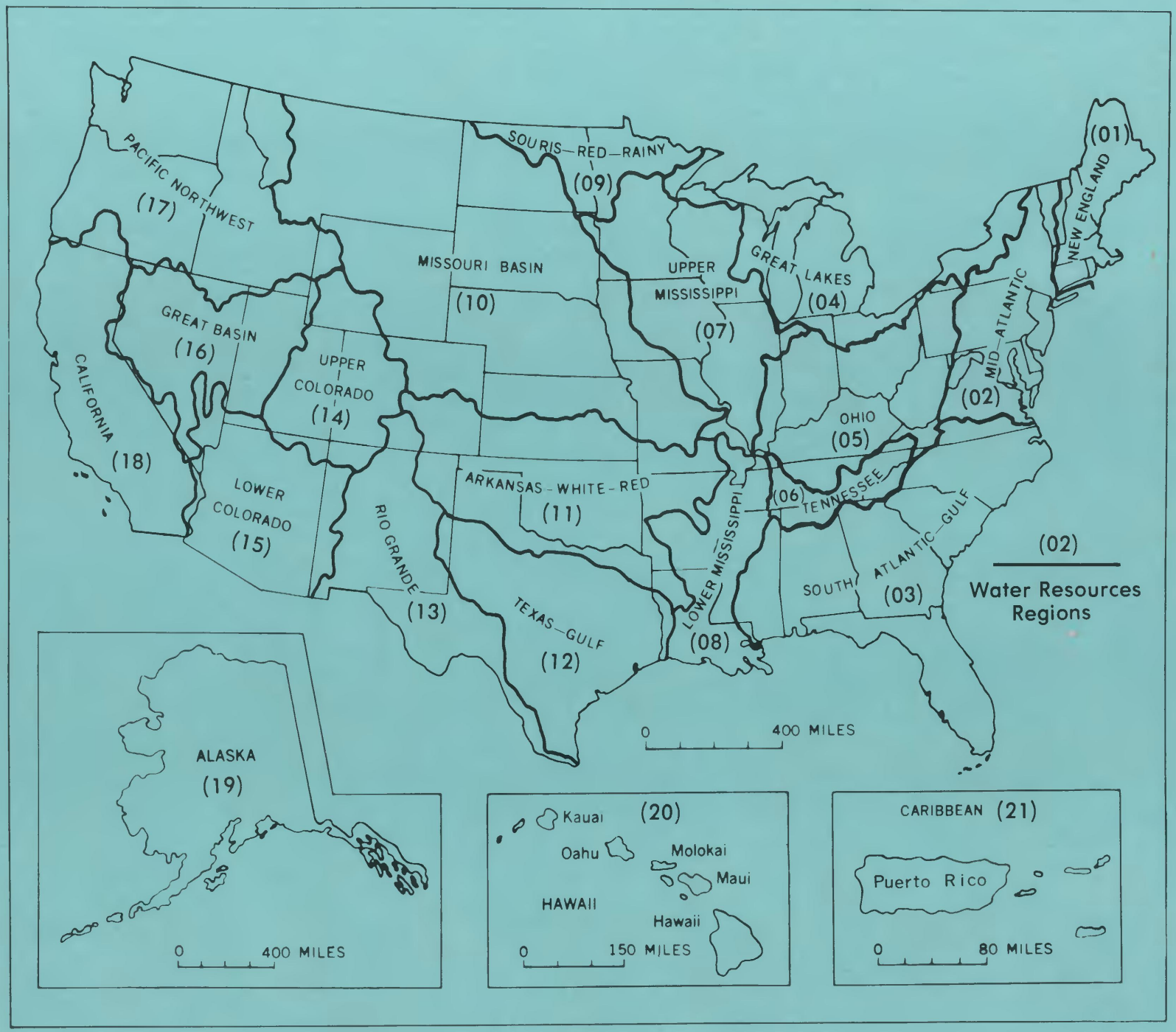
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1980

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
OFFICE OF WATER DATA COORDINATION
RESTON, VIRGINIA 22092



Water Resources Regions of the United States

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1980

Prepared by
U.S. DEPARTMENT OF AGRICULTURE
Science & Education Administration

Agricultural Research
for the
Subcommittee on Sedimentation
of the
INTERAGENCY ADVISORY COMMITTEE OF WATER DATA

U.S. DEPARTMENT OF THE INTERIOR
Geological Survey
Office of Water Data Coordination
Reston, Virginia 22092

June 1981

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1980

Preface

The need for disseminating current information on activities in the field of sedimentation was proposed by the Chairman of the Federal Interagency River Basin Committee's Subcommittee on Sedimentation shortly after the subcommittee was formed in May 1946. At the fifth meeting of the subcommittee on September 17, 1946, the members approved this proposal and agreed to the issuance of the quarterly report as one means of effecting better coordination of the work of various Federal agencies in the field of sedimentation.

Quarterly reports were issued during the period of July 1, 1946, through June 30, 1947, when the reporting period was changed to a 6-month period, and semiannual reports were issued through 1953. Starting in 1954 and continuing through the present, these reports have been made annually and cover the activities of the Federal agencies in the field of sedimentation on the calendar year basis.

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material has been organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign. There is also a section on Research and Other Activities.

In the past, each issue of "Notes on Sedimentation Activities" contained a list of stations at which sediment data have been obtained giving the station location, drainage area, and other related information. Because the station list does not change significantly from year to year, the decision was made to include the listings every other year in the interest of economizing. Therefore, the station list in the 1979 issue is considered to be still current. An updated station listing will be included in the 1981 issue.

Information for "Notes on Sedimentation Activities" for calendar year 1980 was contributed by the representatives of participating Federal agencies. Suggestions for improving the report, both in content and in format, are welcome.

CONTENTS

ILLUSTRATIONS

SUBCOMMITTEE ON SEDIMENTATION

Interagency Advisory Committee on Water Data

FY 1981

DEPARTMENT OF AGRICULTURE

John N. Holeman (Member)
Soil Conservation Service
Room 6132, South Agriculture Bldg.
P.O. Box 2890
Washington, D.C. 20013
Com 447-5858 FTS 447-5858

William F. Mildner (Alternate)
Soil Conservation Service
10,000 Aerospace Road
Lanham, Maryland 20801
Com 436-7810 FTS 436-7810

Dave Farrell (Member)
Science & Education Administration-AR
National Program Staff
Room 240, Bldg. 005-BARC-W
Beltsville, Maryland 20705
Com 334-4034 FTS 344-4034

Jerry Ritchie (Alternate)
Science & Education Administration-AR
National Program Staff
Room 240, Bldg. 005-BARC-W
Beltsville, Maryland 20705
Com 334-4034 FTS 344-4034

John Currier (Member)
Hydrologist, Area Planning & Development
Forest Service, USDA, Room 4207
P.O. Box 2417 Washington, D.C. 20013
Com 447-7403 FTS 447-7403

DEPARTMENT OF THE ARMY

Shapur A. "Shap" Zanganeh (Member)
Corps of Engineers DAEN-CWE-HY
Washington, D.C. 20314
Com 272-0224 FTS 272-0224

Yung H. Kuo (Alternate)
Corps of Engineers DAEN-CWE-HY
Washington, D.C. 20314
Com 272-0224 FTS 272-0224

DEPARTMENT OF THE INTERIOR

Louis W. Cable (Member)
U.S. Geological Survey
Office of Water Data Coordination
417 National Center
Reston, VA 22092
Com 860-6935 FTS 928-6935

David F. Gudgel (Member)
Bureau of Reclamation
Department of the Interior
Room 7451
Washington, D.C. 20240
Com 343-5275 FTS 343-5275

Wilton Johnson (Member)
Bureau of Mines
Division of Mineral
Land Assessment
2401 E. Street N.W.
Washington, D.C. 20241
Com 634-4746

Jose' R. Del Rio (Member)
Office of Surface Mining
Room 118, So. Interior Bldg.
1951 Constitution Ave., N.W.
Washington, D.C. 20245
Com 343-4022 FTS 343-4022

Milton Schloss (Member)
Bureau of Land Management 211
18th and C Streets, N.W.
Washington, D.C. 20240
Com 343-5994 FTS 343-5994

DEPARTMENT OF COMMERCE

Richard B. Perry (Chairman)
National Ocean Survey
NOAA 6001 Executive Blvd. Cx43
Rockville, Maryland 20852
Com 443-8154 FTS 443-8154

David B. Duane (Alternate)
National Sea Grant Program NOAA,
Room 606 6010 Executive Blvd.
Rockville, Maryland 20852
Com 443-8894 FTS 443-8894

DEPARTMENT OF ENERGY

Shou-Shan Fan (Member)
Regulatory Analysis
Room 3000 Fed'l Energy Regulator Comm.
825 N. Capitol Street N.W.
Washington, D.C. 20426
Com 357-8292

John Mathur (Member)
Regional Assessment Division
Energy Research & Development Admin.
Mailstop E-201
Washington, D.C. 20545
Com 353-5898

TENNESSEE VALLEY AUTHORITY

William M. McMaster (Member)
Tennessee Valley Authority Data
Services Branch
350 Evans Bldg.
Knoxville, Tennessee 37902
Com 615-632-3295 FTS 856-3295

DEPARTMENT OF TRANSPORTATION

Murray L. Corry (Member)
FHWA
Room 3113 Nassif Bldg.
400 7th Street, S.W.
Washington, D.C. 20590
Com 472-7690

D.C. "Charlie" Woo (Alternate)
FHWA (HRS-42) Room 6320 Nassif Bldg.
400 7th St., S.W.
Washington, D.C. 20590
Com 426-4980

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Truman Goins (Member)
Office of Environmental Quality
7274 Room HUD Bldg. 451 7th St., S.W.
Washington, D.C. 20410
Com 755-6304

ENVIRONMENTAL PROTECTION AGENCY

Robert E. Thronson (Member)
Office of Water Program Operations (WH-554)
Room 2417-D
Waterside Mall EPA
Washington, D.C. 20460
Com 755-9233

NEW ENGLAND REGION

GEOLOGICAL SURVEY

St. John Subregion

1. Suspended-sediment data are being collected on a monthly basis at Aroostook River at Caribou, Maine, and at St. John River near Van Buren, Maine, as a part of the National Stream Quality Accounting Network (NASQAN).

Penobscot Subregion

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

Kennebec Subregion

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

Androscoggin Subregion

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

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

Maine Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Croix River at Milltown, Maine, and bimonthly at Narraguagus River at Cherryfield, Maine, as a part of NASQAN.

Saco Subregion

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

Merrimack Subregion

1. Suspended-sediment data are being collected on a monthly basis at Merrimack River above Lowell, Mass., and bimonthly at Merrimack River at Concord, New Hampshire, as a part of NASQAN.

Connecticut Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Connecticut

River at Wells River, Vt., and monthly at Connecticut River at North Walpole, N.H., (relocated from North Walpole) and at Connecticut River at Thompsonville, Conn., as a part of NASQAN.

Massachusetts-Rhode Island Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Charles River at Dover, Mass., bimonthly at Blackstone River at Millville, Mass., and at Pawcatuck River at Westerly, R.I., as a part of NASQAN.

Connecticut Coastal Subregion

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

2. Suspended-sediment data were collected on approximately a daily basis at Yantic River at Yantic, Conn., to determine daily sediment loads. Data collection was discontinued at this site on Sept. 30, 1980.

St. Francois Subregion

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

Special Studies

1. Sediment data were collected on approximately a daily basis at Housatonic River at Great Barrington, Mass., Housatonic River at Falls Village, Conn., and Housatonic River at Gaylordsville, Conn., as part of a study to determine the quantity, distribution, and method of transport of PCB in the Housatonic River. The study was done in cooperation with the State of Connecticut Department of Environmental Protection. The data collection was discontinued on Sept. 30, 1980.

2. Sediment data are being collected on a daily basis at Muddy Brook at Childs Hill Road near Woodstock, Conn., to determine daily sediment loads, as part of a study to determine the effects of agricultural management practices being implemented in the Little River watershed. The study is being done in cooperation with the Northeastern Connecticut Regional Planning Agency.

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

District Chief, WRD
U.S. Geological Survey
135 High Street, Room 235
Hartford, CT 06103

District Chief, WRD
U.S. Geological Survey
150 Causeway Street, Suite 1001
Boston, MA 02114

SOIL CONSERVATION SERVICE

1. Determinations of sediment yields were completed in the following watersheds:

a. Public Law-566

Major Drainage	Watershed	County	State
Kennebec River	Lovejoy pond	Kennebec	ME

b. River Basin Investigations

Major Basin	Basin Reported	State
Housatonic	Town Brook	MA
Atlantic Coastal	Maidford River	RI
Atlantic Coastal	Hardig Brook	RI

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Libby Brook Site 1	Aroostook	ME
Libby Brook Site 2	Aroostook	ME

MID ATLANTIC REGION

CORPS OF ENGINEERS

North Atlantic Division

Baltimore District

The following data are on accumulated sediment, collected during 1980. The data are records of the material removed during routine maintenance of flood control projects.

Project Location	Stream	Sediment Removal	Sediment Removed During 1980 (CU YDS)
Almond Lake	Canacadea Creek	Rt. 21 Br	2,800
Arkport Dam, N.Y.	Canisteo River	Intake Channel	3,665
Binghamton, N.Y.	Pierce Creek	Channel above paved channel	610
Canisteo, N.Y.	Purdy Creek	Check Dam	7,540
		Confluence with Bennett Creek	456
Hornell, N.Y.	Canacadea Creek	Check Dam	3,492
		Unpaved Channel below check dam	450
	Crosby Creek	Check Dam	6,913
		At confluence with Canisteo River	582
Lisle, N.Y.	Dudley Creek and Tioughnioga River	Channel at confluence	4,300
Oxford, N.Y.	Chenango River	Channel	2,200
Whitney Point, N.Y.	Tioughnioga River	Channel	150

New York District

The District conducted sediment tests at the following locations:

Project Name	Bioassay*	Bioaccumulation	Elutriate	Grain Size
Bay Ridge Channel (Fed. Proj. #34)			X	
Mud Dump				X
Ward's Point Bend (Fed Proj. #63)	X	X	X	X
Milton Harbor (#85)	X	X	X	X
Flushing Bay and Creek (#9)	X	X	X	X
Sandy Hook Junction (#63)	X	X	X	X
Red Hook Anchorage (#62)	X	X	X	X
Bay Ridge Channel (#34)	X	X	X	X
Ambrose Channel (#62)				X
Shrewsbury River (#80)				X
Buttermilk Channel (#36)	X	X	X	X
Passaic River (#64)	X	X	X	X
Newark Bay (#64)	X	X	X	X
Port Elizabeth-Pt. Newark (#64)	X	X	X	X
Keyport-Matawan Hbrs (#74-75)	X	X	X	X
Harlem River				X
Little Neck Bay				X
Southwest of Mud Dumpsite				X
Site South of Milton Harbor				X
Manhasset Bay				X
Great Kills Harbor (#69)				X
Navesink River				X
Avon Beach (at Shark R. #81)				X
Shark River (#81)				X

			Bulk Analysis	Grain Size
Port Authority-Passenger Ship Term.			X	X
United States Gypsum			X	X
Hudson River-Edgewater-Weehawken Channel (#41)			X	
Transect across Hudson R. (#41)	suspended particulate profile			
Bronx River (#8)	suspended sediment sampling			

*The bioassay of appropriate sensitive marine organisms can be used as an aid in evaluating the importance of dissolved chemical constituents released from the sediment during disposal operations. This procedure can also be used to evaluate the effect of suspended particulate matter that is present in the water column for certain periods of time during disposal of dredged material. A series of experimental treatments and controls are established using the liquid phase or suspended particulate phase of the dredged material and disposal site water. The test organisms are added to the test chambers and incubated under standard conditions

for a prescribed period of time. The surviving organisms are examined at appropriate intervals to determine if the test material is producing an effect.

Philadelphia District

District sedimentation activities during 1980 were continued financial support of the United States Geological Survey for the collection of sediment data at:

Delaware River at Trenton, New Jersey
Schuylkill River at Berne, Pennsylvania
Schuylkill River at Philadelphia, Pennsylvania
Delaware River below Tocks Island, New Jersey

MID ATLANTIC REGION

GEOLOGICAL SURVEY

Richelieu Subregion

1. Suspended-sediment data are being collected on a periodic basis at Richelieu River (Lake Champlain) at Rouses Point, N.Y., 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, N.Y., and Hudson River at Waterford, N.Y., in cooperation with the New York State Department of Environmental Conservation. Sediment data collected on a daily basis at Mohawk River at Cohoes, N.Y., was discontinued September 30, 1979. Collection of sediment data at Hudson River at Rogers Island at Ft. Edward, N.Y., and Hudson River at Schuylerville, N.Y., was reduced from daily to periodic basis on September 30, 1979.

2. Suspended-sediment data are being collected on a periodic basis at Hudson River at Glens Falls, N.Y., in cooperation with the New York State Department of Environmental Conservation (discontinued September 30, 1979).

3. Suspended-sediment data are being collected on a periodic basis at Hudson River at Green Island, N.Y., as a part of NASQAN.

4. Suspended-sediment are being collected on a periodic basis at Esopus Creek at Shandaken, N.Y., as a part of the National Hydrologic Benchmark Network.

5. Suspended-sediment data are being collected on a periodic basis at Hudson River at Castleton-on-Hudson, N.Y., Hudson River at Catskill, N.Y., Hudson River at Staatsburg, N.Y., Hudson River at Clinton Point near New Hajburg, N.Y., and Hudson River at Highland Falls, N.Y., in cooperation with New York Department of Environmental Conservation.

Lower Hudson-Long Island Subregion

1. Suspended-sediment data are being collected at Passaic River at Little Falls, N.J., Raritan River near South Bound Brook, N.J., Peconic River at Riverhead, N.Y., Nissequoque River near Smithtown, N.Y., and at Carmans River at Yaphawk, N.Y., as a part of NASQAN.

2. Suspended-sediment data are being collected twice monthly at Passaic River at Singac, N.J., and Passaic River at Elmwood Park, N.J., as part of the Environmental Protection Agency's National Water Quality Surveillance System program.

Delaware Subregion

1. Suspended-sediment data are being collected on a monthly basis at Toms River near Toms River, N.J., Maurice River at Norman, N.J., and West Branch Wading River at Maxwell, N.J., and on a daily basis at Delaware River at Trenton, N.J., as a part of NASQAN.

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

3. Suspended-sediment data are being collected on a daily basis at Brandywine Creek at Wilmington, Del., in cooperation with the Delaware Geological Survey.

4. Suspended-sediment data are being collected on a daily basis at two sites on the Schuylkill River, Berne and Philadelphia, (Manayunk) Pa. The data will be anaylzed by the U. S. Corps of Engineers to evaluate the Delaware River dredging programs. Sediment data are also being collected on a daily and storm basis on Schuylkill River near Landingville, Penn., to determine storm and daily sediment discharge rates.

Susquehanna Subregion

1. Suspended-sediment data are being collected on a daily basis at Switzer Creek near Cohocton, N.Y., and with an automatic sampler to provide additional data during high flow. Data are collected in cooperation with the Susquehana River Basin Commission.

2. Suspended-sediment data are being collected on a monthly and storm event basis at Young Womens Creek near Renovo, Penn., as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected at Juniata River at Newport, Penn., as a Federal sediment index station.

4. Suspended-sediment data are being collected on a daily basis at Tioga River at Lindley, N.Y., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a daily basis at Susquehanna River at Conowingo, Md., for the Environmental Protection Agency's Chesapeake Bay Program and as a part of NASQAN.

Upper Chesapeake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Choptank River near Greensboro, Md., and at Patuxent River near Bowie, Md., as a part of NASQAN.

Potomac Subregion

1. Suspended-sediment data are being collected on a monthly basis at the following stations as part of the hydrologic assessment of the Eastern Coal Province:

a. North Branch Potomac River at Steyer, Md.
b. Savage River below Savage River Dam near Bloomington, Md.
c. Georges Creek at Franklin, Md.
d. North Branch Potomac River at Pinto, Md.
e. Wills Creek near Cumberland, Md.

2. Suspended-sediment data are being collected on a daily basis at North Branch Potomac River near Cumberland, Md., and at Monacacy River at Reichs Ford Bridge near Frederick, Md., in cooperation with the Maryland Geological Survey.

3. Suspended-sediment data are being collected on a daily basis at Cononcocheaque Creek at Fairview, Md., and at Potomac River at Point of Rocks, Md., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected at Potomac River at Shepherdstown, W.Va., and Shenandoah River at Millville, W.Va., as a part of NASQAN.

5. Suspended-sediment data are being collected on a monthly basis at Lost River at McCauley near Baker, W. Va., for the U.S. Soil Conservation Service (discontinued September 30, 1979).

6. Suspended-sediment data are being collected on a monthly basis at North Fork of South Fork Potomac River at Cabin, W.Va., and at Abram Creek at Highway 50 Bridge near Mount Storm, W.Va., as part of the Coal Hydrology Program.

7. Suspended-sediment data are being collected on a daily basis at Potomac River at Chain Bridge, Washington, D.C., for the Environmental Protection Agency's Chesapeake Bay Program, and as part of NASQAN.

Lower Chesapeake Subregion

1. Suspended-sediment data are being collected on a daily basis on Rappahannock River at Remington, Va., as a Federal sediment index station.

Special Studies

1. A study of non-point sources of sediment, nutrients, and pesticides was started during the 1977 water year in the Pequea Creek Basin in Lancaster County, Pennsylvania. Data collection which continued through the 1978 water year includes the operation of an automatic suspended-sediment sampler on the Pequea Creek at Martic Forge. The study is in cooperation with the Susquehanna River Basin Commission, and has the support of the Chesapeake Bay Program.

2. Sediment data were collected during the 1978 and 1979 water years at three sites in Northern Pennsylvania. The data were collected as part of a study to evaluate the effects of surface mining operations on the Babb Creek basin. The study is in cooperation with USGS-OACR.

3. The basic suspended-sediment sampling network of 210 stations established by the New Jersey District is carried out in cooperation with the U.S. Corps of Engineers, N.J. Department of Environmental Protection, and the N.J. Department of Agriculture, Soil Conservation Service. Suspended-sediment samples are collected six to eight times a year.

4. Collection of sediment data was obtained at the Coastal Plain Index Station at Great Egg Harbor River at Folsom, N.J., normally at a frequency of twice weekly and twice daily during runoff conditions. This work is being done

as part of the Federal CBR program to determine trends and the general hydrologic conditions.

