurements were made in the audio-frequency range. The soils were modeled as air-filled, rigid-framed porous media. The acoustic-reflection measurements involved analysis of propagation data from a small loudspeaker and two vertically separated microphones. The acoustic-transmission measurement utilized a specially designed probe microphone. Analysis of the acoustic-reflection data yielded qualitative indications of the relative air permeability of the soils. The transmission measurement yielded information about the changes in air permeability with depth. Quantitative information on surface porosity, air permeability, tortuosity, and layering was obtained by fitting theoretical predictions based on the soil model to the measured sound reflection and transmission data. The acoustically determined air porosity for these soils was within 10% of the values determined by gravimetric techniques.

For additional information contact C. K. Mutchler, Laboratory Director, USDA-ARS, National Sedimentation Laboratory, P. O. Box 1157, Oxford, MS 38655.

NEBRASKA

AGRICULTURAL RESEARCH SERVICE

Research activities of the Soil and Water Conservation Research Unit at the University of Nebraska - Lincoln, Nebraska, include the following:

1. Rill density and rill flow rates were determined during rainfall simulation tests conducted at 11 sites located throughout the eastern United States. A mean rill density of 1.0 rills/m was found for the study locations. From measurements of the relative distribution of flow rates, a procedure was identified for partitioning flow between individuals rills. Regression equations were developed for relating rill width and hydraulic roughness coefficients to flow rate. Equations were also derived for predicting mean flow velocity from visually determined measurements of advance velocity. Information reported in this study can be used to estimate hydraulic characteristics of rills.

2. Information concerning hydraulic parameters on upland areas could be expanded through the use of tracing techniques. If bromide is used as a tracer, adsorption of bromide onto sediment may be of concern. Therefore, a laboratory study was conducted to identify the effects of sediment content and initial bromide concentration on adsorption of bromide for selected soils. When bromide solutions were used within the appropriate instrument measurement range, neither soil texture, liming, nor sediment content were found to significantly affect adsorption of bromide. In contrast to systems using fluorescent dyes, correction factors for estimating adsorption of bromide are unnecessary. Since it is not readily absorbed onto sediment, bromide appears to be very well-suited for use as a tracer in dilution studies.

3. Analysis of surface runoff on upland areas requires identification of roughness coefficients. A laboratory study was conducted to measure Darcy-Weisbach and Manning roughness coefficients for corn, cotton, peanut, pine needles, sorghum, soybeans, sunflower and wheat residue. Varying rates of flow were introduced into a flume in which selected amounts of residue had been securely attached. Roughness coefficients were calculated from measurements of discharge rate and flow velocity. The laboratory data were used to derive regression equations for relating roughness coefficients to Reynolds number and either percent residue cover or residue rate. Separate equations were developed for Reynolds number values from 500 to 20,000, and from 20,000 to 110,000. Generalized equations were presented for estimating roughness coefficients for other residue materials not used in this investigation. Accurate prediction of roughness coefficients for residue materials will improve our ability to understand and properly model upland flow hydraulics.

For additional information contact James F. Power, Research Leader, USDA-ARS, University of Nebraska, Room 122 Keim Hall, Lincoln, NE 68583-0915.

OKLAHOMA

AGRICULTURAL RESEARCH SERVICE

Research activities at the National Agricultural Water Quality Laboratory in Durant, Oklahoma include the following:

1. ^{137}Cs, a nuclear fallout product, has been used to quantify soil erosion but few studies have measured both ^{137}Cs loss and soil loss because of time and expense involved. The purpose of our study was to measure ^{137}Cs loss from field plots where long term soil loss records were available so the relationship between long term ^{137}Cs loss and soil loss could be examined for low erosion rates. Six field plots at the Midwest Claypan Experiment Station in central Missouri were sampled to determine ^{137}Cs loss from 1954 to 1987. A linear relationship with a correlation coefficient of 0.97 was found between ^{137}Cs loss and soil loss from the plots. The average relationship was 2.7 Mg/ha soil loss to 1% ^{137}Cs loss. These results indicate considerable enrichment of ^{137}Cs in eroded material. Comparisons with other published data indicated that a single relationship between ^{137}Cs and soil loss may not be generally applicable.

2. Due to easier identification and control of point sources, nonpoint inputs of nitrogen (N) and phosphorus (P) from agricultural runoff, now account for a larger share of all surface water inputs than a decade ago. Accurate simulations of sediment-associated (particulate) N (PN) and P (PP) loss are needed for more efficient evaluation of relative management effects on the eutrophic response of a water body, in agricultural areas characterized by high erosion rates. A regression equation relating soil loss and nutrient enrichment (ER) in runoff, was developed from simulated rainfall studies and used to predict PN and PP transport in runoff. Inaccurate predictions were attributed to use of simulated rainfall and disturbed soil, however, limited field information is available. Thus, ER of PN and PP in runoff from 28 Southern Plains watersheds, were calculated for periods of up to 12 years. The consistently greater ER of PN (3.80) than PP (2.60) observed, was attributed to the fact that the former is mainly of lighter organic origin compared to the inorganic origin of PP forms. Slope and intercept values of the logarithmic soil loss-ER relationship, were greater for reduced compared to conventional tillage practices at each watershed location. Making these values a function of surface area and density of eroded material and particle size ER, rather than total soil loss, may improve PN and PP predictions.

3. Patterns of suspended sediments, biological productivity, and water quality were monitored routinely over a fourteen year period in Lake Chicot, Arkansas (1) to determine the effects of runoff from intensive agriculture and (2) to measure recovery after diversion of storm flows. Lake Chicot is one of the largest oxbow lakes (19.3 km^2) of the Mississippi River. Following extensive flooding and watershed enlargement in 1927, a dam which isolated the northern third of the lake basin was constructed across the lake above Connerly Bayou, the major point of inflow. The catchment area of the larger south basin was channelized and converted from hardwoods to rowcrop agriculture while catchment for the isolated north basin was cleared but not enlarged. Chlorophyll a concentrations showed that algal production density in the south basin was limited seasonally by suspended sediments. In comparison, algal density in the isolated north basin was significantly higher as a result of lower turbidity levels. In 1985, a pumping plant was completed on Connerly Bayou which allowed diversion of storm flows with large concentrations of suspended sediments into the Mississippi River. Without suspended sediment loading, water quality in the south basin rapidly improved and chlorophyll a concentrations increased. Significant differences in productivity between the two basins could not be detected as physical/chemical water quality parameters became more closely aligned.

4. The scale dependence of the relation between suspended sediment and phosphorus (P) is investigated for the Washita Basin, Oklahoma. Sediment, particulate P (PP), and soluble P (SP) were measured in watersheds ranging in size from 0.6 to 1,865,000 ha. A continuous PP-sediment relation appears to hold within and across all watershed scales. The uniformity of the relation is attributed to similar transport processes within each scale, and to the proportionality of the size of upstream sediment and P sources and instream transport capacity with watershed scale. This suggests that sediment and P yield at large watershed scales can be estimated from an adequate coverage of representative source area watersheds to encompass spatial and temporal variations in climate, soil, geology, and land use. More subtle changes are revealed when sediment and P are expressed as relative quantities. For a given sediment concentration higher PP concentrations are observed at the source areas than at the larger watershed scales. This is attributed to the erosion of P-deficient sediment from stream banks. Further, a decrease in mean SP concentration with increasing scale is attributed to SP sorption by P-deficient eroded stream bank material, and to the dilution of stream flow by subsurface return flow of low SP concentration. Spatial variability of large natural areas and temporal variability of precipitation

overshadow the subtle adjustments of the PP-sediment relation in downstream direction. This and limited data availability suggests physically-based numerical modeling as an alternative to quantify the details of P transport across watershed scales.

5. Climate fluctuations, defined in this study in terms of annual precipitation, have a pronounced impact on watershed runoff and can easily mask beneficial effects of soil and water conservation measures. The effect of two major climate fluctuations, a dry (1963-1969) and wet (1981-1985) period, on water and sediment yield in the Little Washita River Watershed is presented. Water yield tripled and the frequency of floods over 500 cms quadrupled from the dry to the wet period. A previous study indicated that Flood Water Retardation Structures (FRS), which were installed in the 1970's and which controlled 45% of the drainage area, had little effect on water and sediment yield. The beneficial effect of the FRS, among other reasons, have been overshadowed by the climate fluctuations. Therefore, relevant hydrologic and meteorologic influences must be checked and, if necessary, adjustments made to avoid misinterpretations of the effects of soil and water conservation measures. The direct influence of climate fluctuations on sediment yield is, to some degree, avoided by interpreting sediment-discharge rating curves. Sediment yield was found to have decreased by about 50% presumably due to the construction of the FRS. Ultimately, a disaggregation of the effects of the FRS and those of climate fluctuations on watershed runoff may only be achieved with physically based numerical models.