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

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 1350
U.S. Post Office and
Courthouse Building, Room 304
Albany, NY 12201

District Chief, WRD
U.S. Geological Survey
P.O. Box 1238
Federal Building, Room 436
Trenton, NJ 08607

District Chief, WRD
U.S. Geological Survey
200 Grace Street, Room 304
Richmond, VA 23220

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S.
Courthouse
Room 3017
500 Quarrier Street
East Charleston, WV 25301

District Chief, WRD
U.S. Geological Survey
Post Office Box 1107
4th Floor, Federal Building
228 Walnut Street
Harrisburg, PA 17108

SOIL CONSERVATION SERVICE

1. Reservoir sedimentation surveys were made in the following reservoirs in 1980:

Reservoir	Major Drainage	County	State
Marsh Creek PA-600	Susquehanna	Tioga	PA
Clove Acres Lake	Clove Brook	Sussex	NJ
Mountain River 8A	Rappahannock River	Culpeper	VA
Mountain River 11	Peppahannock River	Culpeper	VA
South River 26	Potomac River	Augusta	VA
Cannonsville	Delaware River	Delaware	NY

SOUTH ATLANTIC-GULF REGION

CORPS OF ENGINEERS

South Atlantic Division

Charleston District

A sedimentation report and a Reservoir Sediment Data Summary for W. Kerr Scott Reservoir were completed and forwarded for approval in March 1980. The report was approved and the Reservoir Sediment Data Summary revised in October 1980.

On 1 April 1980, operational responsibilities of W. Kerr Scott Reservoir were transferred to Wilmington District. All backup data for the above sedimentation report has been transferred too.

Mobile District

Sedimentation Range Network Monitoring

1. The sedimentation range networks in the Coffeeville, Demopolis, Gainesville and Aliceville Projects were resurveyed during the year. Initial survey of the Columbus Project sedimentation range network is planned for January and February 1981. These projects are located on the Tombigbee River and are a part of the Tennessee-Tombigbee Waterway.

2. Complete network resurveys of the projects are made annually to provide data for a cooperative study that is being conducted by this office and the Waterways Experiment Station at Vicksburg, Mississippi.

3. In addition, resurveys of selected ranges are being conducted at 6-month intervals to supplement the data collected annually.

4. Resurveys of the range networks in Bankhead and Holt Reservoirs on the Black Warrior River were also made during the year.

Sedimentation Design Memoranda. The sedimentation design memorandum for the Canal Section Project was completed and approved on 25 September 1980. This memorandum is the fifth in a series of five for the Tennessee-Tombigbee Waterway.

Sedimentation Studies

1. The on-going study to determine the natural sedimentation characteristics of the Tibbee River and its tributaries continued through 1980 and probably will be completed in 1981.

2. The analysis to determine the erosion rates, deposition, and predicted future effects to six Alabama Power Company dams by the

proposed construction of the Coosa River Waterway is continuing on a limited basis due to man-hours available.

3. The sedimentation study of the lower Tombigbee and Alabama Rivers and the Mobile River Delta began in March 1980 and is planned to continue through 1981.

4. The sedimentation study Twenty Mile Creek began in the fall of 1980 with data collection to continue in 1981.

Suspended Sediment Investigations

1. During the year data were collected on a daily basis from locations on the Tombigbee River at Columbus, Aberdeen, Amory, and Fulton, Mississippi. Additionally, suspended sediment samples for various studies were obtained at stations located throughout the Tombigbee, Alabama, and Mobile River systems during the year.

2. The installation of permanent suspended sediment monitors on dams located in the Tenn-Tom Project area was stopped due to damages to the submerged pumps during high water. Alternative locations and/or samplers are being considered and installations are planned in 1981.

3. The reduction in the number of stations, where sedimentation data was collected at 5-week intervals, from those listed in the 1979 Report was required due to the available man-hours.

Wilmington District

Sedimentation Surveys

1. John H. Kerr Dam and Reservoir, Roanoke River, VA and NC. The sedimentation ranges at Kerr were resurveyed during 1976 in order to determine the amount of storage lost to sedimentation since the last survey was made in 1959-60. A sedimentation report was prepared and approved by the Office of the Chief of Engineers on 26 June 1980. A study using the revised capacity curve revealed that an adjustment to the hydroelectric dependable capacity of the project was not warranted.

2. Philpott Lake, Smith River, VA. The sedimentation ranges at Philpott were resurveyed during 1976 in order to determine the amount of storage lost to sedimentation since the last resurvey was made in 1960. A sedimentation report was prepared and approved by the Office of the Chief of Engineers on 14 July 1980. A study using the revised capacity curve revealed that an adjustment to the hydroelectric dependable capacity of the project was not warranted.

3. B. Everett Jordan Dam and Lake, Haw River, NC. In CY 1979, a system of 57 sedimentation ranges were established across the main body and tributaries of Jordan Lake (a new unfilled lake). A report describing the ranges monumentation and resurvey plans was prepared and approved by the Office of the Chief of Engineers on 19 September 1980.

4. W. Kerr Scott Dam and Reservoir, Yadkin River, NC. In CY 1980, operation of W. Kerr Scott Dam and Reservoir was transferred to Wilmington District. A report on the 1978 sedimentation resurvey was prepared by Charleston District prior to transfer of operation. This report was approved by the Office of the Chief of Engineers on 26 August 1980.

Sediment Load Measurement. Two suspended sediment sampling stations (at Randolph, VA on Roanoke River and at Paces, VA on Dan River) upstream from John H. Kerr Reservoir were operated. The data (suspended sediment, particle size, chemical analysis and temperature) were used in connection with operation and maintenance of the reservoir.

SOUTH ATLANTIC-GULF REGION

GEOLOGICAL SURVEY

Chowan-Roanoke Subregion

1. Suspended-sediment data are being collected daily during flood events and at 7-day intervals for periods of medium to low flows at Dan River at Paces, Va., and at Roanoke River at Randolph, Va., in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are collected monthly at Nottaway River near Sebrell, Va., Meherrin River at Emporia, Va., and Blackwater River near Franklin, Va., as a part of NASQAN.

3. Suspended-sediment data are collected monthly at Roanoke River at Roanoke Rapids, N.C., as part of the National Stream Quality Accounting Network NASQAN).

Neuse-Pamlico Subregion

1. Suspended-sediment data are being collected on a daily basis at the main station on the Chicod Creek and on a monthly basis at three sites in the Chicod Creek watershed near Grimesland, N.C., in cooperation with the U.S. Department of Agriculture, Soil Conservation Service. These data will be used to determine changes caused by channelization. Automatic sediment samplers were installed at two in-stream sediment traps to determine settling characteristics of the traps. Cross-sectional surveys of the traps were made immediately following major storms to determine the amounts of sediment deposited by high flows.

2. Suspended-sediment data are collected monthly at Neuse River at Kinston, Tar River at Tarboro, and Contentnea Creek at Hookerton, N. C. as a part of NASQAN.

Cape Fear Subregion

1. Suspended-sediment data are being collected at Black River at Dunn, N.C. to determine effects on stream characteristics by channel construction. This is being done in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are collected monthly on the Cape Fear River at Lock 1 near Kelly, N.C. as part of the NASQAN program.

Pee Dee Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at Lynches River at Effingham, S.C., Black River at Kingstree, S.C., and at Pee Dee River near Rockingham, N.C., as a part of NASQAN.

3. Suspended-sediment are being collected bimonthly at Pee Dee River at Pee Dee, S.C., as a part of NASQAN.

4. Suspended-sediment data are being collected daily at the Yadkin River at Yadkin College, N.C., as a Federal Sediment Index Station.

Santee-Edisto Subregion

1. Suspended-sediment data are being collected on a monthly basis at Lakes Marion - Moultrie Diversion Canal near Pineville, S.C., at Edisto River near Givhans, S.C., and at Coosawhatchie River near Hampton, S.C., as a part of NASQAN. 2. Suspended-sediment data are being collected on a monthly basis at Crawl Creek near Pineville, S.C., Santee River below St. Stephens, S.C. This is being done in cooperation with the U.S. Corps of Engineers.

Ogeechee-Savannah Subregion

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

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

3. Suspended-sediment data are being collected on a periodic basis at Brier Creek near Wagesboro, Ga., in cooperation with the Georgia Geologic Survey.

Altamaha-St. Marys Subregion

1. Suspended-sediment data are being collected on a monthly 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 monthly basis at Altamaha River near Everett City, Ga., at Satilla River at Atkinson, Ga., and at St. Mary's River near Macclenny, Fla. as a part of NASQAN.

3. Suspended-sediment data are being collected at South River near McDonough, Ga., at Yellow River near Covington, Ga., at Pates Creek near Flippin, Ga., Ohoope River near Reidsville, Ga., Penholoway Creek near Jessup, Ga., and at Little Satilla River near Offerman, Ga., in cooperation with the Georgia Geologic Survey Division.

St Johns Subregion

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

Southern Florida Subregion

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

Peace-Tampa Bay Subregion

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

Suwannee Subregion

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

Ochlockonee Subregion

1. Suspended-sediment data are being collected on a monthly basis at two sites 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 monthly basis at three sites in Florida as a part of NASQAN. Suspended-sediment data are being collected periodically at five sites in the Apalachicola River basin as part of a River Quality Assessment program.

2. Suspended-sediment data are being collected on a periodic basis at Chattahoochee River near Cornelia, Ga., at Sweetwater Creek near Austell, Ga., at Upatoi Creek near Columbus, Ga., in cooperation with the Georgia Geologic Survey.

Choctawhatchee-Escambia Subregion

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

Alabama Subregion

1. Suspended-sediment data are being collected on a periodic basis at Coosawatee River near Ellijay, Ga., Holly Creek near Chatsworth, Ga., and West Armuchee Creek near Subligna, Ga., in cooperation with the Georgia Geologic Survey.

2. Suspended-sediment data are being collected in the Upper Coosa River basin at two sites on a monthly basis and at ten sites on a semi-annual basis as part of the OSM Coal Hydrology study in Georgia.

3. Suspended-sediment data are being collected on a monthly basis at Alabama River at Montgomery, Ala., and at Alabama River at Claiborne, Ala., as a part of NASQAN.

Mobile-Tombigbee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tombigbee River at Gainesville, Ala., and at Tombigbee River at Coffeeville lock and dam, Ala., and bimonthly at Black Warrior River below Warrior Dam near Eutaw, Ala., as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Sipsey Fork near Grayson, Ala., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected by an automatic pumping sampler at Mackeys Creek below Bay Springs lock and dam, Miss., in cooperation with the U.S. Corps of Engineers, to estimate the impact of sediment loads on the Tennessee-Tombigbee Waterway.

Pascagoula Subregion

1. Suspended-sediment data are being collected on a monthly basis at Pascagoula River near Benndale, Miss., and bimonthly at Wolf Creek near Landon, Miss., as a part of NASQAN.

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

3. Suspended-sediment data are being collected on a bimonthly basis at Escatawpa River near Agricola, Miss., 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 monthly basis at Bogue Chitto River near Bush, La., as a part of NASQAN.

Special Studies

1. Suspended-sediment sampling by an automatic sampler was continued on Yellow Creek near Northport, Ala., on Blue Creek near Oakman, Ala., and on Bear Creek near Samantha, Ala., as part of a study of coal-mine hydrology in cooperation with the Bureau of Land Management. Samples were collected monthly and during flood events at one additional site in the Yellow Creek basin, one site on Turkey Creek (Tuscaloosa County) near Tuscaloosa, Ala. one site on Cripple Creek east of Samantha, Ala. Beginning in March, 1980 samples were collected monthly and during flood events on Tyro Creek near New Lexington, Ala., on Hurricane Creek near Cedar Cover. Ala., on Barbee Creek near Samantha, Ala., and on Hamah Mill Creek near Burchfield, Ala.

2. Suspended-sediment sampling by an automatic sampler was continued on Trinity Creek near Carbon Hill, Ala., and on Blue Creek near Oakman, Ala.

3. Suspended-sediment sampling during storm events was continued in two agricultural basins in southwest Georgia in conjunction with an ongoing study of the effects of agricultural runoff on receiving waters.

4. Suspended-sediment sampling by automatic pumping sampler was started on Dorsey Creek near Arkadelphia, Ala., on March 1, 1979.

5. Suspended-sediment sampling by automatic pumping sampler was begun at three forested sites located in North Carolina to define characteristics of relatively unpolluted streams.

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

District Chief, WRD
U.S. Geological Survey
P.O. Box V
Oil and Gas Board Building
Room 202
University, AL 35486

District Chief, WRD
U.S. Geological Survey
325 John Knox Road, Suite F-240
Tallahassee, FL 32303

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
6554 Florida Boulevard
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
P.O. Box 2857,
Century Station Post Office Building
Room 436
Raleigh, NC 27602

District Chief, WRD
U.S. Geological Survey
2001 Assembly Street, Suite 200
Columbia, SC 29201

District Chief, WRD
U.S. Geological Survey
200 West Grace Street, Room 304
Richmond, VA 23220

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for watershed plans in the following watersheds during 1980:

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Santee River	Northeast Calhoun	Buckhead Ck. Squirrel Ck. Warley Ck. Halfway Swamp Creek	Calhoun	SC
Savannah River	Little River	Little River	Abbeville, Anderson, & McCormick	SC
Choctawhatchee-Escambia	Upper Choctawhatchee 03140201	Kelly-Preston Mill Ck. SCS Subwatershed 040	Dale	AL
Neuse River	#13-Bear Ck.	Un-Named Trib of Bear Ck.	Wayne	NC
Neuse River	#1-Crabtree Ck.	Sirrup-Iron	Wake	NC
Yadkin River	#10-Dutchman Ck.	Un-Named Trib of Cedar Ck.	Davie	NC
Yadkin River	#16-Muddy Ck.	South Fork of Muddy	McDowell	NC
Yadkin River	#7A-Third Ck.	Third Ck.	Alexander	NC

b. River Basin Investigations

River Basin	State
Tombigbee	MS
Pascagoula	MS
Pearl River	MS

River Basin	State
Apalachicola	GA
Altanaha	GA
Suwannee	GA
Ochlocknee	GA

C. Reservoir sedimentation surveys were made in the following reservoirs in 1980:

Reservoir	County	State
Site 14 Choccolocco Ck	Talladega	AL
Site 22 Town Ck	Lawrence	AL
Site 8 Powell Ck	Marango	AL
Str. 16	Pickens	SC
Site 4	Oconee	SC
Sautee Ck #13	White	GA

GREAT LAKES REGION

CORPS OF ENGINEERS

North Central Division

Buffalo District

Lake Erie Wastewater Management Study. The Water Quality Section supported water sample collection and analysis at 10 stations during CY 80. Continuous automatic samplers were operated at:

1. Honey Creek near New Washington, OH
2. Honey Creek at Melmore, OH
3. Sandusky River at Mexico, OH
4. Sandusky River at Fremont, OH
5. East Branch Wolf Creek near Bettsville, OH
6. West Branch Wolf Creek at Bettsville, OH
7. Bean Creek at Powers, OH
8. West Branch Rocky River at Valley City, OH
9. Ottawa River at Allentown, OH
10. South Branch Cattaraugus Creek near Cattaraugus, NY

Samples collected at the stations above were analyzed for:

1. Suspended Solids
2. Conductivity
3. Dissolved Orthophosphorus
4. Nitrite - Nitrate Nitrogen
5. Ammonia Nitrogen
6. Dissolved Silica
7. Total Phosphorus
8. Chloride
9. Sulfate
10. pH

Beginning FY 81 the Sandusky River at Mexico, Sandusky River at Fremont, East Branch Wolf Creek, and West Branch Wolf Creek at Bettsville will be discontinued. The remaining station plus two unidentified agricultural watersheds will be sampled for the parameters above along with the pesticides below.

1. Alochlor (Lasso)
2. Cyanazine (Bladex)
3. 2,4-D
4. Carbofuran (Furadan)
5. Butylate (Sultan)
6. Metribuzen (Lexon)
7. Atrazine
8. Fonofos (Dyfonate)

9. Turbofos
10. Phorate (Thimet)

Lorain Harbor, Ohio, Erosion and Sedimentation Study. In August 1980, a support agreement was entered into with the U.S. Geological Survey to conduct a 1-year sediment sampling program in the Black River, Ohio Watershed. The purpose of the program is to provide sediment yield data at various locations on the river in order to identify the prolific source areas of sediment within the watershed.

The sampling network consists of water discharge and sediment data collection at an existing permanent gage on the main stem, Black River at Elyria, Ohio, as well as one additional permanent gage and two temporary gages installed upstream on the East and West Branches of the river. Suspended sediment samples are collected at permanent stations by both automatic and manual sampling methods. Bedload sampling will be performed at the permanent station on the main stem at Elyria, Ohio, in order to estimate the total load carried by the Black River.

Results of the 1-year sediment sampling program will be published in a Reconnaissance Report on Erosion and Sedimentation for Lorain Harbor, Ohio. The report, scheduled for completion in early 1982, will identify and quantify the primary sources of sediment requiring annual maintenance dredging from the navigation channel at Lorain Harbor.

Lakeview Park, OH. Lakeview Park is located 1 mile west of Lorain Harbor on the south shore of Lake Erie. In the summer of 1977, three detached offshore breakwaters plus 100,000 cubic yards of beach fill were placed as a cooperative beach erosion control project for Lakeview Park. In July 1980, an additional 6,000 cubic yards of beach fill were placed at the west end of the park as part of the periodic replenishment program. All beach fill used was obtained from commerical offshore sources.

The Buffalo District in cooperation with CERC is involved in a 5-year monitoring program (1977 - 1982) to document the effectiveness of these offshore breakwaters in retaining the fill and controlling beach erosion.

Hydrographic and topographic surveys were made along 32 profile lines in April 1980 and October 1980. The surveys extend 2,000 feet west and 4,500 feet east of the project. In addition, 69 sediment samples were collected along a 100 foot increment sampling grid during the October survey. The offshore samples were collected with a Peterson sampler. Samples were evaluated for grain-size distribution. Quantities sediment transport in the project were completed from the survey data.

Vermilion Harbor, OH. Vermilion Harbor is located about 11 miles west of Lorain Harbor on the south shore of Lake Erie. The lower half mile of the Vermilion River plus dual lake approach channels have been dredged and protected by parallel piers and a detached breakwater in order to provide a small-boat harbor. In support of an ongoing Section 111 Study, hydrographic and topographic survey data was collected in August 1980 for the beach and offshore east of the Federal harbor. This survey data was compared to similar data from April 1968, April 1971, April 1973, July 1974, October 1977, and June 1979 to compute volumetric change.

Presque Isle State Park, PA. Presque Isle is a large recurved sand spit which completely shelters the harbor for Erie, PA, and functions as a very popular State park. Since 1975, the Buffalo District, in cooperation with the Commonwealth, conducts an annual replenishment program. In 1980, 216,000 tons of medium sand was obtained from various land sources located within a 20-mile radius of Erie, PA, and placed on the beach.

In 1978, three prototype rubblemound offshore breakwaters were constructed at Beach 10. The performance of these breakwaters and the associated beach has been monitored through semiannual surveys. Fifteen stations were both metrically and topographically surveyed in April 1980 and September 1980. In addition, during the September survey, 40 sediment samples were collected at established offset locations along a 100-foot increment sampling grid. Samples were evaluated for grain-size distribution.

Erie Harbor Entrance Channel, PA. The feasibility of using dredged sediments from the Federal harbor entrance channel at Erie, PA for beach nourishment operations at Presque Isle State Park was investigated during early summer of 1980. Sediment samples were collected in three phases from Erie Harbor Entrance Channel to represent the in-situ and dredged material gradation conditions. Phase I involved the acquisition of bottom sediment samples from fifteen locations positioned to represent shoals which were apparent from the spring 1980 project condition soundings. Phase II samples were collected from the Dredge LYMAN hoppers during a dredging run over locations represented by the Phase I samples. Phase III samples were collected to represent the discharged product of the Dredge LYMAN after the Phase II material had been pumped into a containment area. As a result of this study, it was found that the dredging sequence does concentrate the sand fraction but that the material from Erie Harbor Entrance Channel sampled during 1980 was too fine grained to be used as beach fill.

Sediment density measurement by means of nuclear sediment density probe. In calendar year, in-situ density measurements were updated on the following projects:

City	Project	No. of Measurements	Date
Cleveland, OH	Cuyahoga River	31	8-16 April 1980
Buffalo, NY	Buffalo River	23	12 June 1980
Buffalo, NY	Buffalo Harbor	2	12 June 1980

Complete reports on these studies are available.

Environmental Resources for O&M Support.

In 1980, sediments were sampled from a number of Federal navigation channels for chemical analyses, particle size analyses, elutriate

testing, and bioassay testing. The purpose of the testing was to evaluate the suitability of sediments for open-lake disposal. The following projects were included in this program:

City	Project	Type of Tests
Ashtabula, OH	Ashtabula Harbor O&M Dredging	Bulk Chemistry
Sandusky, OH	Sandusky Harbor O&M Dredging	Bulk Chemistry Elutriate Mechanical Bioassay
Huron, OH	Huron Harbor O&M Dredging	Bulk Chemistry Elutriate Mechanical Bioassay
Conneaut, OH	Conneaut Harbor O&M Dredging	Bulk Chemistry Elutriate Mechanical Bioassay
Dunkirk, NY	Dunkirk, Harbor O&M Dredging	Bioassay
Erie, PA	Erie Harbor O&M Dredging	Bulk Chemistry
Fairport, OH	Fairport Harbor O&M Dredging	Bioassay
Rochester, NY	Rochester Harbor	Bulk Chemistry Elutriate Mechanical Bioassay

GREAT LAKES REGION

GEOLOGICAL SURVEY

Western Lake Superior Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis at Nemadji River Nr. South Superior, Wisc., at Bad River near Odanah, Wis., at Baptism River near Beaver Bay, Minn., and at St. Louis River at Scanlon, Minn., as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis by an automatic sampler at Deer Creek near Holyoke, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

Southern Lake Superior-Lake Superior Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at Ontonagon River near Rockland, Mich., Sturgeon River near Chassell, Mich., (converted to bi-monthly Oct. 1, 1980) and at Tahquamenon River near Tahquamenon, Mich., as a part of NASQAN.

Northwestern Lake Michigan Subregion

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

2. Suspended-sediment data are being collected on a periodic and storm-event basis at Fox River at Wrightstown, Wis., Ford River near Hyde, Mich., Escanaba River at Cornell, Mich., and at Menominee River near McAllister, Wis., as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic and storm-event basis for the State of Wisconsin at the following sites:

Highway 141 storm sewer at Green Bay, Wis.
Halron Oil Company storm sewer at Green Bay, Wis.
Beaver Dam Creek at Green Bay, Wis.

Southwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis for the State of Wisconsin at the Onion River at Hingham, Wis., and at the Onion River near Sheboygan Falls, Wis.