6. Prediction of sediment-nutrient transport in surface runoff is important from land use, management, and environmental standpoints. Because sediment and associated nutrient transport are greatest from severe storms, accurate prediction during these events is critical. The study here comprises 17 grassland, cropland, and drastically disturbed watersheds in the Reddish Prairie and Rolling Red Plain land resource areas of Oklahoma and Texas, involving the ten most severe storm events during periods of 3 to 10 years. Sediment transport was predicted using the Modified Universal Soil Loss Equation, which is designed for individual storms. Corresponding losses of N and P were predicted by a desorption equation or an enrichment ratio (nutrient content of sediment/source soil) approach. Overall, maximum discharge observed per severe storm event for sediment, soluble P, particulate P, and particulate N, averaged 51,000, 0.2, 6, and 19 kg/ha, respectively. The severe storms provided rigorous tests of the predictive approaches and, for the most part, realistic sediment and nutrient predictions were obtained. However, the

constancy of prediction equation factors and/or exponents is less uniform for severe storms than under more normal events and land conditions.

7. Descriptive information was obtained for 230 filter strip sites which included locations from 29 states. The sites encompassed a wide range of slopes, slope profiles, soils, crops, management practices, climatic conditions, and filter strip lengths and vegetation types. To appraise projected water quality improvements due to the establishment of filter strips, a series of CREAMS computer model simulations of before and after installation conditions were conducted. Filter strips reduced sediment loss by 10 to 80% depending on the soil type, slope and slope profile. Similar reductions were noted for sediment associated nutrients (P). However no reductions in soluble nutrients or pesticides were noted.

For additional information contact Frank Schiebe, Laboratory Director, USDA-ARS, National Agricultural Water Quality Laboratory, P.O. Box 1430, Durant, Oklahoma 74702.

OREGON

Research activities at the Columbia Plateau Conservation Research Center in Pendleton, Oregon include the following:

1. The 1989-90 winter produced no significant erosion at the Kirk erosion site. Measured erosion on the fallow plots was less than 2 t/ha compared to an average of 39 t/ha. For the winter wheat plots, measured erosion was less than 1 t/ha compared to an 11 year average of 4 t/ha. The erosion site lease was terminated 1 October, 1990 and all plots, instrumentation and collection tanks were removed. The site was operated for 12 years and climatological, runoff, sediment and chemical data were collected.

2. Twelve years of runoff and erosion data from the Kirk site were analyzed using hydrologic frequency analyses and probability theory. The soil management treatments involved were fall seeded winter wheat, fall plowed wheat stubble and continuous fallow as the control. Preliminary results indicate that major runoff and soil loss are the result of extreme events, and these extreme events are the major contributor to long term soil losses. This appears to be the case for both daily events and seasonal erosion. At this site, the soil loss tolerance of 11.2 t/ha was never exceeded for any daily event for the winter wheat and fall plowed treatments. Seasonal erosion exceeded the tolerance only once in 12 y for the winter wheat treatment. This was associated with the largest November-May precipitation recorded at the site and the second largest in 61 y at a nearby site. The seasonal erosion for the fall plowed treatment never exceeded the soil loss tolerance during the 12 years of observation. These data demonstrate the large temporal variability associated with runoff and erosion.

For additional information contact John Zuzel, Hydrologist, USDA-ARS, Columbia Plateau Conservation Research Center, P. O. Box 370, Pendleton, OR 97801.

USDA, AGRICULTURAL RESEARCH SERVICE
TEXAS

Research activities at the Grassland, Soil and Water Research Laboratory in Temple, Texas include:

Work is underway to develop an improved sediment yield prediction equation for use on watersheds ranging from 1 ha to 150 km^2. The new equation will be similar to the Modified Universal Soil Loss Equation (MUSLE) developed in the early 70's in several ways: (1) Both equations use the linear (KCPLS) factors of the USLE; (2) Delivery ratio is implicit in both equations; and (3) The individual storm peak runoff rate and total volume are used in both equations. However, the new equation estimates individual storm sediment concentration as a function of an upper limit of sediment concentration, the storm's peakness ratio (q_p/Q), and KCPLS. Sediment yield is simply calculated as the product of sediment concentration and runoff volume. Data from 778 storms that occurred on 18 small watersheds at Riesel, Texas, and Hastings, Nebraska, were used to calibrate the two MUSLE parameters. The new equation contains only one parameter (power of peakness ratio) and it is theoretically determined. Fortunately, data from 4320 storms that occurred on 70 small watersheds are now available for validating the new equation. Watershed locations include Riesel, Texas; Hastings, Nebraska; Treynor, Iowa; Chickasha, Oklahoma; Oxford, Mississippi; Boise, Idaho; and Pullman, Washington.

For additional information contact Jimmy R. Williams, USDA-ARS, Southern Plains Area, Grassland, Soil and Water Research Laboratory, 808 East Blackland Road, Temple, TX 76502.

WASHINGTON

AGRICULTURAL RESEARCH SERVICE

The following research is being conducted by the Land Management and Water Conservation Research Unit at Pullman, Washington:

1. Runoff plots have been installed at the Palouse Conservation Field Station at Pullman on various crop treatments including conventionally tilled, conservation tilled, and direct stubble seeded winter wheat, and various primary tillages of wheat stubble. The purposes are (1) determine the effect of crop treatments on runoff and soil loss; (2) determine the relative magnitudes of sheet and rill erosion; and (3) develop a residue effectiveness relationship. Instrumentation includes frost depth gages to determine the effect of crop treatment on frost depth and subsequent runoff and erosion during periods of thawing soils.

2. A subfactor method of determining crop management factors (C factor in the Revised Universal Soil Loss Equation [RUSLE]) has been developed and output is being used by SCS in Idaho, Oregon, and Washington. Thirteen years of runoff and erosion plot data from the Palouse Conservation Field Station at Pullman are being used to substantiate and improve the method. Work is continuing to improve the consistency of the relationships and to apply the method to additional crop rotations.

3. Shallow frozen soil is a major factor causing severe runoff and erosion in the Pacific Northwest and other States of the U.S. where intermittent frost occurs, but is very unpredictable due to many influences in a short time span. A detailed mathematical model has been developed and tested which computes a simultaneous solution of the vertical soil heat and water (SHAW) budget for two meters above and below the soil surface to account for the hourly impacts of climate, residues, snow cover, and tillage. This research model has proven to be quite accurate on farmland studies over four test years. Further parameter development and sensitivity analyses will aid in broader applications; a more application-oriented version is being developed.

4. Investigations into the effect of soil freezing and thawing on soil shear strength indicate very low surface shear strength during the thawing process. A flume study, in which soil is frozen and thawed under a range of soil moisture tensions, is being conducted to determine relationships between soil loss and applied shear stress. The results of this study, which provide critical shear strength and rill erodibility data, will be used to improve winter erosion prediction with runoff/erosion models.

5. Relationships for the six factors of the Revised Universal Soil Loss Equation (RUSLE) have been developed specifically for the non-irrigated cropland of the Pacific Northwest. This will enable greater confidence in the use of RUSLE in this region of unique climate, topography and cropping conditions.

For additional information, contact Donald K. McCool, USDA-ARS, Agricultural Engineering Department, 219 Smith Engineering Building, Washington State University, Pullman, Washington 99164-6120.

FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) concentrated its activities on five major areas: evaluation of embankment stability subject to flood overtopping, control of stream instability at highway crossings, bridge scour studies, control of sediment produced by highway construction, and control of highway water quality. Major efforts were carried out by staff and contract research, and by the various studies in the Highway Planning and Research program (HRP) and in the National Cooperative Highway Research Program (NCHRP). Following is a description of ongoing studies in 1990 in each of the five major areas.

Evaluation of Embankment Stability Subject to Flood Overtopping - The objectives of this study are to evaluate stability of embankments subject to flood overtopping and to determine expected rates of erosion when damages do occur. Various types of embankment materials and various types of protective measures were evaluated. In the overall design framework for highway stream crossings, these results provide guidelines for risk analysis and lowest total expected cost design. Simons, Li and Associates (SLA) completed a study sponsored jointly by FHWA and the U.S. Bureau of Reclamation (BOR) to investigate measures for "Overtopping Damage Minimization." This study was a follow-up to a completed FHWA study on Embankment Damage due to Flood Overtopping. Additional work to investigate cable-tied block systems was conducted under the FHWA contract but sponsored jointly by the BOR, TVA and SCS. Two final reports were published in 1990.

FHWA-RD-88-181, "Minimizing Embankment Damage During Overtopping Flow" P.E. Clopper and Y. H. Chen, Simons, Li and Associates, Inc., Fort Collins, Colorado, November 1988. It documents results of 38 full scale tests of selected commercially available embankment protection systems. (NTIS No. PB 90266107)

FHWA-RD-89-199, "Hydraulic Stability of Articulated Concrete Block Revetment Systems During Overtopping Flow" P. E. Clopper, Simons, Li and Associates, Inc., Fort Collins, Colorado, November 1989. it documents results of a more detailed investigation of cable-tied block systems. (NTIS No. PB 90266156)

Control of Stream Instability at Highway Crossings - The objectives of these studies are to evaluate the significance of natural stream adjustments on the structural integrity of highway crossings, to provide techniques for resolving the impact of these changes, then to provide guidelines for measures to mitigate stream instability at highway stream crossings.

A. The FHWA hydraulics lab study on sizing riprap to protect bridge piers from local scour was complete. Parola's Ph.D dissertation at Penn State University titled "The Stability of Riprap Used to Protect Bridge Piers" dated May 1990 is based on this study. A Public Roads article "Design of Riprap to Protect Bridge Piers from Local Scour" briefly summarized the results of the study in the September 1990, Vol 54, No. 2 issue.

B. A similar lab study on sizing riprap to protect bridge abutments from local scour was conducted in FHWA's hydraulics lab by Jorge E. Pagan-Ortiz. His M.S. thesis at George Washington University titled "Stability of Rock Riprap for Protection at the Toe of Abutments Located at

Floodplains" is based on this study. He is currently revising his thesis to be published as a FHWA R&D report.

Bridge Scour Studies - The objective of these studies is to investigate expected scour at bridges. Goals include developing procedures for assessing vulnerability of bridge scour, developing an improved sediment transport model, and developing prediction equations for pier, abutment and contraction scour at bridges.

A. Field scour studies were being sponsored by Arkansas, Arizona, Louisiana, Ohio, Oklahoma, Delaware, Virginia, Maryland, Tennessee, and Washington State using either State or HP&R funds. Most of these studies are aimed at reconnaissance prior to flooding and scour monitoring during flooding to document field data. Data from these studies will be fed into the national scour study described in B below. Exceptions to the general nature of these studies are Louisiana and Tennessee. The Louisiana study which was conducted by Louisiana State University focused on developing a computerized system for the organization, analysis and display of routine hydrographic survey data collected by the bridge monitoring teams. The Tennessee study is focused on assessing vulnerability of bridges to scour in the western part of the State.

B. The USGS continued the bridge scour study "Performance of Bridges during Flooding," sponsored by the FHWA. This study, generally referred to as the National Scour Study, awarded in September 1987, was intended to assemble a response team to monitor bridge scour wherever floods might occur in this country. The response team would work with study leaders in the individual States that have scour studies to standardize data collection and serve as a national repository of data. This study was extended from 3½ to 5 years in duration, it is scheduled for completion in 1992, but another extension is anticipated to utilize additional data being collected under the State funded field studies in A above.

C. NCHRP Project 15-11 "Hydraulic Analysis of Bridges on Streams with Moveable Beds and Banks" resulted in development of the BRI-STARS sediment transport model for general scour analysis of highway stream crossings. BRI-STARS is based on the stream tube concept that was originally developed under sponsorship of the Bureau of Reclamation. This initial contract for this NCHRP project was completed in 1990 but a follow-up phase II contract has been negotiated to debug the BRI-STARS model, add some extra features and provide user support for one year. A third phase is being considered for adding some major enhancements for the model but this phase has not been approved yet.

D. AN NCHRP study (Project 21-3) "Instrumentation for Measuring Scour at Bridge Piers and Abutments" was awarded to Resource Consultants, Inc., in Fort Collins, Colorado. It is to develop, test, and evaluate fixed instrumentation for use in monitoring the maximum scour depth at bridge piers and abutments during high flow events. It is felt that often the best measure to take for a potential scour critical bridge is to monitor scour during floods but reliable instrumentation is very limited.

E. The USGS Connecticut District Office continued the study "Seismic and Radar Scour Equipment," sponsored by the FHWA. This is a continuation of a pilot study on the use of selected geophysical techniques to recreate the scour history of bridge piers and abutments. Equipment and deployment methods being evaluated include the use of color video fathometers, low frequency sonar, and ground penetrating radar for subbottom plotting and for detection of refilled scour holes.

F. Florida initiated the HP&R study "Highway Bridge Scour Evaluation of Predictions and Methods." This is an analytical study to determine how applicable the existing bridge scour prediction equations are for the coastal zones of Florida and to evaluate methodology recently developed for the Florida Department of Natural Resources by Sheppard and Niedorada.

G. Several Implementation and National Highway Institute (NHI) activities using FHWA research results were completed: HEC-18 on scour at bridges, HEC-20 on stream stability at highway structures, training course on scour and stream stability, and Highways in the River Environment training course and manual (all of these will be available in 1991).

H. The FHWA completed the first phase of Demonstration Project #80, "Underwater Bridge Inspection." This project was conducted a total of 47 times to groups of bridge inspectors, divers and bridge program managers. The focus of the project was on programs for underwater inspection of bridges and a demonstration of state of the art equipment for scour detection and underwater inspection. Access equipment and nondestructive testing equipment were also covered.

   FHWA is currently evaluating plans for a second phase which would include more and improved underwater inspection equipment and also methods for underwater repair.

<u>Control of Sediment Produced by Highway Construction</u> - This problem consists of two stages: during construction and just after construction.

A. During construction and after completion of highway construction, immediate and adequate protection against erosion can be provided for slopes and other roadside areas affected by grading. In most regions of the country this has been accomplished with the use of erosion control fabrics and the proper establishment and maintenance of roadside vegetation. There are currently five States conducting eight studies designed to reduce erosion through improved vegetation establishment and maintenance, and through the use of improved erosion control fabrics. The participating States are California, New Jersey, Tennessee, Oklahoma, and Washington. Colorado and Indiana completed their studies.

   CDOH-DTD-R-89-15, "Evaluation of Miramat Erosion Control Fabric," T.R. Hunt, Colorado Department of Highways, Denver, Colorado, December 1989.

   FHWA/IN/JHRP-88/4, "Prediction of Erosion on Cut or Fill Slopes," J.C. Fan, Purdue University, West Lafayette, Indiana, January 1988.

B. In addition to the foregoing studies supported by States in the HP&R program, a contractual effort through the FHWA's Federal Land program at North Dakota State University completed an investigation of the corrective repair of road edge scour for grassed highway shoulders. The final report was reviewed, and will be published in 1991.

Control of Highway Water Quality - The objectives of these studies are to monitor the highway water pollution parameters, to determine their source and their impact on the environment, and to devise cost-effective means to control them.

A. In order to draw together the results of all the research on characterization of highway stormwater runoff, FHWA contracted with Woodward-Clyde Consultants to develop a "Design Procedure to Estimate Pollutant Loading from Highway Stormwater Runoff." This study was completed with a computer model to estimate pollutant loading and to evaluate the potential impact to water resources. The final report was published in 1990.

   E.D. Driscoll, P.E. Shelley, and E.W. Strecker, Woodward-Clyde Consultants, Oakland, California, April 1990:
   "Pollutant Loadings and Impacts from Highway Stormwater Runoff,
   Vol. I: Design Procedure" FHWA-RD-88-006.
   Vol. II: Users Guide for Interactive Computer Implementation of Design Procedure" FHWA-RD-88-007.
   Vol. III: Analytical Investigation and Research Report" FHWA-RD-88-008.
   Vol. IV: Research Report Data Appendix" FHWA-RD-88-009.

B. An FHWA administrative contract research study, "Retention, Detention and Overland Flow for Pollutant Removal from Highway Stormwater," was completed by Versar, Inc., Springfield, Virginia. This research developed performance criteria for mitigation measures using this subject removal mechanism. Laboratory tests and design for laboratory and field validations were conducted. The final report was reviewed, and will be published in 1991.

C. An FHWA administrative contract research study, "Guidelines for Protective Systems for Spills of Hazardous Materials on the Highway System," was completed by the Kansas State University of Manhattan, Kansas. This investigation focused on areas of high risk where spills could result in severe, long term or permanent consequences. The emphasis of the research is on developing implementable procedures and guidelines for effective, practical, and feasible protective systems. The draft final report was reviewed. The final report will be published in 1991.

D. In the FHWA's Federal Lands program for roads in Indian reservations, national forests, national parks, and Bureau of Land Management, land areas concerns over the degradation of water quality from road areas have been noted from excavated acid producing materials brought to the surface as a result of road construction or rehabilitation. The University of Tennessee completed an investigation of the cost-effective management of such materials and thus prevent or neutralize leaching of deleterious low pH runoff from excavated acid soil materials. The final report was published in 1990.

FHWA-FL-90-007, "Handling Excavated Acid Producing Material," D.W. Byerly, University of Tennessee, Knoxville, Tennessee, September 1990.

E. Thirteen States continued 22 investigations on effects of highway design, operation, and maintenance on water quality impacts and means to reduce such impacts.

Arizona, "Porous Pavements for Control of Highway Runoff."

California, "Effect of Bridge Repainting Operations on the Environment."

California, "Use of Vegetation to Reduce the Toxicity of Stormwater Runoff."

California, "Reducing the Volume of Hazardous Waste from Bridge Repainting."

California, "Soil Infiltration Rates for Septic Tank Effluents."