2. Suspended-sediment data are being collected on a periodic and storm-event basis at Milwaukee River at Milwaukee, Wis., Manitowac River at Manitowac, Wis. and at Little Calumet River near McCool, Ind., as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Trail Creek at Michigan City, Ind., and Galena River near LaPorte, Ind., in cooperation with the Indiana Department of Natural Resources.

Southeastern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a weekly basis at Pigeon Creek near Angola, Ind., and at Little Elkhart River at Middlebury, Ind., in cooperation with the Indiana Department of Natural Resources.

2. Suspended-sediment data are being collected on an intermittent basis at North Branch Elkhart River at Cosperville, Ind., in cooperation with the Indiana Department of Natural Resources.

3. Suspended-sediment data are being collected on a monthly basis at Grand River at Eastmanville, Mich., St. Joseph River at Niles, Mich., (both converted to bimonthly Oct. 1, 1980) and at Kalamazoo River at Saugatuck, Mich., as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis as part of the Van Buren County study at the following sites:

Paw Paw River near Paw Paw, Mich.
Paw Paw River near Hartford, Mich.
Black River near Bangor, Mich.

On monthly basis at the following sites:
Dowagiac Drain near Decatur, Mich.
Lake of the Woods Drain near Decatur, Mich.
South Branch Paw Paw River near Paw Paw, Mich.
East Branch Paw Paw River at Lawton, Mich.
East Branch Paw Paw River at Paw Paw, Mich.
South Branch Paw Paw River near Paw Paw, Mich.
North Branch Paw Paw River near Paw Paw, Mich.
Unnamed Tributary to North Branch
Paw Paw River near Paw Paw, Mich.
Brandywine Creek near Paw Paw, Mich.
Bush Creek at Lawrence, Mich. Brandywine Creek near Covert, Mich.
Deerlick Creek near South Haven, Mich.
Haven & Max Lake Drain near Bangor, Mich.
Black River at Bangor, Mich.
Cedar Creek near South Haven, Mich.
Black River near South Haven, Mich.

On a periodic basis at the following sites:
Dowagiac Drain at Decatur, Mich.
Obsorne Drain near Keeler, Mich.
Eagle Lake Drain near Lawton, Mich.
Gates Drain near Lawton, Mich.
East Branch Paw Paw River near Lawton, Mich.
Cook Drain near Mattawan, Mich.
Brandywine Creek near Gobels, Mich.
North Extension Drain near Gobels, Mich.
Brush Creek near Lawrence, Mich.
Red Creek near Lawrence, Mich.

Pine Creek near Hartford, Mich.
Paw Paw River at Riverside, Mich.
Haven & Max Lake Drain at Bloomingdale, Mich.
Haven & Max Lake Drain near Bloomingdale, Mich.
Middle Fork Black Lake near Bloomingdale, Mich.
Melvin Creek near Bloomingdale, Mich.
Barber Creek near Grand Junction, Mich.
Pine Creek near Gobles, Mich.

Northeastern Lake Michigan-Lake Michigan Subregion

1. Suspended-sediment data are being collected on a monthly basis at Manistique River above Manistique, Mich., at Muskegon River near Bridgeton, Mich., and at Manistee River at Manistee, Mich., as a part of NASQAN.

Northwestern Lake Huron Subregion

1. Suspended-sediment data are being collected on a monthly basis at Cheboygan River at Cheboygan, Mich., and Au Sable River near Au Sable, Mich., (converted to bimonthly Oct. 1, 1980) as a part of NASQAN.

Southwestern Lake Huron-Lake Huron Subregion

1. Suspended-sediment data are being collectd on a monthly basis at Pigeon River near Caseville, Mich., (converted to bimonthly Oct. 1, 1980) Thunder Bay River at Alpena, Mich., Rifle River near Sterling, Mich., and at Sagiraw River at Saginaw, Mich., as a part of NASQAN.

St. Clair-Detroit River Subregion

1. Suspended-sediment data are being collected on a monthly basis at Clinton River at Mt. Clemons, Mich., Detroit River at Detroit, Mich., and at River Raisin near Monroe, Mich., (converted to bimonthly Oct. 1, 1980) as a part of NASQAN.

Western Lake Erie Subregion

1. Suspended-sediment data are being collected on a daily basis at Maumee River at Waterville, Ohio, in cooperation with the U.S. Corps of Engineers, and at Sandusky River near Fremont, Ohio, in cooperation with the Ohio Department of Natural Resources.

2. Suspended-sediment data are being collected on an about-monthly basis at Cedar Creek near Cedarville, Ind., in cooperation with the Indiana Department of Natural Resources.

Southern Lake Erie Subregion

1. Suspended-sediment data are being collected on a daily basis at Rocky River near Berea, Ohio, and at Chagrin River at Willoughby, Ohio, for the Northeast Ohio Areawide Co-ordinating Agency, and at Cuyahoga River at Old Portage, Ohio, in cooperation with the Cayahoga County Sanitary Engineering Department.

2. Suspended-sediment data are being collected on a daily basis at Cuyahoga River at Independence, Ohio, in cooperation with the U.S. Corps of Engineers, Buffalo District.

3. Suspended-sediment data are being collected on a daily basis at Grand River at Painseville, Ohio, in cooperation with the Ohio Department of Natural Resources.

Eastern Lake Erie-Lake Erie Subregion

1. Suspended-sediment data are being collected on a periodic basis at Cattaraugas Creek at Gowanda, N.Y., Niagara River (Lake Ontario) at Ft. Niagara, N.Y., and Tonawanda Creek at Batavia, N.Y., as a part of NASQAN.

Southwestern Lake Ontario Subregion

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

2. Suspended-sediment data are being collected on a periodic and storm-event basis in cooperation with Monroe County Health Department at the following sites:

Irondequoit Creek at Thornell Rd. near Pittsford, N.Y.
Barge Canal Tributary at Cranston Rd. near East Rochester, N.Y.
White Brook Tributary at Southgate Rd. near Pittsford, N.Y.
Thomas Creek At BOCES at Fairport, N.Y.
Irondequoit Creek Tributary (Storm Sewer) at East Rochester, N.Y.
Irondequoit Creek at Linden Ave. at East Rochester, N.Y.
Irondequoit Creek at Blossom Rd. near Rochester, N.Y.
Irondequoit Creek at Wetland Narrows at Rochester, N.Y.
Irondequoit Creek at Empire Blvd. at Rochester, N.Y.

Southeastern Lake Ontario Subregion

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

Northeastern Lake Ontario-Lake Ontario-St. Lawrence Subregion

1. Suspended-sediment data are being collected on a periodic basis at Black River at Watertown, N.Y., Raquette River at Raymondville, N.Y., St. Regis River at Brasher Center, N.Y., St. Lawrence River at Cornwall, Ontario, near Massena, N.Y., and at Oswegatchie River at Heuvelton, N.Y., 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 E. Main St., 4th Floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48910

District Chief, WRD
U.S. Geological Survey
Post Office Building, Room 702
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
P.O. Box 1350
U.S. Post Office and
Courthouse Building
Albany, NY 12201

District Chief, WRD
U. S. Geological Survey
1815 University Avenue, Room 200
Madison, WI 53706

SOIL CONSERVATION SERVICE

1. Special Studies

A cooperative study was carried out on the South Branch of Cattaraugus Creek, New York. This work was done under contract with the Corps of Engineers. It consisted of a detailed streambank erosion study of approximately 26 miles of channel in the upper portion of the watershed. The results will be incorporated in the Lake Erie Wastewater Management Study.

CORPS OF ENGINEERS

Ohio River Division

Report on sedimentation activities in the Ohio River Division for calendar year 1980 is as follows:

Sedimentation Resurveys

1. Martins Fork. A second resurvey of sediment ranges was completed in July 1980. A comparison of the 1980 data with the previous 1979 resurvey data showed unreasonable fluctuations in reservoir bottom elevations; therefore, the majority of the 1979 data was rejected. Analysis of the 1980 data shows that the amount of deposition greatly exceeds the design rate. The resurvey report, "Supplement 1 to Design Memorandum No. 9, Reservoir Sedimentation Ranges, Martins Fork Lake (including Cranks Creek Reservoir), Resurvey of July 1980," is expected to be submitted to the Division late in February of 1981. This report recommends a resurvey of all sediment ranges in the spring of 1981, and the establishment of suspended sediment monitoring sites throughout the Martins Fork Basin above the dam in order to detect the source of the sediment inflow into Martins Fork Lake.

2. Wolf Creek (Lake Cumberland). The resurvey of August 1979 report was completed and approved in 1980.

3. Cordell Hull. The reservoir was resurveyed in June 1980. The resurvey report entitled, "Supplement 1, Design Memorandum No. 12, Cordell Hull Reservoir Sediment Resurvey of June 1980," was completed and approved by the Division.

4. Old Hickory. The sediment range resurvey was completed in September 1980. The resurvey data is pending analysis with submittal of the resurvey report expected in the summer of 1981.

5. Dale Hollow. The sediment range resurvey was completed in August 1980. Analysis of the data and submittal of the resurvey report is expected in the summer of 1981.

6. Tygart Lake. A detailed sediment resurvey was completed. The report will be submitted in 1981.

7. Sedimentation reconnaissance surveys of Dillon Lake, Licking River, Ohio and Tom Jenkins (Burr Oak) Lake, East Branch of Sunday Creek, Ohio, were completed in 1980. Reports on these reconnaissance investigations were submitted to the Ohio River Division in 1980.

8. East Lynn Lake, Twelvepole Creek, West Virginia: A resurvey of 12 sediment ranges at East Lynn Lake was completed in 1980. In addition, five category "A" sediment ranges above East Lynn Dam, namely 1-A, 13-A, 15-A, 17-A and 26-A, recommended in Design Memorandum No. 16 and approved by the Ohio River Division by 1st Indorsement, 31 March 1977, were established and profiled to complete the sediment range network. A report on the resurvey is scheduled for completion by the Huntington District in 1981.

9. R. D. Bailey Lake, Guyandot River, West Virginia: A resurvey of 10 existing sediment ranges at R. B. Bailey Lake was completed in 1980. Eleven new sediment ranges, nine category "A" ranges above the dam and two category "C" ranges downstream of the dam, recommended in Design Memorandum No. 17 and approved by the Ohio River Division by 1st Indorsement, 12 January 1978, were established and profiled to complete the sediment range network. A report on the resurvey is scheduled for completion by the Huntington District in 1981.

10. Barren River Lake. A sediment resurvey was completed. The report will be submitted by 1 May 1981.

Initial Range Surveys and Range Layouts.

1. Design memoranda to present sediment range networks at Burnsville Lake, Little Kanawha River, West Virginia and Paintsville Lake, Paint Creek, Kentucky, were submitted to and approved by the Ohio River Division in 1980. At Burnsville Lake, one sediment range was resurveyed and 12 new ranges were established in the field to complete the sediment range network. At Paintsville Lake, two sediment ranges were resurveyed and three new ranges were established in the field.

2. Bay Springs Reservoir. Establishment of base sedimentation ranges was completed in 1980 with the exception of one range to be located immediately upstream of the presently uncompleted dam. The sediment range design memorandum, "Design Memorandum No. N-16, Sedimentation Ranges," is currently scheduled for completion in the spring of 1981. This report will recommend the establishment of additional sedimentation ranges along the canal portion and Yellow Creek Embayment portion of the Divide Section.

Sediment Load Measurements.

1. Fishtrap Lake, Levisa Fork, Kentucky, and Dewey Lake, Johns Creek, Kentucky: The U.S. Geological Survey collected suspended sediment data at the Johns Creek at Meta, Kentucky, monitoring station through 30 September 1980. After that date, the Huntington District collected suspended sediment data at this station. Suspended sediment data were collected by the U.S. Geological Survey in cooperation with the Huntington District, at Levisa Fork at the Big Rock, Virginia, gaging station through 30 September 1980. After that date, the U.S. Geological

Survey collected the suspended sediment data without participation by the Huntington District. The Huntington District collected suspended sediment data on four tributary streams, Fishtrap Lake Drainage Basin, and on three tributary streams in the Dewey Lake Drainage Basin throughout 1980.

2. R. D. Bailey Lake, Guyandot River, West Virginia: Suspended sediment data were collected by the Huntington District at the Clear For, Indian Creek, and the Baileysville monitoring stations during 1980.

3. A sediment monitoring station was established at Cumberland Falls, Kentucky, to monitor sediment inflow from the Upper Cumberland River Basin into Wolf Creek Reservoir (Lake Cumberland). The monitoring station will become operational in 1981.

4. In order to control sediment flowing north into Yellow Creek (Tenn-Tom) Embayment, a turbidity plant was established just north of Highway 72. This plant diverts inflow from the existing Yellow Creek Channel, up to 105 cfs, through two parallel settling basins containing a flocculating agent, and back into the existing Yellow Creek channel. Due to low flows through 1980, efficiency of the plant since its construction in June 1980 has been high with an average turbidity release of less than 50 NTU's. The turbidity plant replaced the previous test pit used as a settling basin which will eventually become part of the waterway.

5. Suspended sediment samples were taken twice daily at the continuous monitoring station located just north of Highway 25 beginning late in 1980 in order to monitor sediment inflow into the Yellow Creek Embayment of Pickwick Lake.

6. The design of the spoil area dikes and treatment system for dredge material inflow was determined based on a sediment deposition analysis for the spoil area to be used with a planned dredging operation north of Highway 25 in the Tenn-Tom project.

7. Data collection continued on the pilot study of the sediment control dam on Defeated Creek a tributary of Carr Fork Lake. An interim report will be submitted to ORD in January 1981.

8. Construction of the Littcarr Sediment Dam at Carr Fork was completed in 1980. Monitoring at four sampling stations should commence within a few months.

Additional Division Activities

Special Programs and Assistance.

1. Technical assistance was provided by Nashville District to the Lyon County Port Authority located on Lake Barkley to identify the source of sediment accumulating around the barge docking facilities. This assistance also covered recommended courses of action to alleviate the sediment problem.

2. An analysis of the effects of sediment flowing from a dredge site at Tennessee River Mile 193.0 on the Adamsville, Tennessee municipal water intake located downstream of the dredge site was performed to determine if a means of protecting the intake prior to starting the dredging at Tennessee River Mile 193.0 could be found to prevent clogging of the intake. The Adamsville water plant would also be notified of potentially turbid flows occurring during the dredge operation.

3. Construction of a high level intake at Sutton Dam was completed in 1980. Its purpose is the improvement of environment attributes of the Elk River downstream of Sutton Dam. With the high level intake, it is anticipated that a slight net increase in sediment deposition in the lake will be experienced because of the higher withdrawal levels.

OHIO REGION

GEOLOGICAL SURVEY

Monongahela Subregion

1. Suspended-sediment data are being collected about monthly and on a storm basis at Stalnaker Run near Bowden, W. Va., and at Taylor Run near Alpena, W. Va., in cooperation with the West Virginia Department of Highways.

2. Suspended-sediment data are being collected on a daily basis at Taylor Run at Bowden, W. Va., at Shavers Fork above Bowden, W. Va. (discontinued October 1980) and at Shavers Fork below Bowden, W. Va., as part of the Shavers Fork Basin Cooperative Program with the West Virginia Department of Highways.

3. Suspended-sediment data are being collected on a near monthly and storm-event basis at Becky Creek at Hwy. 56 Branch near Huttonsville, W. Va., Leading Creek at Hwy. 3 Branch near Kerens, W. Va.; Sand Run near Buckhannon, W. Va.; Three Fork Creek at Hwy. 33 Branch near Gladesville, W. Va.; West Fork River at Hwy. 19 Branch at Roanoke, W. Va.; Little Paw Creek at Hwy. 25 Branch at Hoodsville, W. Va.; Shavers Fork at Hwy. 250 Branch at Cheat Bridge, W. Va.; Big Sandy Creek at Hwy. 14 Branch at Clifton Mills, W. Va. as part of the USGS's Coal Hydrology Monitoring project (discontinued October 1980).

4. Suspended-sediment data are being collected on an infrequent basis at Youghiogheny River at Friendsville, Md., S. Br. Casselman River at Bittinger, Md., and Casselman River at Grantsville, Md., as part of hydrologic assessment of the Eastern Coal Province.

Upper Ohio Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ohio River at Benwood, near Wheeling, W. Va., and at Little Kanawha River at Palistine, W. Va., as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a monthly basis at Little Grave Creek near Moundsville, W. Va., at Par Run near mouth near Moundsville, W. Va., and at Middle Grave Creek near Moundsville, W. Va., in cooperation with the U.S. Soil Conservation Service.

3. Suspended-sediment data are being collected on a near monthly and storm-event basis at Little Grave Creek at Hwy. 10 Branch at Glendale Hts., W. Va.

4. Suspended-sediment data are being collected on a daily basis and with automated samplers at Little Kanawha River near Wildcat, W. Va., as part of the USGS's Coal Hydrology Monitoring project.

5. Suspended-sediment data are being collected on a near monthly and storm-event basis at Coxcamp Fork at Hwy. 47 Branch at Coxs Mills, W. Va.; Henry Fork at Hwy. 25 Branch at Linden, W. Va.; Bonds Creek at Hwy. 1 Branch at Highland, W.Va., as part of the USGS's Coal Hydrology Monitoring project. (discontinued October 1980).

6. Suspended-sediment data are being collected on a daily basis at Hocking River below Athens, Ohio, in cooperation with the Ohio Department of Natural Resources.

7. Suspended-sediment data are being collected on a daily basis at Consol Run near Bloomingdale, Ohio, in cooperation with the U.S. Environmental Protection Agency (EPA).

8. Suspended-sediment data are being collected on a daily basis and with automated samplers at Short Creek near Dillonvale, Ohio; East Branch Shade River near Tuppers Plains, Ohio, as part of the USGS's Coal Hydrology Monitoring project.

Muskingum Subregion

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

2. Suspended-sediment data are being collected on a daily basis at Sand Fork near Wakatomika, Ohio, in cooperation with the U.S. EPA.

3. Suspended-sediment data are being collected on a near-monthly and storm-event basis at Clear Fork tributary near Hanover, Ohio, and at Opossum Run tributary near Wakatomika, Ohio, in cooperation with the U.S. EPA.

4. Suspended-sediment data are being collected on a daily basis and with automated samplers at Mud Run at Tuiscarawas, Ohio; Moxahala Creek near Crooksville, Ohio, as part of the USGS'S Coal Hydrology Monitoring project.

Kanawha Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Kanawha River at Winfield, W. Va. as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Little Coal River at Danville, W. Va., Little Coal River at Julian, W. Va., Big Coal River near Alum Creek, W. Va., Coal River at Alum Creek, W. Va., Coal River at Tornado, W. Va., Rock Creek at Danville, W. Va., Rock Creek at Rock Creek, W. Va., Trace Fork at Ruth, W. Va., and Trace Fork Downstream Dryden Hollow at Ruth, W. Va. (starting July 1980) in cooperation with the West Virginia Department of Highways.

3. Suspended-sediment data were collected about monthly at Cranbery Creek at Beckley, W. Va., Little Whitestick Creek at Beckley, W. Va., and Soak Creek at Sophia, W. Va.

4. Suspended-sediment data are being collected on a near monthly and storm-event basis at Laurel Creek at Wallis Branch near Sandstone, W. Va.; Gauley River at Hwy. 46 Branch at Williams River, W. Va.; Campbells Creek at Hwy. 73 Branch downstream from Coal Fork, W. Va.; Leatherwood Creek at Hwy. 26/4 Branch at Bergoo, W. Va.; Laurel Creek at Hwy. 9 Branch at Erbacon, W. Va.; Grassy Creek at Hwy. 20 Branch at Diana, W. Va.; Little Birch River at Hwy. 40/15 Branch near Little Birch, W. Va.; Eighteen Mile Creek at Hwy. 6 Branch at White Star

School, W. Va.; Clear Fork at Hwy. 1/21 Branch at Leevale, W. Va., as part of the USGS's Coal Hydrology Monitoring project (discontinued October 1980).

5. Suspended-sediment data are being collected on a daily basis and with automatic samplers at Buffalo Creek at Barracksville, W. Va.; Piney Creek at Raleigh, W. Va.; and Cranberry River near Richwood, W. Va., as part of the USGS's Coal Hydrology Monitoring project.

6. Suspended-sediment data are being collected on a daily basis at Peters Creek at Lockwood, W. Va., as part of the Gauley River basin project in cooperation with the West Virginia Geological and Economic Survey (started July 1980).

7. Suspend-sediment data are being collected on a monthly basis as part of NASQAN on the New River at Glen Lyn, Va.

Scioto Subregion

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

2. Suspended-sediment data are being collected on a daily and storm-event basis at the following locations in cooperation with the Ohio Department of Transportation:

Olentangy River near Worthington, Ohio
315 Expressway and Rt. 161 Drainage at Worthington, Ohio
Ohio Rush Run at Worthington, Ohio
Ohio Linworth Road Creek at Columbus, Ohio
Ohio Bethel Road Creek at Columbus, Ohio
Unnamed Tributary to Olentangy River at 315 Expressway at Columbus, Ohio
Olentangy River at Henderson Road at Columbus, Ohio

Big Sandy-Guyandotte Subregion

1. As part of the Coal Monitoring program in southwestern Virginia, suspended-sediment samples were collected at seven stations. Bottom-material samples for coal-separation analysis were collected at 27 sites, and bottom-material samples for trace-metals analysis were collected at 22 sites in the Big Sandy River basin.
2. Suspended-sediment data are being collected, on a near monthly basis at Guyandotte River at Branchland, W. Va., as a part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis at Marsh Fork at Maben, W. Va., Still Run at Itman, W. Va., Allen Creek at Allen Junction, W. Va., and at Bearhole Fork at Pineville, W. Va., and at Milam Fork at McGraws, W. Va. as part of a study on the effects of mining on the hydrologic environment of southern West Virginia, in cooperation with the West Virginia Geological and Economic Survey (discontinued January 1980).

4. Suspended-sediment data are being collected on a daily basis at Elkhorn Creek at Maitland, W. Va., Tug Fork at Welch, W. Va., Pigeon Creek at LeNore, W. Va., Dry Creek at Avondale, W. Va., West Fork Twelvepole Creek at Echo, W. Va. and at Rockcastle Creek at Inez, Ky. (started October 1979), as part of the Tug River Basin project in cooperation with the West Virginia Geological and Economic Survey and the West Virginia Department of Natural Resources.