Florida/USGS Study, "Effects on Wetlands When Utilized for Treating Highway Runoff" was completed in 1990. The final report was published: FL-ER-46-89, "Wetlands for Stormwater Treatment," D.M. Schiffer, Florida Department of Transportation, Gainesville, Florida, January 1990.

Florida/USGS Study, "Impacts of Stormwater Management Practices on Ground Water" was completed in 1990. The final report was published: FL-ER-45-89, "Impact of Stormwater Management Practices on Groundwater," D.M. Schiffer, Florida Department of Transportation, Gainesville, Florida, January 1990.

Florida, "Effects of Structural Changes on Water Quality Efficiency of Stormwater Detection Ponds."

Florida, "Maintenance Guidelines for Accumulated Sediments in Retention/Detention Ponds Receiving Highway Runoff."

Florida, "Design and Maintenance of Exfiltration Systems."

Florida, "Activated Carbon Filter."

Georgia's Study, "Biodegradation of Organic Compounds" was completed in 1990. The final report was published: FHWA-GA-89-08, "Biodegradation of Organic Compounds," D.S. Orokunle, Georgia Department of Transportation, Atlanta, Georgia, January 1990.

Georgia, "Bioremediation of Organic Contaminants."

Louisiana, "Accelerated Biodegradation of Herbicides Applied to the Roadside."

Massachusetts, "Effectiveness of Highway Drainage Features for Control of Ground Water Pollution."

New Jersey, "Handling and Mitigation of Acid-Producing Soils."

Ohio, "Effects of Highway Deicing Chemicals on Shallow Unconsolidated Aquifers in Ohio."

Pennsylvania, "Analyses of Pollution Controls for Bridge Painting."

Tennessee, "Deposition of Sediments of Wetlands of Bridge Crossings."

Virginia, "Field Performance of Porous Asphaltic Pavement."

Washington, "Improving the Cost of Effectiveness of Highway Construction Site Erosion/Pollution Control."

Wisconsin, "Hydrological Guidelines for Wetland Resotation and Creation."

If more information is desired about these research studies, inquiries should be addressed to the sponsoring agencies.

GEOLOGICAL SURVEY, CORPS OF ENGINEERS, BUREAU OF RECLAMATION, BUREAU OF LAND MANAGEMENT, AGRICULTURAL RESEARCH SERVICE, FOREST SERVICE, TENNESSEE VALLEY AUTHORITY, FEDERAL HIGHWAY ADMINISTRATION

Federal Interagency Sedimentation Project
Minneapolis, Minnesota

During 1990, the Federal Interagency Sedimentation Project developed new field-sampling equipment, improved automatic sediment-concentration sensors and participated in establishing standards for collecting and analyzing sediment samples.

A new dredge-type field sampler for use in gravel-lined rivers was built for test and evaluation. The sampler, suggested by Mr. D. W. Hubbell, has cutting teeth that penetrate armored river beds. The teeth pry and scoop gravel- and cobble-size particles upward as the sampler is trolled along the bottom. The particles collect in a mesh bag mounted behind the teeth and under a tail-vane which keeps the sampler facing into the approaching river flow. The sampler is designed to collect stationary particles forming river beds but not moving particles propelled by the flowing water and transported as bedload. Moving particles are deflected away from the collection bag by a streamlined shield fastened to the nose of the sampler. Additional details on cost and delivery may be obtained by contacting the Sedimentation Project.

Another bed-material sampler currently under development is referred to as the BM 91. It collects fine sediment deposited in pavement layers of gravel-bed rivers. The sampler consists of a flat plate with turned-down edges that set on the bed. Two submersible pumps, which are powered from a low-voltage battery and are fastened to the plate, discharge water downward to scour the bed and suspend fine particles in the recirculating flow. A third pump lifts the fine-particle slurry to the river surface where the mixture can be collected for analysis or processed through a portable centrifuge.

The D-77, a depth-integrating suspended-sediment sampler, was modified for use in collecting specimens of river water for trace-metal analysis. All components that contact the sample water are available in special noncontaminating flurocarbon materials.

An experimental sediment-concentration gage is being developed in cooperation with engineers from the Tennessee Valley Authority. Termed the plummet, the instrument consists of a sealed glass bulb suspended in a container of river water Because sediment is denser than water, buoyancy on the bulb increases as suspended-sediment concentration increases. Buoyancy registers on an electronic scale attached to a thin wire that supports the bulb. Signals from the scale are transmitted and stored on a data logger. At programmed intervals, a fresh batch of water is pumped into the container from the river. A single-board computer performs all control and data-collection operations. Commands are entered through a keyboard; weight readings are shown on a liquid-crystal display; the control program is stored in a nonvolatile memory; and sediment data are stored in a removable solid-state memory cartridge.

Project personnel assisted with the preparation of two documents pertaining to the standardization of techniques for collecting sediment data. The "National Handbook of Recommended Methods for Water-Data Acquisition," which is published and distributed by the Office of Water-Data Coordination , U.S. Geological Survey, contains a chapter devoted to sediment. In cooperation with sediment specialists from several federal agencies, the Project updated the chapter to explain the latest methods, several of which are referenced to ASTM standards. The Project continued to participate in ASTM Committee D-19 which is concerned with a broad variety of water-related studies.

CR098	SEDIMENT TRANSPORT PHENOMENA

TITLE: Measurement and Prediction of Sediment-Transport Phenomena

PROJECT NUMBER: CR 74-098

LOCATION: Topical Research

PROJECT CHIEF: Stevens, Herbert H., Jr.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: In alluvial streams, for every hydrologic condition, the bed configuration, sediment transport, and hydraulic characteristics mutually change to achieve quasi-equilibrium. These changes affect the ability of the stream to convey given quantities of water, accommodate navigation, transport and dilute solid and solute wastes, support aquatic biota, and function in a variety of other ways. As yet, the relations between pertinent hydraulic and sedimentologic variables are not completely understood. Hence, the extent to which important variables, particularly bed-form roughness and sediment transport, will change in response to natural or human-induced alterations to the flow regime cannot be predicted with desired reliability. As a result, optimum use and management of a waterway usually is not assured. Often, modifications intended to enhance the utility of a waterway are ineffective or have adverse effects. Lack of understanding is due, in part, to inadequate instrumentation for measuring bedload transport. This problem is particularly acute in mined areas.

OBJECTIVE: Provide an improved understanding of sedimentation phenomena in alluvial streams and the response of such streams to imposed changes through the use of improved instrumentation. Consider the interrelations between bed-form characteristics and the transport of bedload and bed-material load.

APPROACH: Analyze existing data to relate bed-form characteristics to the conditions of flow and sediment transport. Develop one or more bed-load samplers to permit accurate measurements of bedload transport. Study the characteristics of bed-forms, sediment transport, and other pertinent variables as required to meet specific needs. Use acoustic instrumentation, including side-scan sonar, to measure bed-form configuration and movement. Use suitable bedload samplers and suspended-load samplers to define transport rates. Analyze information to define criteria for predicting bed-form morphology and to provide a better under- standing of sediment-transport phenomena in sand and gravel-bed streams.

PROGRESS: Established a procedure for a moving-boat method to collect suspended-sediment samples and water-discharge data from the Mississippi River. Water-discharge data were verified by comparisons with data collected by conventional methods at selected sites.

REPORTS PUBLISHED:

Stevens, H.H., Jr., and Yang, C.T., in press, Summary and use of selected fluvial sediment-discharge formulas: U.S. Geological Survey Water-Resources Investigations Report 89-4026.

CR102	SEDIMENT IN RIVERS

TITLE: Movement and Storage of Sediment in River Systems

PROJECT NUMBER: CR 75-102

LOCATION: Nationwide

PROJECT CHIEF: Meade, Robert H.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Sediment moves through a river system in response to specific events and changing conditions in the drainage basin. The movement of sediment is usually discontinuous. Episodes of movement are separated by periods of storage that can range from less than 1 year to more than 1,000 years. Understanding the movement and storage of sediment in rivers is important to navigation, flood control, and other aspects of river engineering, as well as to the prediction of the fate of contaminants absorbed on sediment particles.

OBJECTIVE: Assess (1) changes in river-sediment loads over periods of decades or longer and the factors (natural or artificial) that cause the changes; (2) rates at which sediment is stored in river systems and the residence times of sediment particles in storage; and (3) sources, pathways, and sinks of sediment particles in river systems.

APPROACH: (1) assess long-term changes in sediment loads from data previously collected by USGS and other agencies; (2) assess sediment storage by repeated (annual) surveys of selected river channels and by comparing old and new maps and aerial photographs of rivers and their flood plains; and (3) assess sources, pathways, and sinks by intensive field studies of selected large and small rivers.

PROGRESS: Two sampling cruises were completed on the Mississippi River between St. Louis and New Orleans. A resurvey of cross sections in Powder River, Montana, showed small to moderate amounts of channel change since last year. The total amount of channel change in Powder River in the 10 years since the flood of 1978 is of the same magnitude as the change that occurred during the few days of the flood itself.

REPORTS PUBLISHED:

Johnsson, M.J., Stallard, R.F., and Meade, R.H., 1988, First-cycle quartz arenites in the Orinoco River basin, Venezuela and Colombia: Journal of Geology, v. 96,no. 3, p. 263-277.

Meade, R.H., 1988, Movement and storage of sediment in river systems, in Lerman, A., and Meybeck, M., eds., Physical and chemical weathering in geochemical cycles: Dordrecht, Holland, Kluwer Academic Publishers, p. 165-179.

Marron, D.C., 1988, Field and laboratory data describing physical and chemical characteristics of metal-contaminated flood-plain deposits downstream from Lead, west-central South Dakota: U.S. Geological Survey Open-File Report 88-347, 32 p.

Marron, D.C., 1989, The transport of mine tailings as suspended sediment in the Belle Fourche River, west-central South Dakota, in Hadley, R.F., and Ongley, E.D., eds., Sediment and the environment: International Association of Hydrological Sciences Publication 184, p. 19-26.

Marron, D.C., 1989, Trends in arsenic concentration and grain-size distribution of metal-contaminated overbank sediments along the Belle Fourche River downstream from Whitewood Creek, South Dadota, in Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Phoenix, Arizona, September 26-30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-4220, p. 211-216.

Marron, D.C., in press, Physical and chemical characteristics of a metal-contaminated overbank deposit, west-central South Dakota, U.S.A.: Earth Surface Processes and Landforms, v. 14.

Meade, R.H., Yuzyk, T.R., and Day, T.J., in press, Movement and storage of sediment in rivers of the United States and Canada, in Wolman, M.G., and Riggs, H.C., eds., Surface water hydrology: Geological Society of America, The Geology of North America, v. 0-1, Ch. 11.

Meade, R.H., Weibezahn, F.H., Lewis, W.M., Jr., and Perez Hernandez, David, in press, Suspended-sediment budget for the Orinoco River, in Alvarez, H., Weibezahn, F.H., and Lewis, W.M., Jr., eds., Ecosistema Orinoco: Caracas, Editorial Arts.

CR105 CHANNEL MORPHOLOGY

TITLE: Effects of Water and Sediment Discharges on Channel Morphology

PROJECT NUMBER: CR 65-105

LOCATION: Topical Research

PROJECT CHIEF: Williams, Garnett P.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Channels of alluvial streams change with time. Bed elevations and channel widths can change, meander bends can shift laterally and downstreamward, the sizes of the bed particles can change, instream bars can grow and migrate, and the amount and type of vegetation along the river can increase or decrease. Sometimes the change is insignificant, even over decades, but in other cases catastrophic modifications occur in minutes. The transformations can be natural or human-induced, and they can have significant effects on humans and the environment.

OBJECTIVE: Determine and analyze the influence of the major variables, particularly water and sediment discharges, governing channel morphology.

APPROACH: Study the effect of large contributions of sediment to stream channels. Make field surveys and aerial-photograph analysis, preferably time-sequential, of stream reaches that have received exceptionally large sediment inputs. Document channel response, with a view towards eventually developing a general model of channel response.

PROGRESS: Concurrent bedload and suspended-load measurements at cross sections on 93 streams in the Western United States permit analyses of the proportion of bedload to total sediment load. Bedload was measured with the Helley-Smith sampler and was composited for the entire channel cross section. The instantaneous bedload proportion at a stream cross section was found to be characterized chiefly by variability. The variability occurs in patterns or absolute magnitudes with (a) time, such as during a single hydrologic event or a runoff season, and (b) water discharge during a hydrologic event, runoff season, or longer period. The bedload proportion as a function of water discharge for a hydrograph rise and fall can show hysteresis loops and other patterns that are often associated with suspended load. For runoff seasons and longer periods, the bedload proportion can increase, decrease, have no relation, or remain reasonably constant with water discharge. The variability of the bedload proportion indicates that a cross section for the streams of this study cannot adequately be characterized by a single, representative, instantaneous bedload proportion.

REPORTS PUBLISHED:

Waythomas, C.F., and Williams, G.P., 1988, Sediment yield and spurious correlation--toward a better portrayal of the annual sediment load of rivers: Geomorphology, v. 1, no. 4, p. 309-316.

Williams, G.P., 1988, Stream-channel changes and pond formation at the 1974-76 Manti landslide, Utah: U.S. Geological Survey Professional Paper 1311-C, p. 43-69.

Williams, G.P., in press, Sediment concentration versus water discharge during single hydrologic events in rivers: Journal of Hydrology, v. 111, no. 1-4.

Williams, G.P., and Rosgen, D.L., in press, Measured total sediment loads (suspended loads and bedloads) for 93 United States streams: U.S. Geological Survey Open-File Report 89-67.

CR187 BEDLOAD TRANSPORT RESEARCH

TITLE: Hydraulics and Mechanics of Bedload-Transport Processes

PROJECT NUMBER: CR 74-187

LOCATION: Topical Research

PROJECT CHIEF: Emmett, William W.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Of all processes operating in river channels, and especially of those of practical concern to engineers and others interested in river-channel behavior, perhaps the least information is available regarding the hydraulics and mechanics of bedload transport. As scientific knowledge of river behavior advances, and is applied to management of the nation's rivers, additional understanding of bedload-transport processes will be necessary.

OBJECTIVE: (1) Define (a) spatial and temporal variations in transport rate and particle size of bedload; and (b) the average magnitudes of transport rate and particle size throughout a range of geographic locations, channel geometries, and river hydraulics. (2) Evaluate the adequacy of sampling equipment and field procedures, provide interpretation of bedload-transport processes, and assess the applicability of existing or new predictive techniques in river hydrology. (3) Demonstrate the value of sediment data in designing hydrologic networks and in evaluating regional and temporal trends in water-resources information. (4) Assess the usefulness of numerical simulations as hydrologic tools in fluvial geomorphology. (5) Provide interdiscipline perspectives in evaluation of environmental resources (for example, fishery habitat), impact assessments (for example, alluvial mining), and management alternatives (for example, operating policy). (6) Apply the information to operational programs of the USGS and other organizational units to assist in the solution of practical problems.

APPROACH: (1) Use continuous sampling of bedload (for example, conveyor-belt bedload trap on the East Fork River near Pinedale, Wyo.) as a control to evaluate spatial and temporal variability factors in bedload transport and to evaluate general relations between sediment movement and river hydraulics. (2) Fieldcalibrate the sediment-sampling efficiency of the Helley-Smith bedload sampler simultaneously with operation of the bedload trap. (3) Use the calibrated Helley-Smith sampler and the concurrent measurements of streamflow hydraulics in the systematic collection of bedload samples from a variety of sand- and gravel-bed streams, and within the laws of general physics, stochastically develop empirical relations of bedload transport and interpret the physical significance of the developed relations. (4) At the conveyor-belt bedload-trap research facility Initiate a tracer study using fluorescent particles (sand to fine gravel) to evaluate (a) residence time of sediment (b) average speed of varioussizes of particles (c) depth of bed material involved in transport (d) dispersion of bed material (e) short-term channel changes accompanying sediment transport (f) influence of availability of sediment on transport rate and (g) other related aspects of sediment transport. (5) Extend the fluorescent-tracer study to larger particles (coarse gravel to cobbles) by implanting microradio transmitters in individual rocks and, by periodic and (or) continuous detection by receivers/data loggers,provide time-sequence data on motion and location of separately identifiable particles. (6) Establish field sites for bedload sampling that document varying characteristics of geographic coverage (factors of hydrology, meteorology, soils, biology, and so forth); maintain one or more bedload stations as long-term observation sites so that time-trend data can be evaluated. (7) Initiate and participate, as needed, in studies comparing sampler types, sampling procedures, and analytical techniques to formulate and modify guidelines on equipment needs and field/laboratory practices; provide emphasis on relevancy to WRD mission and on need for consistency of data collection. (8) In conjunction with biologists, chemists, and other scientists, develop a field-oriented strategy for comprehensive environmental assessments; apply developed strategy to specific sites to demonstrate and document sediment-related varables as important ecological factors.