5. In cooperation with the U. S. Bureau of Mines and the Office of Surface Mining, Reclamation and Enforcement, suspended-sediment data were collected daily and with automatic samplers at the following sites as part of a study of the effects of land-use changes on the magnitude and frequency of flood-peak flows and on sediment characteristics of the Tug Fork in Kentucky, Virgina, and West Virginia:

Right Fork Hurricane Creek near Stopover, Ky.
Puncheoncamp Branch at Leckie, W. Va.
Left Fork Sandlick Creek at Elbert, W. Va.
Pumpkin Branch near Hurley, Va.
Camp Creek near Argo, Ky.
Elkfoot Branch near Nigh, Ky.
Elkhorn Creek Tributary at Welch, W. Va.
Freemans Branch near Skygusty, W. Va.
Right Fork Sandlick Creek near Gary, W. Va.
Crane Creek near Panther, W. Va.

6. Suspended-sediment data were being collected on a daily basis at Tug Fork near Glenhayes, W. Va., (discontinued October 1980) in cooperation with the West Virginia Geological and Economic Survey as part of the Tug River Basin project.

7. Suspended-sediment data are being collected on a near monthly and storm-event basis at Pennacle Creek at Hwy. 16 Branch near Pineville, W. Va.; Buffalo Creek at Hwy. 16/5 Branch at Kistler, W. Va.; Middle Fork at Hwy. 3 Branch at Hamlin, W. Va.; Elkhorn Creek at Hwy. 52/20 Branch at Elkhorn, W. Va.; Panther Creek near Panther, W. Va.; Pigeon Creek near LeNore, W. Va., as part of the USGS's Coal Hydrology Monitoring project (discontinued October 1980).

8. Suspended-sediment data collection was begun on a twice-weekly plus storm-event basis in October 1980 at the following sites in the Tug River basin:

Pumpking Branch near Hurley, Va.
Camp Creek near Argo, Ky.
Rt. Fork Hurricane Creek near Stopover, Ky. and at Elkfoot Branch near Nigh, Ky., in the Levisa Fork basin. All four of these stations were established to provide information to assist in investigation of flooding in the Tug Fork basin of Virgina, Kentucky, and West Virginia.

9. Suspended-sediment data are being collected on a monthly basis at Big Sandy River at Louisa, Ky., as a part of NASQAN, and as part of the Coal Hydrology program.

10. Suspended-sediment data are being collected on a daily basis at Johns Creek near Meta, Ky., to monitor sediment discharge into Dewey Lake. The work is being done in cooperation with the U.S. Corps of Engineers, (COE), Huntington

District. This station is a baseline sediment station as part of the Coal Hydrology program.

11. Suspended-sediment data are being collected on a quarterly basis at Grapevine Creek near Phyllis, Ky., and at Dicks Fork at Phyllis, Ky., as a part of the Coal Hydrology project.

12. Suspended-sediment data are being collected on a weekly and storm-event basis at Russell Fork at Elkhorn City, Ky., Levisa Fork at Pikeville, Ky., and Johns Creek near Van Lear, Ky., as part of the Coal Hydrology program.

13. Suspended-sediment data are being collected on a quarterly basis at 41 other locations as part of the Coal Hydrology program.

Great Miami Subregion

1. Suspended-sediment data are being collected on an intermittant basis at Whitewater River near Hagerstown, Ind., and on a flood-event basis at East Fork Whitewater River at Abington, Ind. This work was done in cooperation with the State of Indiana.

2. Suspended-sediment data are being collected on an intermittent basis at Whitewater River at Brookville, Ind., as a part of NASQAN.

Middle Ohio Subregion

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

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

3. Suspended-sediment data are being collected daily at Big Four Hollow Creek near Lake Hope, Ohio, and at the following stations in the Raccoon River basin on a storm-event basis in cooperation with the Ohio Department of Natural Resources:

Sandy Run above Big Four Hollow Creek, near Lake Hope, Ohio
Big Four Hollow Creek below East Fork, near Lake Hope, Ohio
Hull Hollow Creek near Lake Hope, Ohio
Sandy Run below Hull Hollow Creek, near Lake Hope, Ohio

4. Suspended-sediment data are being collected on a monthly basis at Ohio River at Greenup Dam, Ky., and Ohio River at Markland Dam, Ky., as a part of NASQAN.

5. Suspended-sediment data are being collected on a weekly and storm-event basis at Tygarts Creek near Greenup, Ky., and Little Sandy River at Grayson, Ky., as part of the federally funded coal hydrology network.

6. Suspended-sediment data are being collected on a quarterly basis at 10 locations in Kentucky, as part of the federally funded Coal Hydrology network.

Kentucky-Licking Subregion

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

2. Suspended-sediment data are being collected on a 5-week frequency at the following stations to define sediment yields by physiographic province in Kentucky:

North Fork Triplett Creek near Morehead, Ky.
North Fork Licking River near Lewisburg, Ky.
Troublesome Creek at Noble, Ky. (disc. Sept. 30, 1980)
Goose Creek at Manchester, Ky.
Red River near Hazel Green, Ky.
Elkhorn Creek near Frankfort, Ky.

This work is done in cooperation with the Kentucky Geological Survey. The Goose Creek and Red River stations are also part of the Coal Hydrology program.

3. Suspended-sediment data are being collected on a daily basis at Middle Fork Kentucky River near Hyden, Ky., in cooperation with the U.S. Corps of Engineers, Louisville District, and as part of the Coal Hydrology program.

4. Suspended-sediment data are being collected on a weekly and storm-evert basis at:

North Fork Kentucky River at Hazard, Ky.
North Fork Kentucky River at Jackson, Ky.
Middle Fork Kentucky River at Tallega, Ky.
South Fork Kentucky River at Booneville, Ky.

5. Suspended-sediment data are being collected on a quarterly basis at 54 locations in Kentucky as part of the Coal Hydrology program.

Green Subregion

1. Suspended-sediment data are being collected on a monthly basis at Green River near Beech Grove, Ky., as a part of NASQAN.

2. 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.

3. Suspended-sediment data are being collected on a 5-week frequency at the following stations in cooperation with the Kentucky Geological Survey:

Russell Creek near Columbia, Ky.
Nolin River near White Mills, Ky.
South Fork Panther Creek near Whitesville, Ky.
Bacon Creek near Priceville, Ky. (started Oct. 1, 1978)

4. Suspended-sediment data are being collected on a weekly and storm-event basis as part of the Coal Hydrology program at:

Rough River at Dundee, Ky.
Pond River near Apex, Ky.
Pond River near Vandetta, Ky.
Green River at Rockport, Ky.
Cypress Creek near Calhoun, Ky.
Panther Creek near Owensboro, Ky.
Green River at Lock 2 at Calhoun, Ky.

5. Suspended-sediment data are being collected on a quarterly basis at 47 locations in Kentucky as part of the Coal Hydrology program.

Wabash Subregion

1. Suspended-sediment data are being collected on a daily basis at Buck Creek near Muncie, Ind., and at East Fork White River at Seymour, Ind., in cooperation with the Indiana Department of Natural Resources, and at Big Blue River at Carthage, Ind., for the C.O.E. Additional sampling of the White River and E. Fk. White River and their tributaries in cooperation with the Indiana Department of Natural Resources consists of six weekly stations, five monthly stations, and four high-flow only stations.

2. Suspended-sediment data were collected monthly at 21 sites during steady-flow conditions and at eight sites during flood events in Indiana as part of the Federal Energy program. Coal separation analyses of bed-material samples from 14 sites were also made.

3. Suspended-sediment data were collected monthly at White River at Hazelton, Ind., as part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Eel River near Logansport, Ind., and at Wabash River at Lafayette, Ind., in cooperation with the Indiana Department of Natural Resources.

5. Suspended-sediment data are being collected on a weekly basis from Wabash River tributaries at three sites, on a monthly basis at six sites, and on a high-flow only basis at five sites in cooperation with the Indiana Department of Natural Resources.

6. Suspended-sediment data were collected four times at four sites as part of the Federal Energy program and in cooperation with the U.S. Environmental Protection Agency.

7. Suspended-sediment data are being collected on a monthly basis at Wabash River at New Harmony, Ind., and at Little Wabash River at Carmi, Ill., as a part of NASQAN.

8. Suspended-sediment and bed-material data are being collected seasonally on a daily basis at Little Wabash River at Louisville, Ill., and at Embarras River near Oakland, Ill., in cooperation with the C.O.E., Louisville District.

Cumberland Subregion

1. As part of the Coal Hydrology program, a suspended-sediment discharge station is being operated at Smoky Creek near Hembree, Tenn., in the New River basin. This station monitors daily and storm loads. Also in conjunction with this same program, miscellaneous suspended-sediment discharge measurements are being made at 50 other sites in this Subregion within the State of Tennessee.

2. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a six-week frequency at 11 sites in this Subregion within the State of Tennessee.

3. Suspended-sediment data are being collected on a monthly basis at Cumberland River at Carthage, Tenn., and at Cumberland River near Grand Rivers, Ky., as a part of NASQAN.

4. Suspended-sediment data are being collected on a 5-week frequency at the following stations in cooperation with the Kentucky Geological Survey:

Buck Creek near Shopville, Ky.
Little River near Cadiz, Ky.

5. Suspended-sediment data are being collected on a daily and storm-event basis in cooperation with the U.S. Army Corps of Engineers, Nashville District, and as part of the Coal Hydrology program at the following stations:

Clover Fork near Harlan, Ky.
Yellow Creek near Middlesboro, Ky.
Cumberland River at Barbourville, Ky.
Cumberland River near Pineville, Ky.

6. Suspended-sediment data are being collected on a weekly and storm-event basis as part of the Coal Hydrology program at:

Clear Fork near Saxton, Ky.
Rockcastle River near Billows, Ky.
Cumberland River at Williamsburg, Ky.

7. Suspended-sediment data are being collected on a quarterly basis at 29 miscellaneous stations of the Coal Hydrology program.

Lower Ohio Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rolling Fork near Lebanon Junction, Ky., Salt River at Shepherdsville, Ky., Ohio River at Cannelton Dam, Ky., and at Ohio River at Lock and Dam 53 near Grand Chain, Ill., as part of NASQAN.

2. Suspended-sediment data are being collected on an intermittent basis at Indian-Kentucky Creek near Canaan, Ind., on a highflow only basis at Middle Fork Anderson River at Bristow, Ind., and on a daily basis at West Fork Blue

River at Salem, Ind., in cooperation with the Indiana Department of Natural Resources.

3. Suspended-sediment data are being collected on a once-weekly and storm-event basis at Ohio River at Louisville, Ky., in cooperation with the C.O.E., Louisville District.

4. Suspended-sediment data are being collected on a daily and storm-event basis at Floyds Fork near Crestwood, Ky., in cooperation with the Kentucky Department of Natural Resources.

5. Suspended-sediment data are being collected on a weekly and storm-event basis at Tradewater River at Sullivan, Ky., as part of the Coal Hydrology program.

6. Suspended-sediment data are collected on a quarterly basis at 13 locations in Kentucky as part of the Coal Hydrology program.
7. Suspended-sediment data are collected on a 5-week and storm-event basis at Massac Creek near Paducah, Ky., in cooperation with the Kentucky Geological Survey.

Special Studies

1. Suspended-sediment data were collected with automatic samplers at three sites in Greene County, Penn., during 1979-80,--Castile Run at Clarksville, Penn., Whitely Creek near Kirby, Penn., and Enlow Fork of Wheeling Creek, near West Finley, Pennsylvania. These data were collected as part of a study to evaluate the effects of mining on streams in Greene County.

2. Suspended-sediment data were collected with automatic samplers at two sites in the East Branch Mahanoy Creek basin, Penn., as part of a study to evaluate the effects of surface mining on the stream. The study is in cooperation with the Pennsylvania Department of Environmental Resources, Office of Surface Mine Reclamation.

3. Suspended-sediment data were collected at two sites below a surface mine in Western Clearfield County, Pennsylvania. An automatic sampler collects samples from the inflow and outflow of a sediment control pond. The study is designed to collect data to calibrate a sediment yield-surface mining model.

4. A 4-year study began in 1978 to evaluate surface mining influences on sedimentation characteristics of basins in the Allegheny and Monogahela geologic series in Ohio.

5. Suspended-sediment data were collected at selected sites in the coal mining region of Ohio during storm-events, once in 1979 and 1980, as part of the USGS's Coal Hydrology Monitoring project.

6. A 4-year study began in 1978 to evaluate and quantify any impact that highway construction has on sediment loads to neighboring streams at the construction site of Ohio State Route 315 in Columbus, Ohio.

7. The project report by Joel E. Dysart is in review stage on the federally-funded project, "Downstream effects of coal mining on Levisa Fork of the Big Sandy River, Kentucky-Virginia."

8. Suspended-sediment data were collected with automatic samplers at three sites in the Big Sandy Creek basin in Pennsylvania during 1980. 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.

9. In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across Tennessee. Reports documenting data and research findings are in preparation.

10. A 3-year study was initiated in 1980 to model the cumulative downstream effects of coal mining in the Smoky Creek basin, Tennessee. In conjunction with this study the partial suspended-sediment record station at Bills Branch near Hembree, Tenn., was upgraded to a continous suspended-sediment record station.

A report on the quality of water in the New River and Clear Fork basins, Tennessee was published as follows:

Parker, R. S., and Carey, W., 1980, The quality of water discharging from the New River and Clear Fork basins, Tennessee: U.S. Geol. Survey Water Resources Investigations 80-37, 56 p.

11. In cooperation with the U.S. Army Corps of Engineers, three suspended-sediment discharge stations are being operated; Clear Fork near Robbins, Tenn., New River at New River, Tenn., and Big South Fork Cumberland River near Stearns, Kentucky. These stations monitor daily and storm-event loads. These data will be used to define current water-quality conditions within the Big South National River and Recreation Area, Tennessee.

12. Professional paper 427D by John A. McCabe, a report on the 1974 phase of sediment studies at Cane Branch near Parkers Lake, Ky., is in review stage. This work was done in cooperation with a number of Federal and state agencies.

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 E. Main St., 4th Floor
Urbana, IL 61820

District Chief, WRD
U.S. Geological Survey
1819 North Meridian Street
Indianapolis, IN 46202

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 1107
Federal Building, Fourth Floor
228 Walnut Street
Harrisburg, PA 17108

District Chief, WRD
U.S. Geological Survey
Federal Building and
U.S. Courthouse, Room A-413
Nashville, TN 37203

District Chief, WRD
U.S. Geological Survey
200 West Grace Street
Room 304
Richmond, VA 23220

District Chief, WRD
U.S. Geological Survey
Rm. 572, Federal Building
600 Federal Place
Louisville, KY 40202

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room 3017
500 Quarrier Street
East Charleston, WV 25301

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

SOIL CONSERVATION SERVICE

1. Studies 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	Piney Ck.	Soak Ck.	Raleigh	WV
Ohio River	Piney Ck.	Little Whitestick	Raleigh	WV
Ohio River	Little Grave Creek	Par Run	Marshall	WV
Ohio River	Little Grave Creek	Little Grave Ck.	Marshall	WV
Ohio River	Middle Grave Creek	Middle Grave Ck.	Marshall	WV
Ohio River	Cyphress Ck.	Cypress Ck.	Warrick	IN

b. Resource Conservation and Development

Project Name	County	State
Pleasant County Park	Pleasants	WV

2. Reservoir Sedimentation Surveys

A reservoir sedimentation survey was made on structure no. 12. Little Cache Creek Watershed, Johnson County, Illinois.

As-built reservoir sedimentation surveys were made on the following reservoirs:

Reservoir	County	State
Bank Lick Creek FRS #3	Kenton	KY
Red Lick Creek FRS #5	Madison	KY
Salt Lick Creek FRS #4	Bath	KY

3. Special Studies

Suspended sediment information is being collected on Piney, Middle Grove, and Little Grove Creeks in cooperation with the USGS.

TENNESSEE REGION

GEOLOGICAL SURVEY

Upper Tennessee Subregion

1. As part of the Coal Hydrology program in southwestern Virginia, suspended-sediment samples were collected at 32 stations. Bottom-material samples for coal-separation analysis were collected at seven sites, and bottom-material samples for trace-metals analysis were collected at 41 sites, in the Clinch and Powell River basins.

2. Suspended-sediment data are being collected on a monthly basis at French Broad River at Marshall, N.C., French Broad River near Knoxville, Tenn., and at Clinch River at Melton Hill Dam, Tenn., and at Holston River near Knoxville, Tenn., as part of the National Stream Quality Accounting Network (NASQAN).

3. Suspended-sediment data are collected on a monthly basis at Cataloochee Creek near Cataloochee, N.C., as a part of the National Hydrologic Benchmark program.

4. In conjunction with the Coal Hydrology program, miscellaneous suspended-sediment discharge measurements are being made at 17 sites within the State of Tennessee.

5. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a 6-week frequency at eight sites within the State of Tennessee.

Middle Tennessee-Hiwassee Subregion

1. In conjunction with the Coal Hydrology program, miscellaneous suspended-sediment discharge measurements are being made at 13 sites within the State of Tennessee.

2. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a 6-week frequency at Oostanaula Creek near Sanford, Tennessee.

3. Suspended-sediment data are being collected on a monthly basis at Tennessee River at Watts Bar Dam, Tenn., as part of NASQAN.

4. Suspended-sediment data are being collected in the Tennessee River basin in Georgia at three sites on a monthly basis and at 13 sites on a semi-annual basis as part of the OSM Coal Hydrology program.

Tennessee-Elk Subregion

1. In conjunction with the Coal Hydrology program, miscellaneous suspended-sediment discharge measurements are being made at six sites within the State of Tennessee.

2. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a 6-week frequency at Shoal Creek near Iron City, Tenn.

3. Suspended-sediment data are being collected on a monthly basis at Tennessee River at South Pittsburg, Tenn., as a part of NASQAN. This site is also in a national pesticide monitoring network which requires periodic streambed sediment sampling.

4. Suspended-sediment data are being collected by an automatic sampler at Tennessee-Tombigbee Waterway at Cross Roads, Miss., in cooperation with the U.S.Corps of Engineers.

Lower Tennessee Subregion

1. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a 6-week frequency at three sites within the State of Tennessee.

2. Suspended-sediment data are being collected on a monthly basis at Tennessee River at Pickwick Landing Dam, Tenn., and at Tennessee River at Highway 60 near Paducah, Ky., as a part of NASQAN.

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

4. Suspended-sediment data are being collected on a 5 week-frequency at West Fork Clarks River near Brewers Creek, Ky., in cooperation with the Kentucky Geological Survey.

5. Suspended-sediment data are being collected on a periodic basis at Toccoa River near Dial, Ga., in cooperation with the Georgia Geological Survey.

Special Studies

In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across Tennessee. Reports documenting data and research findings are in preparation.

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
P.O. Box 2857, Century Station
Post Office Building, Room 436
Raleigh, NC 27602

District Chief, WRD
U.S. Geological Survey
Room 572, Federal Building
600 Federal Place
Louisville, KY 40202

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room A-413
Nashville, TN 37203

District Chief, WRD
U.S. Geological Survey
200 West Grace St., Rm. 304
Richmond, VA 23220

SOIL CONSERVATION SERVICE

1. Sediment yields were estimated for 70 large drainage areas covering the state of Mississippi. The portion of the Tennessee River Basin in Mississippi was covered as part of this study.

TENNESSEE VALLEY AUTHORITY

TENNESSEE RIVER BASIN

Notes on Sedimentation Activities in 1980

Upper Bear Creek Reservoir

A reconnaissance sediment survey was made in which twenty-two of the fifty-six sediment ranges that were established in 1978 were sounded.

Tellico Reservoir

Forty-eight sediment ranges were established and sounded in 1980. Closure of the dam occurred on November 29, 1979, with normal operation beginning on December 24, 1979.

UPPER MISSISSIPPI REGION

CORPS OF ENGINEERS

North Central Division

Chicago District

Four sediment-related studies were conducted by the Chicago District in 1980. All four studies were concerned with characterizing the chemical properties of sediments so that an assessment of the degree to which they are polluted can be ascertained. Classification of the pollutional character of sediments is based on a 1977 USEPA Region V report "Guidelines for the Pollutional Classification of Great Lake Harbor Sediments". Data gathered from these studies is being used to plan and design disposal facilities for dredged material from proposed dredging projects.

Investigations into the pollutional characteristics of the sediments within the federal navigation project limits of the Chicago River and Harbor and Calumet River and Harbor were undertaken in April and May of 1980. The purpose of the sampling and analysis was to determine the degree of contamination and the presence or absence of high-priority or toxic pollutants. A combination of core and grab samples were taken at 35 sites within the project limits. Grab samples were collected with a hand-operated, Peterson-type clamshell dredge and core samples were obtained with a splitspoon sampler. A total of 71 sediment samples were recovered and anylyzed for ammonia nitrogen, total kjeldahl nitrogen, phenols, total phosphorus, cyanide, chemical oxygen demand, total volatile solids, arsenic, cadmium, chromium, copper, lead, mercury, zinc, manganese, and PCB's. In addition, 48 samples were subjected to particle size distribution analysis, 67 were analyzed for hexane soluble oil and grease content and 11 sediment samples were analyzed for the base-neutral and volatile fractions of the USEPA priority pollutant list. In general, the sediments from all three reaches show high levels of lead pollution. Copper and zinc contamination is widespread and heavy and mercury levels are high in the North Branch sediments. As in the case of heavy metal contamination, the degree of nutrient and organic pollution is greatest in the North Branch. Contamination of the sediments by the base-neutral fraction of the priority pollutant list is significant throughout the project limits while significant PCB contamination (greater than 50 ppm) is confined to the North Branch sediments. A report on this investigation, titled "Summary Report - Chicago Sites Sediment Quality Analysis," was completed in October, 1980.

In September 1980, a sampling program was carried out at Menominee Harbor in Wisconsin. The purpose of this sampling program was to identify any variations in arsenic contamination in the sediment. Prior sampling by the Corps of Engineers and the University of Wisconsin has identified high levels of arsenic contamination in the sediments and water column of

the Menominee River. Core samples were taken at 9 sites within the project limits and a total of 24 samples were retrieved and analyzed for arsenic. Sediment core samples were obtained with a standard 2-inch diameter splitspoon. Four of the 24 sediment samples were heavily polluted with arsenic, 4 were classified as moderately polluted and the remaining 16 samples were considered unpolluted. A report on the investigation, titled "Sampling Program Report - Menominee Harbor Investigation" was completed in December 1980.