PROGRESS: (1) Field work at the bedload trap and for the fluorescent-tracer study is complete; additional dispersion analysis of fluorescent tracer was begun at University of California, Berkeley, during FY88. Bedload-transport rates, measured synoptically, vary along a river reach; bedload tonnage, measured seasonally, is nearly constant throughout the reach. Mean bedload-transport rates relate to streampower (about the 1.6 power of streampower (slope-discharge product) in excess of streampower at initiation of motion), mean bedload-particle speeds are slow (about 0.1 percent of water speed), and lengths of particle movement may be seasonally limited (distances of about 50 channel widths). (2) Radio transmitters were implanted in cobble-size rocks and movements tracked as part of bedload studies on Toklat River, Alaska (in cooperation with Alaska District, USGS, Denali National Park, National Pak Service, and Cold Regions Research and Environmental Laboratory, U.S. Army Corps of Engineers). Bedload-transport rates relate about to the 1.6 power of discharge (slope is about constant) in excess of discharge at initiation of motion and particle size (mean, modal, and maximum) increased as transport rate increased. Large moving particles (about fist size) travelled about the same distance as smaller particles (about golf-ball size). Particle speeds and distances travelled are in general agreement with observations from East Fork River, Wyo. (3) Six field sites, chosen in FY87 to help provide geographic coverage of total-load measurements, were sampled for bedload during FY88 but were discontinued thereafter. Discontinuance effectively eliminated WRD's establishment of a small hydrologic network for the routine collection of bedload data at operational field sites. During much of the FY 87-88 sampling period, flows were low in some drought-stricken areas, but runoff was normal for many snowmelt streams of the Rocky Mountain area. Most data analysis is pending; for Little Coal River, West Virginia, preliminary data analysis (in cooperation with Marshall University, Huntington) indicates that bedload may be as great as one-third of total sediment load (a greater part of total load than might be expected for streams of that region). (4) Long-term data collection continued for the eighth year at Little Granite Creek, Wyo. (in cooperation with Idaho District, USGS). Although measured total-sediment loads now constitute the longest data set available at a continuous-record gage, the period of record is still too short to allow forecasting of time trends. Generally, during the period of observation, water runoff has decreased and sediment yields have lessened more dramatically. These facts may be related to short-term weather variability rather than to long-term climate change. Values for April are in contrast to values for other months and tend to show an increase in runoff and sediment yield with time; regardless of cause, for this snowmelt stream, there appears to be a tendency for earlier runoff that indicates earlier springtime weather. (5) Comparisons of equipment and procedures were continued in collaboration with personnel in other countries (People's Republic of China) and from other USGS offices (Washington, Alaska, and Iowa Districts). Comparison of analytical procedures for concentration and particle size of suspended-sediment samples yielded nearly identical results among differing techniques of several laboratories in the United States and China. Comparison of bedload samplers were conducted at streams in Wyoming and Alaska; preliminary results between wide- (standard) and narrow-flare angled Helley-Smith type samplers indicate that endorsement of one sampler type over the other is premature (for some samples and/or for some streams, the larger samples were collected variably and alternately between the two samplers, probably reflecting hydraulic conditions, bedforms, and sediment-sorting characteristics). Comparison of bedload-sampling procedures were conducted at streams in Wyoming and Colorado. Although spatial and temporal factors must be considered, initial results indicate that, for a constant number of total samples (about 40), as the number of cross-channel locations are reduced, the mean bedload-transport rate is likely to change from an estimated true value and the value of the standard deviation of the mean rate increases. (6) Interpretation of bedload in the Wind River, Wyoming, was completed (in cooperation with the Wyoming District, USGS, and the Wyoming Highway Department). It is unlikely that either the transport rate (replenishment) or particle size (construction needs) is conducive to large-scale economic operation of gravel mining of bedload at that field site. (7) In collaboration with other USGS scientists and academic personnel (Murray State University and University of Maryland), environmental assessments were conducted on several streams in Yellowstone National Park, Wyoming. A field procedure was developed combining geomorphic aspects (river hydraulics, sediment characteristics, topography), water chemistry (pH, specific conductance, trace elements, organic carbon), and biological factors (benthic drift, invertebrates, fish). Though many laboratory analyses are pending, the procedure appears adequate for descriptive and interpretive purposes. (8) Initial comparison of measured data and numerical simulation is underway; all analyse are in progress.

REPORTS PUBLISHED:

Burrows, R.L., Chacho, E.F., Jr., and Emmett, W.W., 1988, Tracking coarse sediment with radio transmitters [abs]: EOS, Transactions of the American Geophysical Union, v. 69, no. 44, p. 1218.

Emmett, W.W., Burrows, R.L., and Chacho, E.F., Jr., 1989, Gravel transport in a gravel-bed river, Alaska [abs]: EOS, Transactions of the American Geophysical Union, v. 70, no. 15, p. 320.

Emmett, W.W., and Averett, R.C., in press, Fremont Lake--some aspects of the inflow of water and sediment: U.S. Geological Survey Water-Resources Investigations Report 88-4021.

Long, Y., Emmett, W.W., and Janda, R.J., in press, Comparison of some methods for particle-size analyses of suspended-sediment samples, _in_ International Symposium on River Sedimentation, 4th, Beijng, Proceedings.

CR266 ESTUARY SEDIMENTATION/EUTROPHICATION

TITLE: Transport and Deposition of Sediments and Sediment-Borne Contaminants in Tidal Rivers and Estuaries

PROJECT NUMBER: CR 81-266

LOCATION: Topical Research

PROJECT CHIEF: Glenn, Jerry L.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Sediments that contain large concentrations of nutrients and trace metals are accumulating rapidly in part of the tidal Potomac River, the Potomac Estuary, and the adjacent marginal embayments. Accumulations of sediments and sediment-borne contaminants could limit significantly the use of tidal waters and estuaries for commercial, recreational, and aquacultural purposes. The sediments decrease channel depths and widths to the detriment of commercial and recreational interests, and these sediments also cover and destroy productive shellfish grounds. The nutrients are a factor in the development and maintenance of undesirable eutrophic conditions, including nuisance algae blooms and low concentrations of dissolved oxygen. Sedimentation and eutrophication problems in the Potomac are a consequence of essentially uncontrollable natural and anthropogenic influences. The problems began to develop naturally several thousand years ago when the current rise in sea level drowned the Potomac River and began the evolution of the modern tidal river-estuary system.

OBJECTIVE: (1) Identify modern sources of sediments and nutrients; (2) establish changes with time in sources or supply rates due to natural and anthropogenic influences; (3) determine sediment and nutrient transport and deposition patterns; (4) compute rates of accumulation and amounts of sediments and nutrients in selected hydrologic and geomorphic divisions of the Potomac system; and (5) compare supply and accumulation rates for prehistorical and historical periods with contemporary rates from concurrent transport studies.

APPROACH: Determine areal and stratigraphic distributions of sediments, nutrients, and trace metals by a combination of direct sampling (surface and core) and remote sensing (side-scan sonar and subbottom profiling). Analyze sediment samples for indicators of sources (particle size, mineralogy, nutrient and trace-metal concentrations) and accumulation rates (lead-210, ^{14}C pollen concentrations and distributions). Estimate sediment contributions from the shoreline source by use of a combination of field mapping, monitoring, and sampling at selected sites, and by laboratory measurements from available aerial photographs and maps. Integrate data with results from measurements and models of modern sediment and nutrient transport to provide past and present sediment and nutrient budgets for selected reaches of the Potomac .

PROGRESS: Deposition of fine-grained sediments during the 1988-water-year high flow from the Ohio River to the Mississippi River was extremely rapid in many overbank environments in the Mississippi River study reach near Hickman, Ky. More than 15 centimeters of sediment was deposited over a large area of recently logged lowlands adjacent to the main channel, and a layer of oxidized sediment 4 centimeters thick was observed in a nearby channel where only reduced sediments were present before the high water. Flooded farmlands between the mainline levees showed both deposition and erosion, and newly constructed revetments also showed variable sedimentation conditions. Sedimentation in most environments appeared to be related to geomorphology, to vegetation (presence or absence), and to approach angle for flood waters. Trace-metal and lead-210 data for four 1-meter-long cores from a Mississippi River channel abandoned about 1950 failed to reveal profiles that could be interpreted in terms of sedimentation rate, but textural data indicate deposition of about 1 meter of fine sediments in the 38 years since the channel was abandoned.

REPORTS PUBLISHED:

Glenn, J.L., 1988, Bottom sediments and nutrients in the tidal Potomac system, Maryland and Virginia: U.S. Geological Survey Water Supply Paper 2234-F, 72 p.

CR273 RIVER MECHANICS

TITLE: River Mechanics

PROJECT NUMBER: CR 82-273

LOCATION: Topical Research

PROJECT CHIEF: Andrews, Edmund D.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: The geometry and pattern of river channels adjust to significant changes in the water discharge, size, and quantity of sediment supplied to the channel. When the quantity of water and sediment remains relatively constant over a period of years , the channel geometry and pattern vary about a mean or quasi-equilibrium condition. Major watershed alterations that change the supply of water, sediment, and size of sediment reaching the channel necessitate an adjustment of the channel geometry and pattern. That is, the channel is transformed from one quasi-equilibrium state to another. Between the two quasi-equilibrium states is a period of instability. Existing techniques for examining and predicting river-channel adjustment have been developed primarily from investigation of quasi-equilibrium rivers. As a result, it is frequently possible to predict, with a modest range of uncertainty the future quasi-equilibrium hydraulic characteristics of a river after a change in its watershed. The dynamics and rate of river-channel adjustment during the period of instability, however, have rarely been studied and are rather poorly understood. The length of time required for the complete adjustment is commonly a few decades to a century or more. In many channels affected by land uses such as surface mines, reservoirs, and urbanization, the adjustment period may, in fact, be longer than the duration of change in the watershed . In watersheds where various land-use changes occur every few years, the river channel may be continually adjusting to a changing supply of water and sediment and, thus, never reach a quasi-equilibrium condition. In these rivers, the period of instability is the only significant condition. Consequently, an understanding of the dynamics and rate of river-channel adjustment from one quasi-equilibrium state to another is very important to managing fluvial resources. A wide range of social and economic costs can result from significant river-channel changes. One of the most frequent and important adverse effects is damage to the aquatic ecosystem. Aquatic organisms depend upon a particular combination of hydraulic characteristics (that is, their physical habitat) to meet life requirements. When a river channel adjusts to a change in its watershed, the physical habitat of the aquatic organisms in the river may be reduced or even eliminated, either during the period of instability or in the future quasi-equilibrium condition. To evaluate the biological impacts of watershed alternation, hydrologists frequently need to predict the hydraulic geometry and channel pattern at various times in the future so that changes in the physical habitat can be assessed. In many ways, such an analysis of physical habitat concerns the same questions one would address in an evaluation of the impact of channel change upon engineering works or navigation. On the other hand, certain aspects of river-channel changes are of greater importance to the aquatic ecosystem than to the integrity of engineering works. The primary focus of this research project is to understand the dynamics and rate of river-channel change as they affect the physical habitat. The results, however, will no doubt contribute to understanding the broader question of river-channel adjustment. The greatest deficiencies in our present knowledge of river-channel adjustment as it relates to the aquatic ecosystem are (1) the longitudinal sorting of bed material, especially gravel, (2) the formation of gravel bars, (3) adjustment of channel width, and (4) the rates at which the several hydraulic variables adjust.

OBJECTIVE: Describe the physical processes and rate at which a river channel adjusts in response to a change in the water discharge, sediment size and sediment load supplied to the channel. Concentrate, in particular, on the adjustment of those aspects of river channels known to significantly influence the aquatic ecosystem, that is, the bed-material size distribution, occurrence of bars, and channel width. Describe the hydraulic processes controlling these characteristics of river channels as well as the rate at which they function. Formulate mathematical models of the processes as required for longitudinal routing of water and sediment. Develop new analytical tools for describing river-channel adjustment.

APPROACH: Study, in detail, the movement of bed material through a reach of channel considering the transport of bed material, distance transported, and location (bed, banks, or bar) of deposition for each size fraction. From measured bedload and suspended-transport rates, detailed measurements of flow structure, and mapping of channel features, describe the movement of bed material through the study reaches. To the extent possible, generalize these observations to formulate a physically correct model of sediment movement by size fraction. In addition, reconstruct the sequence and rate of adjustment for historical examples of river-channel change, to provide the temporal context in which to view the hydraulic characteristic at a particular point in time.

PROGRESS: During the 1989 fiscal year, three laboratory flume studies were conducted with a laser-Doppler velocimeter. In the first study, a comprehensive data set describing the velocity and Reynolds stress fields over two-dimensional bedforms was obtained; the mesurements are being used to improve computational models for flow over bedforms. In the second study, measurements of velocity and Reynold stress over beds composed of well- and poorly sorted material were collected to assess bed roughness. Sections of the flume bed were preserved, and current work is focused on the development of stereophotographic techniques for determination of bed roughness. Reduction of the flume data indicates that naturally emplaced beds may have roughness values significantly higher than those computed from the results of Nikuradse, a result that has important implications in developing a physically-based understanding of natural beds. In the third study, a flume experiment was conducted on the fluid dynamics of recirculating zones associated with a rapid expansion in channel width. The purpose of this study was to obtain information to improve the understanding of the three-dimensional aspects of recirculation zones in rivers, including the processes by which sediment enters and leaves the recirculation zones. In addition to these flume studies, an investigation of the adjustment of channel topography (including large mid-channel bars in the Green River, Utah) to variations in discharge was completed. Two-dimensional velocity fields, sediment-transport rates, and temporal evolution of channel topography at various discharges predicted by use of a fully nonlinear numerical model are in good agreement with measured characteristics of the study reach.

REPORTS PUBLISHED:

Andrews, E.D., and Nelson, J.M., 1989, Topographic response of a bar in Green River, Utah to variation in discharge, in Ikeda, S., and Parker, G., eds., River meandering: Washington, D.C., American Geophysical Union Mono-graph 12, p. 463-485.

Nelson, J.M., and Smith, J.D., 1989, Flow in meandering channels with natural topography, in. Ikeda, S., and Parker, G., eds., River Meandering: Washington, D.C., American Geophysical Union Monograph 12, p. 69-102.

Nelson, J.M., and Smith, J.D., 1989, Evolution and stability of erodible channel beds, in , Ikeda, S., and Parker, G., eds., River Meandering Washington, D.C., American Geophysical Union Monograph 12, p. 321-378.

Nelson, J.M., and Smith, J.D., 1989, Mechanics of flow over ripples and dunes: Journal of Geophysical Research, v. 94, no. C6, p. 4506-4522.

CR309 MISSISSIPPI RIVER SEDIMENT POLLUTANTS

TITLE: Sediment-Transported Pollutants in the Mississippi River

PROJECT NUMBER: CR 87-309

LOCATION: Topical Research

PROJECT CHIEF: Meade, Robert H.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: The source and fate of many pollutant substances in the Nation's largest river system are closely tied to suspended sediment. Accurate prediction of the fate of these pollutants will require more than our present understanding of the interactions between sediments and pollutants and the ways in which large rivers store and remobilize suspended sediment.

OBJECTIVE: Define and understand (1) processes by which pollutant substances, organic and inorganic, are adsorbed onto sediment particles; (2) downstream mixing of pollutants below the confluence of large tributaries with the mainstem; and (3) seasonal storage and remobilization of sediment and pollutants in the Mississippi River system.

APPROACH: Make two to three boat trips per year, beginning above St. Louis and ending at New Orleans, to sample 15 to 20 cross sections of the Mississippi River and its principal tributaries. Sample cross sections for large volumes of suspended sediment by the equal-width-increment method and other methods. Concentrate and analyze suspended sediment for a large number of organic and inorganic constitutents, both natural and manmade.

PROGRESS: Two sampling trips on the Mississippi between St. Louis and New Orleans were made in March and June 1989, bringing the total number of sampling cruises completed since 1987 to five. A pump-and-centrifuge procedure was refined for collecting and processing large-volume (500-Liter) discharge-weighted samples for analysis of toxic organics. Specific dissolved organic compounds are unique to individual tributaries (fire retardants in the Illinois River, for example), and can be used as tracers of the tributary inputs down the Mississippi mainstem. DDT and its metabolites are still present in river catfish despite the ban on DDT.

REPORTS PUBLISHED:

Meade, R.H., 1989, Sediment-transported pollutants in the Mississippi River: U.S. Geological Survey Yearbook, Fiscal Year 1988, p. 20-23.

Leenheer, J.A., Meade, R.H., Taylor, H.E., and Pereira, W.E., 1989, Sampling, fractionation, and dewatering of suspended sediment from the Mississippi river for geochemical and trace-contaminant analysis, in Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Phoenix, Arizona, September 26-30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-4220, p. 501-511.

Pereira, W.E., Rostad, C.E., and Leiker, T.J., 1989, Preliminary assessment of the fate and transport of synthetic organic agrochemicals in the lower Mississippi River and its tributaries, in Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Phoenix, Arizona, September 26-30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-4220, p. 453-464.

Rees, T.F., and Ranville, J.F., 1989, Characterization of colloids in the Mississippi River and its major tributaries, in Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program--Proceedings of the Technical Meeting, Phoenix, Arizona, September 26-30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-4220, p. 513-522.

CR311 SEDIMENT IMPACTS FROM DISTURBED LANDS

TITLE: Geomorphic and botantical impacts of sediment due to natural and unnatural land disturbance

PROJECT NUMBER: CR 79-311

LOCATION: Topical Research

PROJECT CHIEF: Osterkamp, Waite R.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Increased sediment yields from naturally stressed areas, such as mass-movement sites and devegetated lands, and human-stressed areas, such as mine spoils, urban areas, and agricultural lands, is one of the largest problems being addressed by agencies such as the U.S. Office of Surface Mining and U.S. Soil Conservation Service. The acquisition and interpretation of sediment data are among the most deficient areas that must be considered by these agencies. The impacts of natural and induced sediment movement on geomorphology and botany are sometimes intense; knowledge of these impacts is beneficial for understanding the effects of naturally occurring sediment movement.

OBJECTIVE: (1) Predict movement of sediment from naturally and unnaturally disturbed areas; (2) assess existing techniques and develop new techniques based on geomorphic, botanical, and statistical principles as aids in improving interpretive capabilities; and (3) evaluate geomorphic, botanic, and hydrologic changes changes caused by sediment movement from disturbed areas.