Preliminary investigations into the pollutional characteristics of the sediment in the Little Calumet River, Illinois were undertaken in October of 1980. The information generated from this investigation was used to provide an evaluation of the extent and nature of possible contamination of the silt and to determine whether any future, more comprehensive, sampling efforts are necessary. Samples of sediment were taken in 12 miles of channel using a hand operated piston tube sampler. A total of 24 sediment samples were recovered and analyzed for ammonia nitrogen, total kjeldahl nitrogen, total phosphorus, oil and grease, chemical oxygen demand, volatile solids, cadmium, chromium, lead, mercury and total PCB's. Mercury, PCB's and cadmium are in the nonpolluted range, lead chromium and phosphorus are in the heavily polluted range and the remaining parameters (COD, volatile solids, ammonia nitrogen, oil and grease, and total nitrogen) are generally in the moderately polluted to nonpolluted range. Another aspect of the investigation involved surveying stream cross sections at 2,000 foot intervals and measuring the depth of silt at three points in each cross section with a hand probe. With this information at hand, specific regions in the stream where silt has accumulated to the greatest depths were identified. A report on this investigation, titled "Little Calumet River, Illinois Sediment Sampling and Chemical Analysis (Phase I - Preliminary Studies)", will be completed in January 1981.

In August, 1980 at Manitowoc Harbor, Wisconsin, two sediment cores were taken from a proposed channel extension area. The sediments were analyzed for volatile solid, mercury, barium, oil & grease, lead, total phosphorous, ammonia nitrogen, zinc, cadmium, total kjeldahl nitrogen, chromium, cyanide, and total PCB's. In general, the sediments were nonpolluted. A report on this investigation titled. "Evaluation of Manitowoc Sediment Data" was completed in December, 1980.

Rock Island District

Suspended Sediment Sampling. Suspended load sampling is being conducted at 35 stations; 4 located on the Mississippi River and 31 on its tributaries. Seventeen long-term stations are operated and maintained directly by the district. Eighteen stations which began in conjunction with the GREAT II program are now being operated and maintained under a cooperative program with the US Geological Survey. Sampling at Ames, Iowa on the Skunk River and at Kinderhook, Illinois on Hadley Creek have been discontinued this year.

Bedload Sampling. Bedload sampling is being conducted at 19 stations located on tributaries of the Mississippi River. At 15 of these stations suspended sediment samples are also collected. At the remaining four stations, the Turkey River at Garber, Iowa; Skunk River at Augusta, Iowa; Rock River at Jefferson, Wisconsin; and the Rock River at Afton, Wisconsin, only bedload samples are collected. Bedload samples are collected during the three peak flows for the year using the Helley Smith bedload sampler. All stations at which bedload samples are collected are operated and maintained in cooperation with the USGS. Records for the bedload stations are also maintained by the USGS.

St. Paul District

Sediment Load Measurements. Sediment load measurements are currently being made at 28 stations sponsored by the district. There are 21 stations in the Upper Mississippi River basin and 7 in the Souris-Red-Rainy River basin. All sediment load measurements are being conducted by the U.S. Geological Survey under St. Paul District sponsorship.

Other Investigations. Included in the sediment measurement stations are five stations in Rochester, Minnesota, instituted at the beginning of the current water year to provide data for the Sediment Transport Study for the Rochester, Minnesota, Flood Control Project being accomplished under contract by WES.

Inter-Agency Sedimentation Project. A report on the progress and development accomplished in the "Study of Methods Used in Measurement and Analysis of Sediment Loads in Streams," conducted at the St. Anthony Falls Hydraulic Laboratory during calendar year 1980, is described under "Laboratory and Other Research Activities."

UPPER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Mississippi Headwaters Subregion

1. Suspended-sediment are being collected on a monthly basis at Mississippi River near Royalton, Minn., and at Mississippi River at Naninger, Minn., as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis at Mississippi River near Anoka, Minn., in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on an intermittent and storm-event basis at Crow River at Rockford, Minn., and at Elk River near Big Lake, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

4. Suspended-sediment measurements were made during floods at the following sites:

Mississippi River at Bemidji, Minn.
Mississippi River below Sandy River at Libby, Minn.
Mississippi River at Aitkin, Minn.
Mississippi River Diversion near Aitkin, Minn.

Minnesota Subregion

1. Suspended-sediment data are being collected on a daily basis at Minnesota River at Mankato, Minn., at Whetstone River near Big Stone City, S. Dak., and at Yellow Bank River near Odessa, Minn., in cooperation with the U.S. Corps of Engineers.

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

3. Suspended-sediment data are being collected on an intermittent or storm-event basis at Watonwan River near Garden City, Minn., Chippewa River near Milan, Minn., and at Yellow Medicine River near Granite Falls, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

St. Croix Subregion

1. Suspended-sediment data are being collected on a periodic basis at the following sites:

St. Croix River at CTH "T" near Dairyland, Wis.
Namekagon River at Hayward, Wis.
Namekagon River at Trego, Wis.
St. Croix River near Danbury, Wis.
Yellow River at Danbury, Wis.
Clam River at ice house bridge near Webster, Wis.

Kettle River near Cloverdale, Minn.
Snake River near Pine City, Minn.
Apple River near Somerset, Wis.

2. Suspended-sediment data are being collected on a monthly basis at St. Croix River at St. Croix Falls, Wis., as a part of NASQAN.

Upper Mississippi-Black-Root Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at North Fork Whitewater River near Elba, Minn., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at Zumbro River at Kellogg, Minn., at Whitewater River near Beaver, Minn., at Mississippi River at Winona, Minn., at Root River near Houston, Minn., and at South Fork Root River near Houston, Minn., in cooperation with the U.S. Corps of Engineers.

3. Suspended and bed load-sediment data are being collected on a periodic and storm-event basis for the U.S. Corps of Engineers, at Chippewa River at Durand, Wis., and at Black River at Galesville, Wis.

4. Suspended and bedload sediment data are being collected on an intermittent basis for the U.S. Corps of Engineers, at Plum Creek near Ella, Wis., Chippewa River near Caryville, Wis., and at Chippewa River near Pepin, Wis.

5. Suspended-sediment measurements were made of the Mississippi River at LaCrosse, Wis., as part of a project study of Lake Onalaska in cooperation with the U.S. Fish and Wildlife Service.

Upper Mississippi-Maquoketa-Plum Subregion

1. Suspended-sediment data are being collected on a daily basis at Upper Iowa River near Dorchester, Iowa, and at Mississippi River at McGregor, Iowa, as a part of the Great River Environmental study in cooperation with U.S. Corps of Engineers, St. Paul District.

2. Suspended-sediment data are being collected on a periodic and storm-event basis for the U.S. Corps of Engineers at the Grant River at Burton, Wis.

3. Suspended-sediment data are being collected at Maguoketa River near Maguoketa, Iowa, as a part of the Great II River Environmental study in cooperation with the U.S. Corps of Engineers, Rock Island District.

4. Suspended-sediment data are being collected on an intermittent and storm-event basis at Cedar River near Austin, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

5. Suspended-sediment data are being collected three times per year on an event basis at Turkey River at Garber, Iowa, as part of Great II study in cooperation with the U.S. Corps of Engineers, Rock Island District.

Wisconsin Subregion

1. Suspended-sediment and bedload data are being collected on a periodic and storm-event basis for the U.S. Corps of Engineers at Wisconsin River at Muscoda, Wis.

2. Suspended-sediment data are being collected on a periodic and storm-event basis at the following sites in cooperation with the State of Wisconsin.

Big Eau Pleine River near Stratford, Wis.
Fenwood Creek at Bradley, Wis.
Freeman Creek at Halder, Wis.
Big Eau Pleine River near Mosinee, Wis.

3. Suspended-sediment data are being collected on a periodic and storm-event basis to determine daily suspended-sediment discharge in cooperation with the State of Wisconsin at the following sites:

Site A, Trout Creek near Ridgeway, Wis.
Site B, Trout Creek near Ridgeway, Wis.
Site D, Trout Creek near Ridgeway, Wis.

4. Suspended-sediment data are being collected on an intermittent and storm-event basis in cooperation with Dane County, Wis., at Black Earth Creek at Black Earth, Wis.

5. Suspended-sediment data are being collected on a periodic and event-basis to determine daily suspended-sediment discharge in cooperation with the State of Wisconsin, at Yellowstone River near Blanchardville, Wis. and at Steiner Branch near Waldwick, Wis.

Upper Mississippi-Iowa-Skunk-Wapsipinicon Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Clinton, Iowa, and at Mississippi River at Keokuk, Iowa, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at the following in cooperation with the Iowa Geological Survey:

Iowa River at Iowa City, Iowa
Ralston Creek at Iowa City, Iowa
Skunk River at Augusta, Iowa

3. Suspended-sediment data are being collected on a daily basis at the following sites as part of the Great II River Environmental study in cooperation with U.S. Corps of Engineers, Rock Island District.

Crow Creek at Bettendorf, Iowa
Iowa River at Wapello, Iowa

4. Suspended-sediment data are being collected three times per year on an event basis at Wapsipinicon River at De Witt, Iowa, as part of Great II study in cooperation with the U.S. Corps of Engineers, Rock Island District.

Rock Subregion

1. Suspended-sediment data are being collected on a daily plus storm-event basis in cooperation with Dane County, Wis., on Willow Creek at Madison, Wis.

2. Suspended-sediment data are being collected on a weekly and storm-event basis in cooperation with the U.S. Corps of Engineers and the City of Middleton, Wis., at:

Pheasant Branch Creek at Middleton, Wis., at U.S. Highway 12
Pheasant Branch at Century Avenue at Middleton, Wis.
Tributary to Pheasant Branch at Hwy. 14 at Middleton, Wis.
Tributary to Pheasant Branch at Airport Road at Middleton, Wis.
Pheasant Branch at Middleton, Wis., at CTH "M"

3. Suspended-sediment data are being collected on an intermittent and storm-event basis in cooperation with Dane County, Wis., at the following sites:

Maunesha River near Sun Prairie, Wis.
Yahara River at Windsor, Wis.
Token Creek near Madison, Wis.
Yahara River at STH 113 at Madison, Wis.
Sixmile Creek at Waunakee, Wis.
Sixmile Creek near Waunakee, Wis.
Spring Creek at CTH "M" near Middleton, Wis.
Spring Harbor Storm Sewer at Madison, Wis.
Starkweather Creek - West - at Madison, Wis.
Starkweather Creek - East - at Madison, Wis.
Olbrich Park Storm Ditch at Madison, Wis.
Door Creek near Cottage Grove, Wis.
Mt. Vernon Creek near Mt. Vernon, Wis.

4. Suspended-sediment data are being collected on a monthly basis at Rock River near Joslin, Ill., as a part of NASQAN.

5. At the Kishwaukee River near Perryville, Illinois, daily suspended-sediment data collection began in April 1979 in cooperation with the Rock Island Corps of Engineers.

Des Moines Subregion

1. Suspended-sediment data are being collected on a daily basis at Des Moines River near Saylorville, Iowa, in cooperation with the Iowa Geological Survey.

2. Suspended-sediment data are being collected on a daily basis at Des Moines River at St. Francisville, Mo., as a part of the Great II study in cooperation with the U.S. Corps of Engineers, Rock Island District.

3. Suspended-sediment data are being collected on an intermittent basis at Des Moines River at Jackson, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

4. Suspended-sediment data are being collected on a daily basis at Middle Fork Raccoon River at Bayard, Iowa, and Middle Fork Raccoon River at Panora, Iowa. In conjunction with the operation of these stations, a sediment reservoir sedimentation study is being conducted at Lake Panorama at Panora, Iowa. This study is a cooperative undertaking with the Engineering Research Institute, Iowa State University at Ames, Iowa.

Upper Mississippi-Salt-Subregion

1. Suspended-sediment data are being collected on a monthly basis at Salt River near New London, Mo., and Mississippi River below Alton, Ill., as a part of NASQAN.

2. Suspended-sediment data are being collected on three to six storm-events per year at Middle Fabius River near Monticello, Mo., as a part of the Great II study in cooperation with the U.S. Corps of Engineers, Rock Island Districts.

Upper Illinois Subregion

1. Suspended-sediment data are being collected on a monthly basis at Illinois River at Marseilles, Ill., as a part of NASQAN.

2. Suspended-sediment data are being collected on an intermittent basis at Davis Ditch near Kouts, Ind., Kankakee River near Kouts, Ind., Cobb Ditch near Kouts, Ind., Singleton Ditch at Schneider, Ind., Iroquois River near Rosebud, Ind., and at Iroquois River near Foresman, Ind., in cooperation with the State of Indiana.

3. Suspended-sediment data are being collected on a daily basis at Yellow River at Plymouth, Ind., in cooperation with the State of Indiana.

4. Suspended-sediment data are being collected on a weekly basis at Kankakee River near North Liberty, Ind., in cooperation with the State of Indiana.

5. Bed-material data are being collected on an intermittant basis at Davis Ditch near Kouts, Ind., and at Kankakee River near Kouts, Ind., in cooperation with the State of Indiana.

6. Suspended-sediment data are being collected on a daily basis at Iroquois River near Chebanse, Ill., in cooperation with the Illinois Department of Transportation, Division of Water Resources.

7. Suspended-sediment data are being collected on a daily basis at the following sites in cooperation with the Illinois Kankakee River Basin Task Force:

Kankakee River at Momence, Ill. (begun Oct. 1, 1978)
Kankakee River near Wilmington, Ill. (begun Oct. 1, 1978)
Iroquois River at Iroquois, Ill. (begun Oct. 1, 1978)

8. In cooperation with the Chicago Corps of Engineers daily suspended-sediment data collection began in April 1979 at the Des Plaines River at Riverside, Ill.

Lower Illinois Subregion

1. Suspended-sediment data are being collected on a monthly basis at Illinois River at Valley City, Ill., as a part of NASQAN.

Upper Mississippi-Kaskaskia-Meramec Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Thebes, Ill., at Kaskaskia River at Venedy Station, Ill., at Big Muddy River at Murphysboro, Ill., and at Meramac River near Eureka, Mo., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Kaskaskia River at Cooks Mills, Ill., in cooperation with the U.S. Army Corps of Engineers, St. Louis District.

3. Suspended-sediment data are being collected on a daily basis at Mississippi River at St. Louis, Mo., in cooperation with the U.S. Army Corps of Engineers, St. Louis District.

Special Studies

Three stations are operated in cooperation with the Metropolitan Sanitary District of Greater Chicago to record changes in sediment transport during reclamation of strip-mined areas for irrigation with digested sludge from sewage treatment facilities. Two stations on Big Creek, one above the reclamation area at St. David, Ill., and one below the area near Bryant, Ill., monitor changes in sediment load. One station is operated on Slug Run near Bryant, Ill., which drains an area scheduled to be reclaimed. Annually, size analyses are run on suspended sediment at these stations.

In cooperation with the Rock Island District, Corps of Engineers, daily suspended sediment sampling began at Henderson Creek near Oquawka, Ill, and Green River near Geneseo, Ill. on April 1. At the same time at these stations and at Rock River near Joslin, Ill., sampling began for bed load and bed material sizing during high discharge events. And on December 21, daily suspended sediment sampling began at Edwards River near New Boston, Ill. All these data were gathered for the Sediment and Erosion Work Group of the Great II Mississippi River Basin Study.

In April 1978, in cooperation with Federal Environmental Protection Agency (Energy R&D), six stations were established to determine sediment yield changes from drainage areas affected by coal strip mining. At these locations suspended-sediment samples are being collected monthly with increased sampling during high runoff periods. Three stations: Turkey Creek near Fiatt, South Branch Doza Creek near Lenzburg, Ill., and Little Cana Creek near Creal Springs, Ill., monitor sediment loads from natural drainage areas. The remaining stations: West Branch Big Creek near Canton, Ill., Doza Creek near Lenzburg, Ill., and Bankston Fork near Crab Orchard, Ill., monitor sediment loads from areas affected by strip mining.

Laboratory Activities

The Geological Survey laboratory in Iowa City, Iowa, analyzed suspended-sediment samples collected by the Corps of Engineers at:

Mississippi River at Hannibal, Mo.
Hadley Creek at Kinderhook, Ill.
Bay Creek at Nebo, Ill.
Wapsipinicon River at DeWitt, Iowa
Iowa River at Marengo, Iowa
Iowa River at Coralville Dam, Iowa
Mississippi River at Burlington, Iowa
South Skunk River below Squaw Creek near Ames, Iowa
Mississippi River at Keokuk, Iowa
Des Moines River near Stratford, Iowa
Raccoon River at Van Meter, Iowa
North River near Norwalk, Iowa
Middle River near Indianola, Iowa
South River near Ackworth, Iowa
Des Moines River near Tracy, Iowa
White Breast Creek near Dallas, Iowa
Mississippi River at East Dubuque, Ill.

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 1026
605 North Neil Street
Champaign, IL 61820

District Chief, WRD
U.S. Geological Survey
1819 North Meridian Street
Indianapolis, IN 46202

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Federal Building, Room 269
400 South Clinton Street
Iowa City, IA 52244

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

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

District Chief, WRD
U.S. Geological Survey
1815 University Avenue
Room 200
Madison, WI 53706

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made in the following watersheds:

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Kaskaskia River	Ash-Loop	Ash and Loop Creeks	St. Clair	IL
Rock River	Upper Sugar River	Sugar River	Dane	WI

b. Resource Conservation and Development

RC&D Project Name	County	State
Pathfinders	Mahaska	IA

c. River Basin Investigations

Major Basins	Basin Reported	State
Rock River	Sugar-Pecatonia	WI

Suspended sediment and bedload sampling were conducted by the Great River Environment Action Team, Sediment and Erosion Work Group, under cooperative agreement with USGS and COE at the following locations:

River	Location	State
Illinois	Meredosia	IL
Big Muddy	Murphysboro	IL
Kaskaskia	Venedy Station	IL
Mississippi	Alton	IL
Mississippi	Chester	IL
Mississippi	Thebes	IL
Salt	Monroe City	MO

River	Location	State
Salt	New London	MO
Meramec	Eureka	MO
Saline Creek	Minnith	MO

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys or sediment volume computations were made in the following reservoirs in 1980:

Reservoir	County	State
Springbrook pond	Guthrie	IA
Don Williams reservoir	Boone	IA
Wapello pond	Wapello	IA
Cedar Lake	Cerro Gordo	IA
Glen Hills #7	St. Croix County	WI
N. Wollum pond	Lincoln	WI
C. Banks pond	Lyon	MN
L. Baird pond	Lyon	MN
Jeremiason pond	Lyon	MN
Lyle Harris pond	Lyon	MN
Ed Frueche pond	Houston	MN
East Willow FD-28	Fillmore	MN

LOWER MISSISSIPPI REGION

CORPS OF ENGINEERS

Lower Mississippi Valley Division

A Sediment Studies Seminar was conducted at the Division office on 10-11 Sep 80. The purpose of the seminar was to determine sediment study requirements and develop guidance for conducting and reporting sediment analyses in pre- and postauthorization studies to minimize sediment problems on future projects. It was determined that sediment studies should evaluate the impacts of sediment transport on the project's performance, economics, and the environment. The seminar was attended by representatives of OCE, Colorado State University, USDA Sedimentation Laboratory, WES, HEC, LMVD, and LMVD Districts. The minutes of the seminar have been submitted to OCE for Corps-wide distribution.

Memphis District

Sediment sampling continued at the 24 stations previously established on the St. Francis River, Arkansas and its tributaries between Madison, Arkansas and Fisk, Missouri. Suspended sediment, bed sediment, temperature and flow data are being collected on a monthly basis. Suspended samplers DH76TM, DH78, D74ALTM and bed sampler BMH60 were used.

New Orleans District

Sediment Load Measurements

1. Suspended sediment and bed material sampling was continued at the ranges located in the Mississippi River at Coochie, LA, at Tarbert Landing, MS, at a frequency of semimonthly; in the Old River Outflow Channel near Knox Landing, LA, semimonthly; in the Atchafalaya River at Simmesport, LA, semimonthly; monthly at Wax Lake Outlet at Calumet, LA, and Lower Atchafalaya River at Morgan City, LA. On the Red River samples were taken at Fulton, AR, Shreveport, LA, Alexandria, LA, and above Old River Outflow Channel semimonthly. Weekly sampling was continued in the Atchafalaya Basin at ranges located at Bayou Chene below Bayou Crook Chene, Lake Long below Bayou La Rompe, Little Tensas below Blind Tensas Cut, and East Access Channel above Chicot Pass.

2. Daily suspended sediment samples were taken on the Red River at Colfax, LA.

3. A cooperative program with the US Geological Survey for collection and analysis of suspended sediment samples was in effect for stations located on the Mississippi River at St. Francisville, Plaquemine, Union, Luling Ferry, Violet, and Venice, LA. Samples were taken on the Red River at Boyce and Moncla, LA. The sampling frequency was monthly and the data will be published by USGS in its annual publication.

4. Suspended sediment samples were taken with a U.S. P-46, or U.S. P-61 sampler. Bed material samples were taken with a BM-54 sampler or drag bucket type sampler. Daily suspended sediment samples were taken with a trap type sampler.

Office Investigations

1. Use of a Digital Flow-Sediment Model of the Atchafalaya Basin developed in conjunction with the Hydrologic Engineering Center is continuing. Continued improvements to this model are being made, i.e., incorporation of a new strip segment version.

2. District is continuing development of a Flow Sediment Model of the Mississippi River throughout the District.

3. A flow Sediment Model of the Red River Waterway is being used to study maintenance dredging associated with the construction sequency and the completed project.

4. As part of the LMVD Potamology Program (P-1), WES has compiled a report on the characterization of the suspended-sediment regime and the bed material composition of the Mississippi River. The study is being printed. WES is currently embarking on a study to evaluate the suspended sediment and bed material collection procedures used in the Mississippi River Basin.

5. Computer Data Base System is being built to store hydrographic data for the period of record in the District.

6. A Computer Data Base System is being written to analyze, store and retrieve sediment data.

7. For District, WES is preparing a mathematical model of the Atchafalaya Bay.

8. As part of the LMVD Potamology Program, District through a contract with University of Missouri-Rolla, has documented changes in morphological characteristics in the Mississippi and Atchafalaya Rivers. The report was published December 1980.

St. Louis District

An analysis of the resurvey data for Carlyle Lake was conducted in 1980. This analysis was required in order to evaluate and determine the accuracy between the computed volume of sediment deposited from the initial sediment survey (1971) and the sediment resurvey (1976). The analysis is complete and the results are being prepared in compliance with EM 1110-2-4000 (Reservoir Sedimentation Investigations Program).

Sediment and retrogression ranges at both Rend and Shelbyville Lakes are in the process of being resurveyed. These reports will be submitted during calendar year 1981.

Suspended and bed samples were collected at four ranges in the St. Louis Harbor on the Mississippi River. It is anticipated that data will continue to be collected at these ranges at different stages and at different times of the year. The same scheme was used on the Illinois River at three data ranges. It is hoped that additional sampling will be conducted through a full range of flows and seasons.

Vicksburg District

Sedimentation Surveys. Channel geometry data such as cross sections and profiles were made on many streams within the District to be used in various hydrologic and hydraulic studies.

Sediment Loan Measurements.