APPROACH: (1) Develop techniques for determining the amounts and rates of sediment movement from disturbed areas on the basis of factors such as land use, runoff, basin and landform morphology, and botanical indicators; (2) conduct research on the effects of sediment movement on landforms and vegetation using vegetation age, damage, and patterns of occurrence as indicators of the magnitude, frequency, and time of occurrence of destructive hydrologic events; (3) investigate the influence of ground-water flow on sediment transport and changes in landforms by analyzing near-surface and subsurface rates of water and sediment movement (including piping, sapping, and seepage erosion) in dynamic hydrologic systems; and (4) conduct research on the interactions between hydrology, water chemistry, and geochemistry as determinants of sediment movement through a hydrologic system, in conjunction and close coordination with other research and District personnel.

PROGRESS: (1) Channel-morphology studies are continuing in the Plum Creek basin, Colorado. Detailed data are being collected on water and sediment entering and leaving a valley section severly modified by a 1965 flood. The data will be used to estimate total sediment transport through the reach, estimate the amount of and determine storage sites for fine sediment, and explain how storage of fines affects bottomland recovery and promotes growth of channel islands and channel narrowing. (2) Among the Plum Creek studies is an investigation of the processes by which fines penetrate alluvial-channel beds; penetration is dependent on sizes of fines relative to available bed-material pore sizes. Empirical indices of the potential for fine-particle penetration have been applied to various data and are reliable indicators, but such indices reveal nothing about processes. Currently, quantitative descriptions of available pore sizes in alluvial material are being emphasized. A model for calculating pore sizes from particle-size distributions has been modified from a University of California code. A mercury-injection laboratory technique that appears promising as a method to measure pore-size distributions is being tested with field samples. (3) Studies involving use of beryllium-10 to trace sediment on the Southern High Plains are providing insights into hydrologic and eolian processes. Recent data demonstrate that ground-water recharge occurs from playa lakes, that little recharge occurs elsewhere, and that much of the relatively coarse eolian sediment becomes dunes on lees of playas even though large amounts of finer sediment are removed by wind from the High Plains each year.

REPORTS PUBLISHED:

Jobson, H.E., and Carey, W.P., 1988, Some observations on the interaction of fine sediment with alluvial streambeds, in Mallard, G.E., ed., U.S. Geological Survey Toxic Substances Hydrology Program--Surface-Water Contamination; Proceedings of the Technical Meeting, Denver, Colorado, February 2-4, 1987: U.S. Geological Survey Open-File Report 87-764, p. 145-156.

Carey, W.P., Brown, R.T., and Chatham, C.G., 1988, History of suspended-sediment data collection and inventory of available data for the

Tennessee and Cumberland River basins: U.S. Geological Survey Open-File Report 88-497, 51 p.

Jobson, H.E., and Carey, W.P., 1989, Interaction of fine sediment with alluvial streambeds: Water Resources Research, v. 25 no. 1, p. 135-140.

Osterkamp, W.R., Hack, J.T., Hupp, C.R., Olson, C.G., and Sherwood, W.C., 1989, Geomorphology and plant ecology of the Shenandoah Valley: Washington, D.C., American Geophysical Union, 18 p.

Osterkamp, W.R., 1989, Book review of Fluvial processes in river engineering, by Howard H. Chang: EOS, v. 70, no. 4, p. 51.

Osterkamp, W.R., 1989, Sediment storage and movement on the Southern High Plains of Texas as indicated by beryllium-ten, in Hadley, R.F., and Ongley, E.D., eds., Sediment and the environment (Proceedings of the Baltimore Symposium, May 1989): Wallingford, U.K., International Association of Hydrological Sciences, p. 173-182.

Osterkamp, W.R. (compiler), in press, A tribute to John T. Hack by his friends and colleagues, in Tinkler, Keith, ed., History of geomorphology from James Hutton to John Hack: Boston, Allen and Unwin.

Trimble, S.W., and Carey, W.P., in press, A comparison of the Brune and Churchill methods for computing sediment yeilds applied to a reservoir system, in Subitzky, Seymour, ed., Selected papers in the hydrologic sciences: U.S. Geological Survey Water-Supply Paper 2340, in press

CR313	SED.-WATER CHEM. IN LARGE RIVERS

TITLE: Sediment-Water Chemistry in Large River Systems: Biogeochemical, Geomorphic, and Human Controls

PROJECT NUMBER: CR 88-313

LOCATION: Topical Research

PROJECT CHIEF: Stallard, Robert F.

HEADQUARTERS OFFICE: Lakewood, CO

PROBLEM: Rivers are a major pathway to the ocean for erosion products and human wastes. The mechanisms that control the composition of river-borne materials are only imperfectly understood because erosion and the subsequent transport of material by rivers are mediated by a wide variety of closely linked chemical, biological, and physical processes. Moreover, in developed river systems such as those in the United States, these processes are subject to pervasive human-related perturbations. There is a need to develop through field and theoretical studies, a comprehensive and integrated description, of these processes for large river systems in a form that is useful to researchers in many disciplines.

OBJECTIVE: Describe how the biogeochemical and physical aspects of erosion and transport processes are reflected in the composition of river-borne materials for particular large river systems and develop general theoretical models that can be applied to rivers in general; evaluate the extent to which human activity has affected the river systems. Study how various chemical phases, natural or human-introduced, organic or inorganic, are partitioned between solid and dissolved loads in rivers and estuaries as the result of weathering, particle-surface reactions, biological uptake or release, atmospheric exchange, and storage during transit. Evaluate the dispersal pathways of river-borne substances through river systems and estuaries into and across the coastal marine environment.

APPROACH: Assemble, primarily from maps and data bases, current and historic chemical, geomorphic, biological, and demographic data for an entire river system. Identify phenomena that are especially important in controlling the composition of phases containing the major elements (H, C, O, Na, Mg, Al, Si, S, Cl, K, Ca, Ti, Fe) and certain minor indicator elements (N, F, P, Mn, Sr, Zr) to provide the conceptual framework for solving specific research objectives. Undertake field surveys, design sampling and analytical procedures, and create computer tools to manipulate and model data as part of these investigations. Formulate small scale field and laboratory studies to aid data interpretation as deemed necessary.

PROGRESS: The bulk of project work pertains to the examination of sediment-water chemical interactions in river systems. The emphasis is on describing how the compositions of dissolved and solid load in the mainstem and tributaries relate to the geology and geomorphology of subbasins. Ongoing work includes (1) chemical analysis of suspended load, bed material, water, soil, and atmospheric precipitation; (2) petrological examination of sediment and soil; (3) preparation of geological, biological, and climatological descriptions of the basin; and (4) compilation of historical geochemical and hydrological data to document trends. In July 1988, fieldwork was completed for a 6-year-long study (funded by the National Science Foundation) of the Orinoco River system in Venezuela and Colombia. Work on the Mississippi River project focuses on the mineralogical composition of sediment as a function of particle size, and on data interpretation by use of techniques 3 and 4 above. Collaborative studies of the transport of sediment, nutrients, and trace metals in the New Jersey coastal waters and the Amazon River estuary is continuing. A computer package for the graphical interpretation of major- and minor-element data in rivers and soil waters is being designed and tested; objectives are to identify classes of weathering reactions and biogeochemical processes that control sample composition and to provide a framework for the examination of trace-constituent data. In April 1989, field work was completed for a study (funded by the National Aeronautics and Space Administration (NASA)) of the effect of soil and surface-water hydrologic regime on the biogeochemical processes controlling gas emissions, with a focus on methane and carbon dioxide. Study sites are in Panama at the facilities of the Smithsonian Tropical Research Institute. Surface water, soil water, stream sediment, and soil chemistry are also being studied. In January 1989, a proposal was submitted to NASA to begin a similar study in the United States.

REPORTS PUBLISHED:

Johnsson, M. J., Stallard, R.F., and Meade, R. H., 1988, First-cycle quartz arenites in the Orinoco River basin, Venezuela and Colombia: Journal of Geology, v. 96, no. 3, p. 263-277.

Koehnken Hernandez, Lois, and Stallard, R.F., 1988, Sediment sampling through ultrafiltration: Journal of Sedimentary Petrology, v. 58, no. 4, p. 758-759.

Murnane, R.J., and Stallard, R.F., 1988, Germanium/silicon fractionation during biogenic opal formation: Paleoceanography, v. 3, no. 4, p. 461-469.

Johnsson, M. J., and Stallard, R.F., in press, Physiographic controls on the composition of sediments derived from volcanic and sedimentary terrains on Barro Colorado Island, Panama: Journal of Sedimentary Petrology, v. 59, no. 5.

Stallard, R.F., Koehnken, Lois, and Johnsson, M.J., in press, Weathering processes and the composition of inorganic material transported through the Orinoco River system, Venezuela and Colombia, in Alvarez, H., Weibezahn, F., and Lewis, W.M., Jr., eds., Ecosistema Orinoco--conocimiento actual y necesidades de futoros estudios symposium volume: 0 Caracas, Venezuela. Asociacion Venezolana para el Avance de la Ciencia.