1. Both bed sample and suspended sample measurements are being made weekly at three locations on the Mississippi River, these locations being Natchez, Miss., Vicksburgh, Miss., and Arkansas City, Ark.

2. An ongoing program in which suspended sample, bed material sample, temperature, discharge, and stage data are collected and computerized for approximately 70 stations within the District has been continued.

Office Investigations.

1. The Mississippi River sediment data has been analyzed to determine sediment discharge curves at each of the three stations.

2. Previously collected and analyzed data has been used to determine the best flood control scheme at Greenwood as being a regulating structure in the cutoff. This information has also been used to develop a tentative operating plan for the cutoff structures.

3. A study has been initiated by the District to determine the effects of the Quachita River Navigation Project. This study is to determine the individual and cumulative effects of channel dredging, bend widening, and cutoffs on the sediment regime of the river between Monroe, La., and Felsenthal Lock and Dam.

4. A study which was initiated in 1979 by the District and Colorado State University to determine possible alternatives for reducing sediment inflow into the main stem Yazoo-Tallahatchie-Coldwater River System from its hill tributaries and to determine design of structural measures to reduce a sediment problems is continuing. This study should be completed in October 1982.

5. A comprehensive data collection program was continued as part of the Yazoo Basin Streambank Erosion Control Evaluation and Demonstration Program. This data collection program has been contracted with the Agricultural Research Service and includes detailed water, sediment, and geology data collection, analysis, and evaluation on selected hill tributaries in the Yazoo Basin.

LOWER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Lower Mississippi - Hatchie Subregion

1. In cooperation with the Tennessee Department of Public Health, Division of Water Quality Control, suspended-sediment discharge measurements are being made on a 6-week frequency at seven sites within the State of Tennessee.

2. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Memphis, Tenn., at Obion River at Obion, Tenn., and at Hatchie River at Bolivar, Tenn., as a part of NASQAN.

Lower Mississippi - St. Francis Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Francis River at Parkin, Ark., St. Francis Bay at Riverfront, Ark., Arkansas River at Dam 2 near Gillette, Ark., (converted to bimonthly October 1, 1980) and at White River at Clarendon, Ark., as a part of NASQAN.

Lower Mississippi - Yazoo Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River near Arkansas City, Ark., Yazoo River near Shell Bluff, Miss., and bimonthly at Yazoo River at Redwood, Miss., as a part of NASQAN.

Lower Red - Ouachita Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ouachita River at Columbia, La., and at Red River near Simmesport, La., and at Ouachita River at Camden, Ark., as a part of NASQAN. Sediment data are being collected on a monthly 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 monthly basis at Tensas River at Tendal, La., and at Boeuf River at Fort Necessity, La., as a part of NASQAN.

Lower Mississippi - Big Black Subregion

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

Lower Mississippi - Lake Maurepas Subregion

1. Suspended-sediment data are being collected on a monthly basis at Amite River at 4-H Camp near Denham Springs, La., Tangipahoa River at Robert, La., Lower Grand River at Bayou Sorrel, La., and at Mississippi River near St. Francisville, La., as a part of NASQAN.

Louisiana Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Bayou Teche at Keystone Lock and Dam below St. Martinville, La., Mermentau River at Mermentau, La., Atchafalaya River near Melville, La., and at Calcasieu River near Kinder, La., as a part of NASQAN.

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

Mississippi River at Belle Chasse, La.
Tchefuncte River near Covington, La.
Houma Navigation Canal at Houma, La.

Special Studies

1. In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across Tennessee. Reports documenting data and research findings are in preparation.

2. Monthly collection was begun at 23 stations on the St. Francis River and selected tributaries in October 1977 for the Corps of Engineers. Monitoring is expected to continue for five years. Following the 5-year period, the existing network may be reduced to a few stations that would be monitored more intensively.

3. Suspended-sediment data are collected on a weekly basis and for selected storm events on Tillatoba Creek below Oakland, Miss., and South Fork Tillatoba Creek near Charleston, Miss. This information is collected in cooperation with the U.S.Soil Conservation Service in order to estimate the sediment loads of Tillatoba Creek during periods of high discharge.

4. Suspended-sediment samples are collected on a monthly basis and selected storm events on Coldwater Creek and David Bayou near Sledge, Mississippi. The samples are collected as part of a lignite hydrology project.

Laboratory Activities

The Geological Survey sediment laboratory located in Baton Rouge, La., analyzed suspended-sediment and bed-material samples collected by the U.S. Corps of Engineers at the following locations:

Red River at Alexandria
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

Lower Atchafalaya River at Morgan City
Wax Lake Outlet at Calumet

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
6554 Florida Boulevard
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room A-413
Nashville, TN 37203

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made in the following watershed:

Major Drainage	Watershed	Stream	State
Mississippi River	Mississippi County Spillway Area	Various ditches	MO

2. River Basin Investigations

Major Basin	State
Yazoo River	MS
Big Black	MS
adjoining drainage areas	MS

CORPS OF ENGINEERS

North Central Division

St. Paul District

Sediment loads were measured by the US Geological Survey at seven river stations (Wild Rice, two at Sheyenee, two at Pembina, Souris, and Little South Pembina Rivers) under the St. Paul District sponsorship.

SOURIS-RED-RAINY REGION

GEOLOGICAL SURVEY

Souris Subregion

1. Suspended-sediment data are being collected on a daily basis at Souris River near Sherwood, N. Dak., as part of the Waterways Treaty program with the U.S. Department of State.

2. Suspended-sediment data are being collected on a monthly basis at Souris River near Foxholm, N. Dak., in connection with a pre-impoundment quality water study in cooperation with the U.S. Corps of Engineers.

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

4. Suspended-sediment data are being collected on a monthly basis at Souris River near Verendrye, N. Dak., and at Wintering River near Karlsruhe, N. Dak., as part of the Missouri River Basin program.

5. Suspended-sediment data are being collected on a monthly basis at West Branch Short Creek near Columbus, N. Dak., as part of the Coal Hydrology Program.

Red Subregion

1. Suspended-sediment data are being collected on a daily basis at Sheyenne River at Lisbon, N. Dak., (discontinued Sept. 30, 1979), and at Sheyenne River at Kindred, N. Dak., in connection with a pre-impoundment study in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are being collected on a monthly basis at Wild Rice River near Abercrombie, N. Dak., and at Red River of the North at Hickson, N. Dak., as part of the Missouri River Basin program.

3. Suspended-sediment data are being collected on a monthly basis at Beaver Creek near Finley, N. Dak., as a part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected on a monthly basis at Red River of the North at Halstad, Minn., and at Red River of the North at Emerson, Manitoba, Canada, and at the Redlake River at Crookston, Minn., as a part of NASQAN.

5. Suspended-sediment data are being collected at Pembina River near Vang, N. Dak., (discontinued Sept. 30, 1979), at Little South Pembina River near Walhalla, N. Dak., (discontinued Sept. 30, 1979), and at Pembina River near Walhalla, N. Dak., in cooperation with the U.S. Corps of Engineers.

6. Suspended-sediment data are being collected on an intermittent basis at Buffalo River near Dilworth, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

7. Suspended-sediment data are being collected on a daily basis at Wild Rice River at Twin Valley, Minn., in cooperation with the U.S. Corps of Engineers.

8. Suspended-sediment measurements were made during floods at the following sites:

Wild Rice River above Ada, Minn.
So. Br. Wild Rice River near Felton, Minn.
So. Br. Wild Rice near Borup, Minn.
Wild Rice River near Perley, Minn.
Wild Rice River above So. Br. near Borup, Minn.
State Ditch 45 near Felton, Minn.
Wild Rice River at Hendrum, Minn.
Marsh River near Shelly, Minn.
Marsh River Ditch near Ada, Minn.
Sandhill River near Climax, Minn.
Red Lake River at Highlanding near Goodridge, Minn.
Thief River near Thief River Falls, Minn.
Ruffy Brook near Gonvick, Minn.
Clearwater River at Plummer, Minn.
Lost River at Oklee, Minn.
Clearwater River at Red Lake Falls, Minn.
Snake River at Warren, Minn.
Snake River at Alvarado, Minn.
Middle River at Argyle, Minn.
So. Br. Two Rivers at Lake Bronson, Minn.
Two Rivers at Hallock, Minn.
Roseau River below S. Fork near Malung, Minn.
Roseau River below Roseau, Minn.
Sprague Creek near Sprague, Manitoba
Roseau River at Ross, Minn.

Rainy Subregion

1. Suspended-sediment data were collected on a monthly basis at Little Fork River at Littlefork, Minn., at Roseau River below State Ditch 51 near Caribou, Minn, at Red Lake River near Crookston, Minn., and at Rainy River at Manitou Rapids, Minn., as a part of NASQAN.

2. Suspended-sediment measurements were made during floods at the following sites:

Sturgeon River near Chisholm Minn.
Rapid River near Baudette, Minn.

Special Studies

Suspended sediment data were collected during periods of high flow at two sites in the Park River basin and six sites in the Turtle River basin. The samples were collected during the spring snow-melt period and summer storm events as part of a data monitoring program being conducted in the Red River of the North Basin in cooperation with the U.S. Soil Conservation Service.

Weekly suspended sediment and bedload data were collected during the spring runoff period on the Pembina River near Walhalla, North Dakota. A Helly-Smith bedload sampler was used in this program.

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

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

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

MISSOURI REGION

BUREAU OF LAND MANAGEMENT

Montana

Sediment yield studies are being conducted on native rangeland in central and Eastern Montana. Measurement of long-term deposition in small reservoirs is being used to characterize average annual sediment yield by geological/soil type and surface resource management.

Suspended sediment data are being acquired in connection with coal hydrology studies in Eastern Montana and Western North Dakota. These studies, being conducted cooperatively with USGS, are being used to define baseline hydrologic characteristics and forecast probable impacts of surface coal mining.

Wyoming

Stratton Sagebrush Hydrology Study: The study was begun in 1967 as a cooperative research effort with Rocky Mountain Forest and Range Experiment Station, Laramie, Wyoming Unit. The study has two objectives of providing hydrologic including sedimentation, information for big sagebrush lands where snow relocation has major hydrologic significance and determining how hydrologic characteristics are affected by sagebrush management practices; such as, chemical control of sagebrush.

Suspended sediment concentrations have varied from a minimum of 0 parts per million (PPM) to a maximum of 831 PPM. Maximum concentrations occur when sheep are grazing immediately above a gaging station.

New Publications: In Progress - "Long-term effects of big sagebrush control upon the soil-water regime," Author: David L. Sturgis, Research Forester. Available - Schroeder, Max H. and David L. Sturgis, "Spraying of big sagebrush with 2, 4-D causes negligible stream contamination," Journal of Range Management 33 (4): 311-312, July 1980.

Fifteen Mile Creek Drainage: Streamflow and sediment load are being monitored to determine sediment production as it relates to specific management actions. A riparian area will be fenced to study response to livestock exclusion.

Under contract the USGS is operating 11 stream gages where sediment samples are collected for input to BLM planning and management activities.

BUREAU OF RECLAMATION

Data were collected on the Niobrara River for a range in discharges which were used by ERT, the consultants performing the Niobrara River Environmental Study. Hydraulic data were collected in April for a river discharge of about 37 m^3/s (1,300 ft^3/s) at 17 cross sections in the 64-km (40-mile) study reach starting at the proposed Norden Damsite. Eleven of the cross sections were established during June 10-15, 1979, so data for those cross sections have been obtained for three discharges: One near 23 m^3/s (800 ft^3/s); one near 14 m^3/s (500 ft^3/s); and one near 37 m^3/s (1,300 ft^3/s). The remaining six cross sections were established during the April 1980 trip, so data at these six cross sections are available only for the high discharge of about 37 m^3/s (1,300 ft^3/s). Data collected during April 1980, included a suspended sediment sample, bed material samples, water surface elevations sufficient to compute slope, and cross section survey points. Discharge measurements and water samples for chemical and nutrient analysis were taken at six intermittent cross sections through the study. In addition, the study reach was flown, so cross sections were paneled to provide control for the aerial photographs. In November, at a river discharge of about 17 m^3/s (600 ft^3/s) a representative of the Sedimentation Section assisted Central Nebraska Project personnel in collecting more channel hydraulic data, suspended sediment, and bed material samples on the Niobrara River below the Norden Damsite. Results will be used in verification of a channel degradation model and for use in the Niobrara River studies under contract with ERT, Fort Collins, Colorado.

Members of the Sedimentation Section attended several meetings throughout the year with representatives from the Lower Missouri Regional Office, ERT, CSU consultants to ERT, Fish and Wildlife Service, Nebraska Resources Commission, and Nebraska Water Resources Center, on the Niobrara River Ecological and Hydrological Study.

A representative of the Sedimentation Section toured the Missouri River in the vicinity of the proposed Fort Benton Damsite and downstream, in the company of Upper Missouri Regional personnel; and laid out a tentative program of data collection and methodology to analyze the potential degradation after dam and reservoir construction.

A field inspection was made of the sand abrasion problems at the Milburn Diversion Dam with representatives of the project, regional, and E&R Center personnel. The group also visited the Arcadia Diversion Dam, which has a similar type sand excluder, but a much better system for sluicing sediment downstream through the river gates. At Milburn Diversion Dam the sands being sluiced through the two sluice gates have seriously eroded the entire floor of the sluiceway with grooves several inches deep exposing the rebars around the base of most of the dentates. A slight amount of erosion was noted in the overflow spillway section.

Representatives of the Sedimentation Section, along with Lower Missouri Region, Division of Design, and Division of Research personnel, toured the Denver Water Board diversion facility on the South Platte River. The specific purpose was to inspect the rubber coating used to protect the concrete in the sluiceways of the diversion structure. After 16 years of operation, the rubber coating has shown very little wear due to sand abrasion. One event which sluiced large rock material from the diversion pool at high velocity has penetrated the covering by gouging. The purpose of the inspection was to evaluate the rubberized coating potential for application at sites subject to sand abrasion such as the Milburn Diversion Dam sluiceways.

CORPS OF ENGINEERS

Missouri River Division

Kansas City District

Suspended Sediment Measurement. The District operated, on a routine or part time basis, 25 suspended sediment stations during this calendar year.

1. Missouri River. Three long term stations exist on the Missouri River—St. Joseph, Kansas City, and Hermann, Missouri. The samples are collected by the U.S.G.S. in accordance with a cooperative agreement. At all locations, D.I.'s are scheduled each week and a full set of points are to be collected each month. A minimum of five verticals are measured in the cross section. Bed material samples are collected each time a suspended sample is taken. Hermann, Missouri, has become a high maintenance station, and numerous equipment failures during the past 2 years have decreased the continuity of the established record since 1973. A review of the record indicates only three sets of points were collected in W. Y. 1980, with the last collected in February. Further D. I. 's are sporadic, with complete months missing in the summer. A review of lab sheets indicated a lack of care in preparing the samples for shipment. This has cast some doubt as to the quality of the composited analysis. A review also indicates some of the bed material samples were collected prior to the D.I.'s and/or points being collected. Most of the problems have been solved with collection procedures; however, the frequency of required maintenance remains high. Therefore, in light of the distance to Hermann, Missouri, from Kansas City, manpower availability for such maintenance, and the loss in continuity of the station record, the District is preparing to close Hermann at the end of W.Y. 1981. The Kansas City and St. Joseph records are good and it is proposed that these stations be continued to monitor the suspended sediment for grain size, distribution, and concentration, as well as for quality evaluation and continued evaluation of the channel and stabilization works.

2. Kansas River. On the main stem of the Kansas River, seven stations are presently operated. Three are quasi long term stations, i.e., different agencies have collected data, with 1 or 2 year gaps between periods of continuous sampling due to lack of funding. These stations are Wamego, Lecompton, and Desoto, Kansas. The U.S.G.S. is collecting samples based on a cooperative agreement. Points, D.I.'s, and bed materials are collected at a similar frequency as samples collected in the Missouri River. The four remaining stations are sampled by observers and are short term. These short term stations will be closed on or before the "Kansas River Bank Stabilization Study" is completed. An evaluation of the long term stations will be made at that time as to probable continuance.

3. Osage and Maris des Cygnes River Basin.

(a) Osage River (Downstream of Harry S. Truman Reservoir). Two part time stations were established at 12 and 33 miles below Harry S. Truman Dam for the purpose of additional downstream monitoring of the hydropower operation. These stations will be used in conjunction with the stations at Warsaw and at the outlet in order to detect an increase in concentration and transport of suspended sediments, assuming bank erosion and bed scour downstream due to power production.

(b) Osage River (Upstream of Harry S. Truman Reservoir). The gage at Shell City, Missouri is an inflow station and will be continued until a satisfactory rating curve is developed or until the first resurvey is completed.

(c) Grand River. A gaging station was installed at Clinton as an inflow station to Harry S. Truman Reservoir. Operation will be the same as for the Osage River gage at Shell City, Missouri.

(d) Little Osage River. The gage at Fulton, Kansas, will supplement existing records and will be used to verify original storage allocations established at Ft. Scott Lake initially.

(e) Maris des Cygnes River.

(1) State Line. Cooperative station with U.S.G.S. for sediment and water quality measurements (physical and chemical). This will be used as an inflow station to the Harry S. Truman Reservoir and in conjunction with Little Osage gage to differentiate loadings from each stream.

(2) Outlet Melvern Lake. An outflow station for the purpose of determining trap efficiency of the lake. Station will be closed in W.Y. 1982 provided funding is established for resurveying Melvern Lake. The gage will be maintained until lake is resurveyed otherwise.

(3) Reading, Kansas. Inflow station to Melvern Lake and will be closed or remain open, dpending on resurvey, as explained above.

(4) Other Streams and Rivers. The remaining stations are for routine data collections such as reservoir/lake inflow/outflow trap efficiencies, gross densities, storage allocation for sediment, etc.

Lake Sedimentation Investigations. The initial resurveys for Perry, Milford, and Rathbun Lakes were completed this Fiscal Year. Area capacity curves for Harlan County, Tuttle Creek, Pomme de Terre, and Pomona Lakes are being reviewed for inconsistencies at the pool elevations below maximum flood pool. Some surveying work at the Harry S. Truman Reservoir is still outstanding due to real estate negotiations.

Special Studies. As a result of using two acceptable methodologies to establish total suspended sediment concentrations of simultaneous samples collected at Warsaw, Missouri, (one for water quality and one for sediment), a controversy arose with the Missouri River Division Laboratory as to the difference in measured concentrations. In order to explain these variable differences, MRDL prepared a series (5) of known concentrations for both the Kansas City District Water Quality Laboratory and MRDL to analyze. Although these test samples were somewhat heavier than those normally experienced at Warsaw, Missouri, the results indicate that the filtration method may be more accurate than the standard sediment (1-point pipette) test. However, both methodologies were within the 95 percent confidence limits as determined by students "t test." A review of the results indicated that neither method could attain more than 89 percent of the actual true concentrations prepared. A second series of known concentrations were prepared by MRDL (lighter), similar to those experienced at Warsaw. The Kansas City analysis was completed during the summer of 1980 and the results were forwarded to MRDL for comparison. To date the results of these comparisons are unknown. Nevertheless, these tests have not solved nor explained the apparent difference in concentrations experienced earlier in samples collected at the Warsaw, Missouri, gage.

Omaha District

Sediment Load Measurements. The District operated eight suspended sampling stations during the calendar year. Of these, two are Missouri River stations, four are major tributary stations and two are minor tributary stations. The U.S. Geological Survey operates the two Missouri River and the four major tributary stations under a cooperative stream gaging program which includes computation and publication of sediment load records. In addition, with the Corps assistance, they collect suspended sediment samples, bed material samples and flow velocities in the Missouri River at Nebraska City, Nebraska; Omaha, Nebraska; Sioux City, Iowa; Ponca, Nebraska; Maskell, Nebraska; and Gayville, South Dakota. Data collected include five to seven point integrated samples per stream vertical at five vertical locations in the cross-section as well as one bed sample at each vertical using a BM-54 sampler. The samples, including the velocity measurements, are obtained from a boat at each station at about six week intervals during the open water season. This data will be used to document the bed material load being transported by the Missouri River.

The Corps also operates PS-69 automatic samplers at the two minor tributary stations in the Omaha Metropolitan Area.

Reservoir Sediment Activities.

1. Gavins Point Project. A complete sedimentation resurvey was made of the degradation reach below Gavins Point Dam. Observations included profiling of all degradation ranges by A.E. Contract and collection of

bed surface samples by Corps personnel, to determine degradation and/or armoring trends and bank erosion in the reach. The Niobrara River Arm of the aggradation reach was resurveyed and used with the 1979 resurvey of the mainstem ranges on Lewis and Clark Lake to update the area capacity tables scheduled to be completed in early 1981.

2. Fort Randall Project. A complete resurvey was made of the Fort Randall degradation reach. This included soundings of all ranges, bed material sampling and measuring a water surface profile for a steady state release.

3. Pipestem Reservoir. The first resurvey was made of Pipestem Reservoir including sounding of all range cross-sections and obtaining bed surface material samples.

4. Oahe Project. A resurvey of 32 ranges on Lake Oahe in the Bismarck, North Dakota area was conducted to define and project growth of the delta. Data collected included range soundings, bed material and suspended sediment samples, discharge measurements, special point samples and a water surface profile from Garrison Dam to the Cannonball River. The resurvey data obtained in 1976 was used to update water volume and sediment accumulation values. Percent depletion was 1.74% from August 1958 through August 1976.

5. Lake Sharpe. The resurvey data from the complete sedimentation resurvey of Lake Sharpe in 1975 was used to update water volume and sediment accumulation values. Percent depletion was 3.66% from July 1963 through July 1975.

6. Sediment investigation plans of Holmes Lake were reviewed and updated for input into the revised O&M Manual.

7. In support of Additional Hydropower Studies being conducted on the Missouri River, studies were initiated under A-E Contract to determine the possible sedimentation and water quality impacts associated with operation of a potential pumped back storage facility located on Lake Francis Case in Gregory County, South Dakota. Study results are expected to be available in the third quarter of FY 81.

8. Area capacity tables for Lake Oahe and Lake Sharpe were updated and sent to Reservoir Control Center. Tables of sediment depletion volumes and rates were included in this update.

9. Evaluated limits of surface flooding and groundwater affected acreages on the Missouri and Niobrara Rivers near Niobrara, Nebraska, in support of the Government's position relative to the Cameron vs. U.S. Court of Claims, 16.80, and the Jones vs. U.S. Court of Claims, No. 306-796 lawsuits.

MISSOURI REGION

GEOLOGICAL SURVEY

Saskatchewan Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Mary's River at Montana, U.S.A.--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 daily basis at two sites on Muddy Creek near Vaughn, Mont., to monitor irrigation practices.

2. Suspended-sediment data are being collected on a monthly basis and bi-monthly basis respectively at Missouri River at Toston, Mont., and at Marias River near Chester, Mont., as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the U. S. Water and Power Resources Service (WAPRS):

Belt Creek near Portage, Mont.
Highwood Creek near Portage, Mont.
Missouri River at Fort Benton, Mont.

Missouri - Musselshell Subregion

1. Suspended-sediment data are being collected on a daily basis at Missouri River near Landusky, Mont., in cooperation with the U.S. Corps of Engineers.

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

Missouri River at Virgelle, Mont.
Musselshell River at Mosby, Mont.
Missouri River below Fort Peck Dam, Mont.

3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Bureau of Land Management:

Half Breek Creek near Klein, Mont.
Musselshell River near Roundup, Mont.
East Parrot Creek near Roundup, Mont.
West Parrot Creek near Roundup, Mont.
Fatteg Creek near Delphia, Mont.

Milk Subregion

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

2. Suspended-sediment data are being collected on a quarterly basis at Little Peoples Creek near Hays, Mont., and Boxelder Creek near Rocky Boy, Mont., as part of the Federal CBR program.

3. Suspended-sediment data are being collected on a monthly basis at Rock Creek below Horse Creek at 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 at Redwater River at Circle, Mont., and at Redwater Creek near Vida, Mont., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at East Poplar River at international boundary in cooperation with the Department of State (International Joint Commission).

3. Suspended-sediment data are being collected on a monthly basis at the following sites to define water quality characteristics of the Poplar River Basin as part of the Federal CBR program:

Poplar River at international boundary
East Fork Poplar River near Scobey, Mont.
Poplar River above West Fork near Bredette, Mont.
West Fork Poplar River near Bredette,
Mont. Poplar River near Poplar, Mont.

4. Suspended-sediment data are being collected on a monthly basis at Missouri River near Culbertson, Mont., as a part of NASQAN.

5. Suspended-sediment data are being collected on a monthly basis and quarterly basis respectively at Big Muddy Creek near Antelope, Mont., and at Beaver Creek at international boundary as part of the Federal CBR program.

6. Suspended-sediment data are being collected on a monthly basis at Hardscrabble Creek near Culbertson, Mont., in cooperation with the Bureau of Land Management.

Upper Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis at Yellowstore River at Billings, Mont., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Yellowstone River at Huntley, Mont., in cooperation with the Environmental Protection Agency.

3. Suspended-sediment data are being collected on a monthly and storm-event basis from March to October at Big Sand Coulee at Montana-Wyoming State Line, in cooperation with the U.S. Bureau of Land Management.

4. Suspended-sediment data are being collected on a bi-monthly basis at Yellowstone River near Livingston, Mont., as part of NASQAN.

Big Horn Subregion

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

2. Suspended-sediment data are being collected on a monthly and storm-event basis at East Fork Wind River near Dubois, Wyo., as part of the Missouri River Basin Program.

3. Suspended-sediment data are being collected on a monthly and storm-event basis at Wind River near Crowheart, Wyo., at Nowood River near Tensleep, Wyo., and at Shoshone River near Lovell, Wyo., in cooperation with the Wyoming State Engineer.

4. Suspended-sediment data are being collected on a daily basis at the following sites in cooperation with the U.S. Bureau of Land Management:
   Dry Creek near Bonneville, Wyo.
   East Fork Nowater Creek near Colier, Wyo.
   Fifteenmile Creek near Worland, Wyo.

5. Suspended-sediment data are being collected on a monthly basis at Bighorn River at Kane, Wyo., as a part of the Missouri River Basin Program.

6. Suspended-sediment data are being collected on a weekly basis during irrigation season at Wyoming Canal near Lenora, Wyo., and at Wyoming Canal below Pilot Wosleway near Marion, Wyo., in cooperation with the Water and Power Resources Service, Upper Missouri Region.

7. Suspended-sediment data are being collected on a quarterly basis at Middle Fork Fifteenmile Creek near Worland, Wyo., and Dry Creek near Graybull, Wyo., in cooperation with the Bureau of Land Management.

8. Suspended-sediment data are being collected on a monthly and storm-event basis at Fivemile Creek near Shoshoni, Wyo., as part of the Missouri River Basin Program.

9. Suspended-sediment data are being collected on a monthly and storm-event basis at Wind River below Boysen Reservoir, Wyo., as part of the Federal CBR program.

10. Suspended-sediment data are being collected on a monthly and storm-event basis at Shoshone River above Willwood Dam, near Willwood, Wyo., in cooperation with the Water and Power Resources Service, Upper Missouri Region.

11. Suspended-sediment data are being collected on a weekly basis during the irrigation season at Willwood Canal near Willwood, Wyo., and Shoshone River below Willwood Dam, Wyo., in cooperation with the Water and Power Resources Service, Upper Missouri Region.

12. Suspended-sediment data are being collected on a monthly basis from April to September at Cottonwood Drain near Shoshoni, Wyo., in cooperation with the Water and Power Resources Service, Upper Missouri Region.

13. Suspended-sediment data are being collected on a monthly and storm-event basis at Ocean Drain near Midvale, Wyo., in cooperation with the WAPRS, Upper Missouri Region.

Powder-Tongue Subregion

1. Suspended-sediment data are being collected on a daily basis at Tongue River at Brandenberg Bridge, Mont., at Tongue River at Miles City, Mont., and at Powder River at Locate, Mont.

2. Suspended-sediment data are being collected March through September at Powder River at Moorhead, Mont., and at Powder River at Broadus, Mont., as part of the Federal CBR program.

3. Suspended-sediment data are being collected on a monthly basis at Tongue River at Birney Day School Bridge near Birney, Mont., as part of the Federal CBR program.

4. Suspended-sediment data are being collected on a monthly storm-event basis at the following sites in cooperation with the Wyoming State Engineer:

Goose Creek below Sheridan, Wyo.
Little Powder River above Dry Creek, near Weston, Wyo.

5. Suspended-sediment data are being collected on a monthly storm-event basis at the following sites as part of the Federal CBR program:

Crazy Powder River near Sussex, Wyo.
Woman Creek at upper station, near Arvada, Wyo.
Clear Creek below Rock Creek, near Buffalo, Wyo.
Clear Creek at Ucross, Wyo.
Little Powder River below Corrall Creek, near Weston, Wyo.
Little Powder River near Weston, Wyo.

6. Suspended-sediment data are being collected on a monthly basis in cooperation with the Bureau of Land Management:

Spring Creek near Decker, Mont.
Squirrel Creek near Decker, Mont.
Tongue River at Tongue River Dam, near Decker, Mont.
Prairie Dog Creek near Birney, Mont.
Hanging Woman Creek at State line, near Otter, Mont.
Waddle Creek near Otter, Mont.
Trail Creek near Otter, Mont.
East Trail Creek Otter, Mont.
Corral Creek near Otter, Mont.
Horse Creek near Birney, Mont.
Hanging Woman below Horse Creek, near Birney, Mont. Hanging Woman Creek near Birney, Mont.
Otter Creek near Otter, Mont.
Otter Creek below Fifteen Mile Creek, near Otter, Mont.
Home Creek near Ashland, Mont.
Otter Creek at Ashland, Mont.

Pumpkin Creek near Miles City, Mont.
Mizpah Creek ner Mizpah, Mont.
Locate Creek near Ismay, Mont.

Lower Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis at Yellowstone River near Sidney, Mont., in cooperation with the U.S. Corps of Engineers

2. Suspended-sediment data are being collected on a daily basis at Yellowstone River at Forsyth, Mont. 3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the U.S. Bureau of Land Management:

East Fork Sarpy Creek near Colstrip, Mont.
Sarpy Creek near Hysham, Mont.
East Fork Armelles Creek near Colstrip, Mont.
Armelles Creek near Forsyth, Mont.
Rosebud Creek at reservation boundary near Kirby, Mont.
Rosebud Creek near Colstrip, Mont.
Cow Creek near Colstrip, Mont.
Snyder Creek near Brandenburg, Mont.
Rosebud Creek at mouth, near Rosebud, Mont.
Cherry Creek near Terry, Mont.
O' Fallon Creek near Islamy, Mont.
Glendive Creek near Glendive, Mont.
Cottonwood Creek near Intake, Mont.
Fox Creek near Lambert, Mont.
Beaver Creek near Wibaux, Mont.
Lone Tree Creek near Wilbaux, Mont.

4. Suspended-sediment data are being collected on a monthly basis at Yellowstone River near Miles City, Mont., and Yellowstone River near Terry, Mont., in cooperation with the Environmental Protection Agency.

Missouri-Little Missouri Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River near Williston, N. Dak., in cooperation with the Environmental Protection Agency.

2. Suspended-sediment data are being collected on a monthly basis at Bear Den Creek near Mandaree, N. Dak., as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a monthly basis at Little Missouri River near Watford City, N. Dak., as part of NASQAN.

4. Suspended-sediment data are being collected on a monthly basis at the following sites as part of the Coal Hydrology program:

Stony Creek near Williston, N. Dak.
Beaver Creek near Ray, N. Dak.
Deep Creek near Amidon, N. Dak.

Beaver Creek near Trotters, N. Dak.

Cheyenne Subregion

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

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

3. Suspended-sediment data are being collected on a monthly and storm-event basis at Red Water Creek at Wyoming - South Dakota State line in cooperation with the Wyoming State Engineer.

4. Suspended-sediment data are being collected on a monthly and storm-event basis at Cheyenne River near Dull Center, Wyo., as a part of the Federal Energy program.

5. Suspended-sediment data are being collected on a monthly and storm-event basis at Dry Fork Cheyenne River near Bill, Wyo., at Belle Fourche River below Moorcraft, Wyo., and at Lance Creek near Riverview (formerly known as near Spencer, Wyo.), Wyo., in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on a daily basis at Belle Fourche River below Rattlesnake Creek, near Piney, Wyo., and at Belle Fourche River above Dry Creek, near Piney, Wyo., and at Coal Creek near Piney, Wyo., as part of the Federal Energy program.

7. Suspended-sediment data are being collected on a monthly and storm-event basis at the following sites as part of the Federal Energy program:

Antelope Creek near Teckla, Wyo.
Lodgepole Creek near Hampshire, Wyo.
Little Thunder Creek near Hampshire, Wyo.
Black Thunder Creek near Hampshire, Wyo.
Caballo Creek at mouth, near Piney, Wyo.
Raven Creek near Moorcraft, Wyo.
Donkey Creek near Moorcraft, Wyo.

8. Suspended-sediment data are being collected at Rapid Creek above Canyon Lake near Rapid City, S. Dak., Rapid Creek above Water Treatment Plant at Rapid City, S. Dak., Rapid Creek at Rapid City, S. Dak., Rapid Creek at East Main Street at Rapid City, S. Dak., and Meade Street Drain at Rapid City, S.Dak. as part of the National Urban Hydrology Program.

Missouri-Oahe Subregion

1. Suspended-sediment data are being collected on a monthly basis at Spring Creek near Zap, N. Dak., in cooperation with the U.S. Environmental Protection Agency.

2. Suspended-sediment data are being collected on a monthly basis at Knife River at Hazen, N. Dak., at Grand River at Little Eagle, S. Dak., at Moreau River near Whitehorse, S. Dak., at Heart River near Mandan, N. Dak., (bimonthly) and at Cannonball River at Breien, N. Dak., as a part of NASQAN.

3. Suspended-sediment data are being collected at Missouri River at Bismarck, N. Dak., in cooperation with the U.S. Corps of Engineers.

4. Suspended-sediment data are being collected on a monthly basis at Apple Creek near Mehoken, N. Dak., as part of the Missouri River Basin program.

5. Suspended-sediment data are being collected on a monthly basis during periods of flow at the following sites as part of the Coal Hydrology program:

Knife River at Manning, N. Dak.
Stray Creek near Manning, N. Dak.
Knife River at Marshall, N. Dak.
Elm Creek near Golden Valley, N. Dak.
Coyote Creek near Zap, N. Dak.
Brush Creek near Beulah, N. Dak.
Spring Creek below Lake Ilo at Dunn Center, N. Dak.
Spring Creek near Halliday, N. Dak.
Antelope Creek above Hazen, N. Dak.
Antelope Creek Tributary near Hazen, N. Dak.
Coal Creek near Stanton, N. Dak.
Alderin Creek near Fort Clark, N. Dak.
Missouri River Tributary 2 near Hensler, N. Dak.
Coal Lake Creek near Hensler, N. Dak.
Buffalo Creek near Washburn, N. Dak.
Square Butte Creek near Hannover, N.Dak.
Square Butte Creek above Nelson Lake near Center, N. Dak.
Hagel Creek near Center, N. Dak.
Norwegian Creek near Belfield, N. Dak.
S Branch Heart River near South Heart, N. Dak.
North Creek near South Heart, N. Dak.
Heart River near South Heart, N. Dak.
Green River near New Hradec, N. Dak.
Cannonball River at New England, N. Dak.
Coal Bank Creek near Havelock, N. Dak.
Cannonball River at Regent, N. Dak.
Timber Creek near Bentley, N. Dak.
Buffalo Creek Tributary near Gascoyne, N. Dak.

6. Suspended-sediment data are being collected on a monthly basis at Grand River at Little Eagle, S. Dak., as a part of NASQAN.

7. Suspended-sediment data are being collected on a bi-monthly basis at Moreau River near Whitehorse, S. Dak., as a part of NASQAN

Missouri- White Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River at Pierre, S. Dak., and at Missouri River below Ft. Randall Dam, S. Dak., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Bad River near Ft. Pierre, S. Dak., in cooperation with the U.S. Corps of Engineers.

Niobrara Subregion

1. Suspended-sediment data are being collected on a daily basis at Niobrara River near Verdel, Nebr., in cooperation with the U.S. Corps of Engineers, and as part of NASQAN.

James Subregion

1. Suspended-sediment data are being collected on a monthly basis at James River near Scotland, S. Dak., and at James River near Columbia, S. Dak. as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at James River at LaMoure, N. Dak., as part of the Missouri River Basin program and on a bi-monthly basis at James River near Columbia, S. Dak.

Missouri - Big Sioux Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at Big Sioux River near Dell Rapids, S. Dak.

3. Suspended-sediment data are being collected six times a year on the Missouri River near Gayville, S. Dak., Missouri River near Maskall, Nebr., and Missouri River near Ponca, Nebr., in cooperation with the U.S. Corps of Engineers.

North Platte Subregion

1. Suspended-sediment data are being collected on a daily basis at Canadian River near Lindland, Colo., and at Canadian River near Brownlee, Colo., in cooperation with the U. S. Bureau of Land Management.

2. Suspended-sediment data are being collected on a monthly basis at North Platte River near Lisco, Nebr., as part of NASQAN.

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

4. Suspended-sediment data are being collected on a monthly and storm-event basis at the following stations in cooperation with the Wyoming State Engineer:

Little Medicine Bow River near Medicine Bow, Wyo.
Medicine Bow River above Seminoe Reservoir, near Hanna, Wyo.
Sweetwater River near Alcova, Wyo.
North Platte River at Casper, Wyo.
North Platte River at Orin, Wyo.
Laramie River near Fort Laramie, Wyo.

North Platte River at Wyoming - Nebraska State line

5. Suspended-sediment data are being collected on a monthly and storm-event basis at the following stations in cooperation with the U.S. Bureau of Land Management:

Sage Creek near Saratoga, Wyo.
Big Ditch near Coyote Springs, Wyo.
North Ditch near Coyote Springs, Wyo.
Hannah Draw near Hanna, Wyo.

6. Suspended-sediment data are being collected on an infrequent basis at Sand Creek near Glenrock, Wyo., as part of the Federal CBR program.

7. Suspended-sediment data are being collected on a monthly and storm-event basis at North Platte River at Alcova, Wyo., as part of the Federal CBR program.

South Platte Subregion

1. Suspended-sediment data are being collected on a monthly basis at South Platte River at Julesburg, Colo., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Tarryall Creek near Jefferson, Colo., as part of the Federal Coal Hydrology program.

3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Lefthand St. Vrain Water Conservation District:

St. Vrain Creek at Lyons, Colo.
Lefthand Creek at mouth, at Longmont, Colo.
St. Vrain Creek below Longmont, Colo.

Platte Subregion

1. Suspended-sediment data are being collected on a monthly basis at Platte River near Duncan, Nebr., as part of NASQAN.

2. Suspended-sediment data are being collected on a miscellaneous basis at Mill Creek at Louisville, Nebr., and Cedar Creek near Louisville, Nebr., and at Four-mile Creek near Plattsmouth, Neb., in cooperation with the Nebraska Department of Water Resources.

3. Suspended-sediment data are being collected on a daily basis at Platte River at Louisville, Nebr., in cooperation with the U.S. Corps of Engineers, Omaha District, and as part of NASQAN.

4. Suspended-sediment data were being collected on a monthly basis through Sept.30, 1980, at Salt Creek at Greenwood, Nebr., and on an intermittant basis at Rock Creek near Ceresco, Nebr., in cooperation with the Nebraska Natural Resources Commission and the Nebraska Department of Environmental Control.

5. Suspended-sediment data are being collected on a miscellaneous basis at Platte River at North Bend, Nebr., in cooperation with the Nebraska Natural Resources Commission and the Nebraska Department of Enviromental Control.

Loup Subregion

1. Suspended-sediment data are being collected on a monthly basis at Loup River near Genoa, Nebr., as part of NASQAN.

Elkhorn Subregion

1. Suspended-sediment data are being collected on a miscellaneous basis at Logan Creek at Pender, Nebr., in cooperation with the Nebraska Natural Resources Commission and the Nebraska Department of Environmental Control.

2. Suspended-sediment are being collected at Elkhorn River at Waterloo, Nebr., on a monthly basis as part of NASQAN and on a miscellaneous basis in co-operation with the Nebraska Natural Resources Commission and the Nebraska Department of Enviromental Control.

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 Corps of Engineers, Omaha District:

Missouri River near Sioux City, Iowa
Missouri River at Omaha, Nebr.
Missouri River at Nebraska City, Nebr.

2. Suspended-sediment data are being collected at Missouri River at Sioux City, Iowa, and Missouri River at Omaha, Nebr., as a part of NASQAN.

Missouri - Nishnabotna - Subregion

1. Suspended-sediment data are being collected on a periodic basis at Wolf River at Hiawatha, Kans., Buttermilk Creek near Willis, Kans., Wolf River at Leona, Kans., Wolf River near Sparks, Kans., and at Wolf River southwest of Hiawatha, Kans., in cooperation with the U.S. Soil Conservation Service (discontinued September 30, 1980).

2. Suspended-sediment data are being collected on a daily basis at Nodaway River at Clarinda, Iowa, in cooperation with the Iowa Geological Survey.

3. Suspended-sediment data are being collected on a monthly basis beginning in April 1979 at Nishnabotna River above Hamburg, Iowa, as a part of NASQAN.

4. Suspended-sediment data are being collected on a monthly basis at Platte River at Sharps Station, Mo., and Missouri River at St. Joseph, Mo., as a part of NASQAN.

5. Suspended-sediment data are being collected on a miscellaneous basis at Weeping Water Creek at Weeping Water, Nebr., South Branch Weeping Water Creek

near Union, Nebr., and Weeping Water Creek near Union, Nebr., in cooperation with the Nebraska Natural Resources Commission.

Republican Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Beaver Creek at Cedar Bluffs, Kans., South Fork Sappa Creek near Brewster, Prairie Dog Creek above Norton Reservoir, Kans., and White Rock Creek near Burr Oak, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a flow rate basis at Frenchman Creek near Palisade, Nebr., in cooperation with the U.S. Water and Power Resources Service.

Smoky Hill Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Smoky Hill River near Enterprise, Kans., Saline River near Tescott, Kans., Solomon River at Niles, Kans., North Fork Smoky Hill River near McAllaster, Kans., Ladder Creek below Chalk Creek near Scott City, Kans., Big Creek near Hays, Kans., North Fork Big Creek near Victoria, Kans., Saline River near Russell, Kans., North Fork Solomon River at Glade, Kans., Deer Creek near Phillipsburg, Kans., South Fork Solomon River above Webster Reservoir, Kans., and Kill Creek near Bloomington, Kans., in cooperation with the Kansas Water Resources Board.

Kansas Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Kansas River at Wamego, Kans., Little Blue River near Barnes, Kans., and Stranger Creek near Tonganoxie, Kans., in cooperation with the Kansas Water Resources Board.

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

3. Suspended-sediment data are being collected on a periodic basis at Kansas River at Lecompton, Kans., and Kansas River at DeSoto, Kans., in cooperation with the U.S. Corps of Engineers.

4. Suspended-sediment data are being collected on a periodic basis at Sixmile Creek trib. 5 mi. NE of Auburn, Kans., Sixmile Creek trib. 4 mi. NE of Auburn, Kans., Wakarusa River 5 mi. West of Auburn, Kans., and Wakarusa River 4 mi. west of Auburn, Kans., in cooperation with the U.S. Soil Conservation Service (discontinued September 30, 1980).

5. Suspended-sediment data are being collected on a miscellaneous basis at Big Blue River at Beatrice, Nebr., and at Little Blue River at Hollenberg, Kans., in cooperation with the Nebraska Natural Resources Commission and the Nebraska Department of Environmental Control.

6. Suspend-sediment data collection began on a monthly basis on October 1, 1980, at West Fork Big Blue River near Dorchester, Nebr., in cooperation with the Nebraska Department of Environmental Control.

Big Horn Subregion

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

2. Suspended-sediment data are being collected on a monthly and storm-event basis at East Fork Wind River near Dubois, Wyo, as part of the Missouri River basin program.

3. Suspended-sediment data are being collected on a monthly and storm-event basis at Wind River near Crowheart, Wyo., at Nowood River near Tensleep, Wyo., and at Shoshone River near Lovell, Wyo., in cooperation with the Wyoming State Engineer.

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

Dry Creek near Bonneville, Wyo.
East Fork Nowater Creek near Colter, Wyo.
Fifteenmile Creek near Worland, Wyo.

5. Suspended-sediment data are being collected on a monthly basis at Bighorn River at Kane, Wyo., as a part of the Missouri River Basin program.

6. Suspended-sediment data are being collected on a weekly basis during irrigation season at Wyoming Canal near Lenore, Wyo., and at Wyoming Canal below Pilot Wasteway near Morton, Wyo., in cooperation with the U.S. Water and Power Resources Service, Upper Missouri Region.

7. Suspended-sediment data are being collected on a quarterly basis at Middle Fork Fifteenmile Creek near Worland, Wyo., and Dry Creek near Gray Bull,, Wyo., in cooperation with the Bureau of Land Management.

8. Suspended-sediment data are being collected on a monthly and storm-event basis at Fivemile Creek near Shoshoni, Wyo., as a part of the Missouri River Basin program.

9. Suspended-sediment data are being collected on a monthly and storm-event basis at Wind River below Boysen Reservoir, Wyo., as part of the Federal CBR program.

10. Suspended-sediment data are being collected on a monthly and storm-event basis at Shoshone River above Willwood Dam near Willwood, Wyo., in cooperation with WAPRS, Upper Missouri Region.

11. Suspend-sediment data are being collected on a monthly basis (from April to September) at Cottonwood Drain near Shoshoni, Wyo., in cooperation with WAPRS, Upper Missouri Region.

12. Suspended-sediment data are being collected on a weekly basis during the irrigation season at Willwood Canal near Willwood, Wyo., and Shoshone River below Willwood Dam, Wyo., in cooperation with WAPRS, Upper Missiouri Region.

Chariton-Grand Subregion

1. Suspended-sediment data are being collected on an intermittent basis at Elk Creek near Decatur City, Iowa, 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., and at Chariton River at Praire Hill, Mo., as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis as part of the Coal Hydrology program at the following sites:

Shoal Creek near Glendale, Mo.
Unnamed Creek at Ardmore, Mo.
South Fork Claybank Creek near College Mound, Mo.
East Fork Little Chariton River near Macon, Mo.
East Fork Little Chariton River near Huntsville, Mo.
Blackbird Creek near Sidney, Mo.
North Blackbird Creek near Martistown, Mo.
Sinking Creek near Huntsville, Mo.
Middle Fork Little Chariton River near Callao, Mo.
Middle Fork Little Chariton River near Thomas Hill, Mo.
Ash pond outflow near Thomas Hill, Mo.
Middle Fork Little Chariton River near Prairie Hill, Mo.
Muncas Creek near Thomas Hill, Mo.

Gasconade-Osage Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Dragoon Creek near Burlingame, Kans., and Pottawatomie Creek near Garnett, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a monthly basis at Osage River below St. Thomas, Mo., and at Gasconade River at Jerome, Mo., as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Osage River near Schell City, Mo. , as a part of NASQAN.

4. Suspended-sediment are being collected on a periodic basis as part of the Coal Hydrology program at the following sites:

Unnamed Creek at Worland, Mo.
Mulberry Creek at Mulberry, Mo.
Unnamed tributary to Mulberry Creek near Amoret, Mo.
Mulberry Creek near Amoret, Mo.
Walnut Creek near Foster, Mo.
Dry Wood Creek near Oskloosa, Mo.
Dry Wood Creek near Deefield, Mo.
Panther Creek near Rockville, Mo.
Robinson Branch near Walker, Mo.
Sand Creek near Calhoun, Mo.
Tebo Creek near Calhoun, Mo.
Bear Creek near Montorse, Mo.

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.

2. Suspended-sediment data are being collected on a monthly basis at Lamine River near Blackwater, Mo., as part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis as part of the Coal Hydrology program at the following sites:

Moniteau Creek near Higbee, Mo.
Moniteua Creek near Harrisburg, Mo.
Cedar Creek near Hallsville, Mo.
Cedar Creek near Columbia, Mo.

Special Studies

1. A study by the Kansas District to find relations between channel bed and bank material, gradient, discharge, and channel geometry for streams throughout the Missouri River basin has been completed and the final report is in review.

2. Sediment data are being collected at several sites in the Rock Creek-Clear Creek drainage basin to relate suspended-sediment discharge to water discharge. The purpose is to detect changes in the sediment discharge characteristics of the stream as it heads in the mountains, flows through a municipal area, through an agricultural area, and finally through a badlands, semiarid region.

3. PS-69 pumping sediment samplers are operating at Lower Hay Creek Trib. near Wilbaux, Mont., and at Antelope Creek Trib. No. 4 near Zap, N. Dak., as part of EMERIA studies. Sediment data are collected at these and several other sites in the study basins.

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

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Federal Building, Room 269
400 South Clinton St.
Iowa City, IA 52244

District Chief, WRD
U.S. Geological Survey
1950 Avenue A-Campus West
University of Kansas
Lawrence, KS 66045

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

District Chief, WRD
U.S. Geological Survey
301 South Park Avenue
Federal Building, Room 428
Drawer 10076
Helena, MT 59601

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J.C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

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

District Chief, WRD
U.S. Geological Survey
200 Fourth Street, SW
Federal Building, Room 308
Huron, SD 57350

MISSOURI REGION

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made in the following watersheds:

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Nemaha River	Turkey Ck.	Turkey Ck.	Pawnee	NE
Nemaha River	Lower Little Nemaha	Little Nemaha River	Otoe Nemaha	NE
Nemaha River	Upper Little	Little Nemaha	Lancaster Cass Otoe	NE
Nemaha River	Middle Big Nemaha	Nemaha River	Johnson	NE
Platte River	Rock Ck.	Rock Ck.	Lancaster Saunders	NE
Platte River	Bone Ck.	Bone Ck.	Butler	NE
Platte River	Gering Valley	Gering Drain	Scottsbluff	NE
Missouri River	Muskrat Lake	Unnamed	Mountrail	ND
Kansas River	Wakarusa River	River	Douglas Osage Shawnee Wabaunsee	KS
Missouri River	Roy's Ck.	Roy's Ck.	Brown	KS
Missouri River	Pony Ck.	Pony Ck.	Brown Nemaha	KS
Missouri River	West Fork Big Creek	Big Ck.	Harrison Daviess Ringgold Decatur	MO IA
Maple River	West Aldrich	West Aldrich	Ida	IA

Major Drainage	Watershed	Stream	County	State
Little Sioux River	Westside	Direct Tributaries of Bacon Ck.	Ida Woodbury	IA
Little Sioux River	Camp Ck.	Tributaries of Gareetson Drainage Ditch	Woodbury	IA
Little Sioux River	Hogue	Direct Tributaries of Little Sioux River	Monona	IA

b. River Basin Investigations

River Basin	Basin Reported	State
Missouri River	Upper Missouri Tributaries	NE
Missouri River	White River-Hat Creek	NE
Missouri River	Lower Grand River Subbasin	MO IA

c. Resource Conservation And Development

RC&D Project Name	Project Measure	County	State
North Central	Sand Draw	Brown	NE
Panhandle	Lovers Leap Critical Area Treatment	Banner	NE

d. Conservation Operations-Public Law-566

Major Drainage	Watershed	County	State
Greybull River	Meeteetsee Cr. Trib.	Park	WY
Shoshone River	Mels Draw	Park	WY
Shoshone River	Off Channel (Trail Cr.)	Park	WY
Old Woman Creek	Sage Creek	Niobrara	WY

Major Drainage	Watershed	Stream	State
Indiana Creek	Indian Creek	Niobrara	WY
Laramie River	Antelope Creek	Albany	WY
North Platte River	Unnamed Trib.	Converse	WY

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs in 1980:

Reservoir	County	State
Bosserman	Golden Valley	ND
South Blackfork A-1	Johnson	MO
Walters Creek 18-2	Adams	IA

A reconnaissance sedimentation survey was made on three lakes in the Swan Lake National Wildlife Refuge and on three lakes in Missouri State, Fountain Grove Wildlife Refuge. Cesium-137 analyses were made on selected samples.

3. Special Studies

Erosion evaluations were made on Wolf Creek near Denton, Montana. The Universal Soil Loss Equation was used in the study.

An erosion and land slide hazard map was completed on forested lands owned by the Blackfeet Indian Tribe in Glacier County, Montana.

ARKANSAS-WHITE-RED REGION

BUREAU OF LAND MANAGEMENT

Oklahoma

The Bureau is financing suspended sediment data collection at 12 sites in Eastern Oklahoma as part of the USGS Coal Hydrology Monitoring Program. Ten sites are sampled automatically by PS-69 samplers and two sites by observers. Stations are operated and data are being reported by the USGS. Data are collected to characterize sediment relationships of the coal region. About 2 1/2 years of record are currently available; a regional report will be prepared in the near future.

BUREAU OF RECLAMATION

Field data were collected in Lake Meredith for the sedimentation survey. In all, 29 preestablished rangelines were resurveyed using the Service's Mini-Ranger III positioning system in conjunction with the Raytheon electronic sounder. Of these 29 ranges, 18 were on the mainstem of the Canadian River and 11 were on the tributaries. Sediment samples collected in the underwater portion of the reservoir included 20 on the Canadian River and 2 in the Big Blue Creek. In addition, 24 sediment samples were collected upstream from the reservoir pool. Analysis of the total of 46 sediment samples was made at the E&R Center Soils Laboratory. Analysis of the samples included visual inspection, gradations, water content, and density. All 46 Lake Meredith sediment samples collected during May 1980 were split. Half of each sample was retained by the Soils Lab to analyze. The other halves of the samples were turned over to a representative of the Bureau of Economic Geology, University of Texas at Austin. Wet densities, moisture contents, dry densities, and gradations of the samples are expected from our lab by mid-October.

The 100-year sediment deposition in Corbin Reservoir on the Chikaskia Project is 6.9×10^7 m^3 (56,000 acre-feet) which was recommended for specifications designs. A degradation of 4.5 m (15 feet) or down to shale for tailwater change is proposed for future conditions.

Corps of Engineers

Southwestern Division

Albuquerque District

Sediment Surveys.

1. A hydrographic survey of John Martin Reservoir was performed in April and June 1980. The June survey was done because above normal runoff and soil moisture conditions allowed the storage of water to increase to the highest levels since April 1967. In November 1980, in conjunction with the survey of all project lands, the sediment ranges that were not surveyed hydrographically were surveyed with aerial techniques. Based on these new cross sections surveys, a new area and capacity table was prepared for increments of 0.01 foot in elevation. A contractor was selected in December 1980 to survey the degradation ranges below John Martin and to re-establish missing degradation range monuments.

2. A new area and capacity table was prepared for Trinidad Lake. These data were based on aerial photography that was developed in 1977 immediately following the completion of construction material borrowing activities within the reservoir area.

Sediment Load Measurements. Suspended sediment measurements were made at two stations in this region. In October 1980, funding was discontinued for the intermittent collection of suspended sediment samples by the U.S.G.S. on the Arkansas River at Las Animas and the Purgatoire River near Las Animas.

Other Investigations. The acquisition of water rights by the State of Colorado and the counties of Bent, Crowley and Otero has resulted in the establishment of permanent pools at John Martin and Trinidad of 10,000 acre-feet and 4500 acre-feet, respectively. The effect of these permanent pools on sediment retention and downstream channel response will be monitored.

Little Rock District

Sedimentation Surveys. Sediment ranges in Ozark Lake, Lake Dardanelle, the Entrance Channel, and Pools 1, 2, 3, 4, 5, and 6 were resurveyed with Motorola automated hydrographic survey equipment.

Sedimentation Load Measurements. Measurements continued at 45 stations during the year on Arkansas River, Mulberry; Spadra Creek, Little Piney Creek, Piney Creek, Petit Jean, Fourche La Fave, White River, Taylor Bay, James River, Bryant Creek, North Fork, Current River, Black River, Strawberry River and Little Red River.

Tulsa District

Sedimentation Surveys. The original survey of Big Hill Lake was completed and original surveys of El Dorado and Clayton Lakes have been initiated. Pole monuments were installed at Big Hill, Eufaula, Council Grove, Keystone, Hulah, Kaw, and Lake Texoma. Pole monuments will be installed at El Dorado and Clayton Lakes during FY 81. A computer program developed by Ft. Worth District and modified by Tulsa District has been consolidated by Albuquerque District and put on the SWD computer. This computer program accepts original survey profiles and area data followed by resurvey profile data then computes new elevation-area-capacity tables.

Sedimentation Load Measurements. The suspended sampling program has not changed over the past year. A total of 54 stations, 39 in the Arkansas River Basin and 15 in the Red River Basin are presently in operation. The loss of DeGraff, Kansas on Cole Creek in the Arkansas River Basin was caused by the impoundment of Kaw Lake.

Other Investigations. Investigations of sediment deposits were made on Pryor Creek arm of Ft. Gibson Lake. A similar study was made at the confluence of the Arkansas, Verdigris, and Grand rivers. Investigations of the effects of sediment on navigation through Sallisaw Creek Arm of Robert S. Kerr were conducted.

ARKANSAS-WHITE-RED REGION

GEOLOGICAL SURVEY

Upper White Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at White River at Newport, Ark., (converted to bimonthly October 1, 1980) as a part of the National Stream Quality Accounting Network (NASQAN).

Upper Arkansas Subregion

1. Suspended-sediment data are being collected on a twice monthly basis at Arkansas River at Portland, Colo., in cooperation with the U.S. Bureau of Reclamation, Lower Missouri River Basin Region.

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

3. Suspended-sediment data are being collected on a daily basis at Purgatoire River below Trinidad Dam, Colo., in cooperation with the U.S. Corps of Engineers, Albuquerque District.

4. Suspended-sediment data were collected on a daily basis in cooperation with the U.S. Bureau of Land Management:

Apishapa River at Aquilar, Colo.
MFK Purgatoire River at Stonewall, Colo.
Mulino Canyon near Weston, Colo.
Sarcillo Canyon near Sequndo, Colo.
Purgatoire River at Madrid, Colo.
Mulligan Canyon near Boncarbo, Colo.
Reilly Canyon at Cokedale, Colo.
Carpios Canyon near Jansen, Colo.

Middle Arkansas Subregion

1. Suspended-sediment data are being collected on a near monthly basis at the following sites in cooperation with the Kansas Water Resources Board:

Arkansas River at Syracuse, Kans.
Whitewoman Creek near Leoti, Kans.
Mulberry Creek near Dodge City, Kans.
Arkansas River near Kinsley, Kans.
Guzzler's Gulch near Ness City, Kans.
Pawnee River near Larned, Kans.
Walnut Creek at Albert, Kans.
Rattlesnake Creek near Macksville, Kans.

Cow Creek near Claflin, Kans.
Blood Creek near Boyd, Kans.
Arkansas River near Hutchinson, Kans.
Little Arkansas River at Alta Mills, Kans.
Little Arkansas River at Valley Center, Kans.
North Fork Ninnescah River above Cheney Reservoir, Kans.
South Fork Ninnescah River near Pratt, Kans.
South Fork Ninnescah River near Murdock, Kans.
Ninnescah River near Peck, Kans.
Slate Creek at Wellington, Kans.
Cole Creek near De Graff, Kans.
Whitewater River at Towanda, Kans.
Arkansas River at Arkansas City, Kans.
Walnut River at Winfield, Kans.

Upper Cimarron Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Bear Creek near Johnson, Kans., at Cavalry Creek at Coldwater, Kans., at North Fork Cimarron River near Richfield, Kans., and Crooked Creek near Nye, Kans., in cooperation with the Kansas Water Resources Board.

Lower Cimarron Subregion

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

Arkansas-Keystone Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Medicine Lodge River near Kiowa, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected at Arkansas River near Ponca City, Okla., and at Salt Fork Arkansas River Near Jet, Okla.,in cooperation with the U.S. Corps. of Engineers (COE).

3. Suspended-sediment data are being collected on a monthly basis at Arkansas River at Ralston, Okla., as a part of NASQAN, and in cooperation with the COE.

Neosho-Verdigris Subregion

1. Suspended-sediment data are being collected at Newt Graham Lock and Dam (Verdigris River) near Inola, Okla., and at Neosho River below Fort Gibson Lake near Fort Gibson, Okla., as a part of NASQAN.

2. Suspended-sediment data are being collected at Neosho River near Commerce, Okla., in cooperation with the COE.

Upper Canadian Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ponil Creek near Cimmaron, N. Mex., and Rayado Creek near Cimmaron, N. Mex., in cooperation with the New Mexico Interstate Stream Commission (NMISC).

2. Suspended-sediment data are being collected on a monthly basis at the Canadian River near Sanchez, N. Mex., in conjunction with the Water Quality Surveillance Program and in cooperation with the NMISC.

3. Suspended-sediment data are being collected on a monthly basis at the Revuelto Creek near Logan, N. Mex., in cooperation with NMISC.

4. Suspended-sediment data are being collected on a monthly basis at the Canadian River above New Mexico-Texas State line as a part of NASQAN.

5. Suspended-sediment data are being collected on a quarterly basis at Vermejo River near Dawson, N. Mex., in cooperation with NMISC.

Lower Canadian Subregion

1. Suspended-sediment data are being collected at Canadian River near Whitefield, Okla., and at Canadian River near Canadian, Tex., as part of NASQAN.

2. Suspended-sediment data are being collected at Canadian River at Brideport, Okla., in cooperation with the Water and Power Resources Service.

3. Suspended-sediment are being collected at Canadian River at Calvin, Okla., as a part of NASQAN and in cooperation with the Water and Power Resources Service

4. Suspended-sediment are being collected at the following sites for use in the BLM-EMRIA project:

Blue Creek Tributary near Blocker, Okla.
Blue Creek near Blocker, Okla.
Mathuldy Creek near Blocker, Okla.
Taloka Creek at Stigler, Okla.
Taloka Creek Tributary near Stigler, Okla.

5. Suspended-sediment data are being collected at the following sites for use in the Coal Monitoring Project:

Brushy Creek near Haileyville, Okla.
Peaceable Creek near Haileyville, Okla.
Deer Creek near McAlester, Okla. (discontinued July 1980)
Ti Creek near Blanco, Okla. (started July 1980)

North Canadian Subregion

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

2. Suspended-sediment data are being collected at the following sites in cooperation with the U.S. Corp of Engineers:

Beaver River near Guymon, Okla.
Beaver River near Hardesty, Okla.
North Canadian River near Seiling, Okla.
North Canadian River below Lake Overholser near Oklahoma City, Okla.
Deep Fork near Arcadia, Okla.

3. Suspended-sediment data are being collected at Deep Fork near Beggs, Okla., for NASQAN and in cooperation with the U. S. Corps of Engineers.

Lower Arkansas Subregion

1. Suspended-sediment data are being collected on a monthly basis at Arkansas River at Tulsa, Okla., at Arkansas River at Dam 13 near Van Buren, Ark., and at Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark., as a part of NASQAN.

2. Suspended-sediment data are being collected at the following sites for use in the BLM - EMRIA project:

James Fork near Hackett, Ark.
James Fork near Williams, Okla.
Brazil Creek near Red Oak, Okla.
Rock Creek near Red Oak, Okla.
Brazil Creek near Walls, Okla.

3. Suspended-sediment data are being collected at the following sites for use in the Coal Monitoring project:

Coal Creek near Spiro, Okla.
Fourche Maline near Wilburton, Okla.
Red Oak Creek near Red Oak, Okla.
Caston Creek at Wister, Okla.
Morris Creek at Howe, Okla.
Sugarloaf Creek near Monroe, Okla.
Owl Creek near McCurtain, Okla.
Holi-tuska Creek near Panama, Okla.

4. Suspended-sediment data are being collected at Illinois River near Tahleguah, Okla., in cooperation with the COE.

Red Headwaters Subregions

1. Suspended-sediment data are being collected on a monthly basis at North Fork Red River near Headrick, Okla., at Salt Fork Red River near Elmer, Okla., at Prairie Dog Town Red River near Wayside, Tex., and at Prairie Dog Town Fork Red River near Childress, Tex., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the U.S. Corps of Engineers:

Little Red River near Turkey, Tex. (started daily operation Feb. 1, 1979)
Jonah Creek at Weir, near Estelline, Tex.

3. The collection of suspended-sediment data on a daily or more frequent basis began Feb. 1, 1979, at Little Red River near Turkey, and Prairie Dog Town Red River near Lakeview, Tex., (discontinued September 30, 1980), in cooperation with The University of Texas at Austin.

Red-Washita Subregion

1. Suspended-sediment data are being collected on a monthly basis at Red River near Burkburnett, Tex., at Red River at Denison Dam near Denison, Tex., and at Red River near Gainesville, Tex., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the U.S. Corps of Engineers:

Red River near Quanah, Tex.
Middle Pease River near Paducah, Tex.
Pease River near Childress, Tex.
North Wichita River near Truscott, Tex.
Red River near DeKalb, Tex.

Red-Sulphur Subregion

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

2. Suspended-sediment data are being collected at Coal Creek near Lehigh, Okla., for use in the BLM - EMRIA project.

3. Suspended-sediment data are being collected at Muddy Boggy Creek at Atoka, Okla., for use in the Coal Monitoring project.

4. Suspend-sediment data are being collected at McGee Creek near Farris, Okla., in cooperation with the U.S. Water and Power Resources Administration (converted bimonthly October 1, 1980).

5. Suspended-sediment data are being collected on a monthly basis at Little River at Millwood Dam, near Ashdown, Ark., Red River at Fulton, Ark., and at Sulphur River south of Texarkana, Ark., as a part of NASQAN.

6. Suspended-sediment data are being collected on a monthly basis at Twelvemile Bayou near Dixie, La., as a part of NASQAN.

Laboratory Activities

1. The Geological Survey sediment laboratory located in Baton Rouge, La., analyzed suspended-sediment and/or bed-material samples collected by the U.S. Corps of Engineers at the following locations:

Red River at Fulton, Ark.
Red River at Shreveport, La.
Red River at Colfax, La.

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
6554 Florida Boulevard
Baton Rouge, LA 70896

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

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
1950 Avenue A - Campus West
University of Kansas
Lawrence, KS 66045

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U. S. Geological Survey
Federal Building, Room 649
300 East Eighth Street
Austin, TX 78701

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made in the following watersheds:

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Neosho River	Diamond Creek	Diamond Creek	Morris Chase	KS
Neosho River	South Fork Cottonwood River	River	Butler Greenwood Chase	KS
Neosho River	Middle Creek	Middle Creek	Morris Chase Marion	KS
Neosho River	Peyton Creek	Peyton Creek	Chase	KS
Arkansas River	Flat Bayou	Bayou	Jefferson	AR
Arkansas-White-Red	Beaver Creek	Big Beaver	Comanche & Stephens	OK
Chickaskia River	Bois d' Arc Cr.	Bois d' Arc Morton Dollar Sham	Kay	OK
Continued studies on:				
Cimarron River	Turkey Creek	Turkey Elm Sand Dry Hell Gone Buffalo Dry Salt	Garfield Major Kingfisher Alfalfa	OK
Deep Fork Canadian River	Dry Creek	Dry Beaver Shiny N. Branch Chuckaho Dosie	Lincoln	OK

Studies suspended on:

Major Drainage	Watershed	Stream	County	State
South Canadian R.	Coal Creek	Coal Cr. Wildhouse Caney Buckhorn Sandy Deer	Pittsburg Hughes	OK

b. River Basin Investigations

Inventories of sheet, gully, and streambank erosion, including mapping on 1/24,000 scale maps, were made on 27 small watersheds in Custer, El Paso, Fremont, Huerfano, Las Animas, and Pueblo counties, Colorado. This area covers approximately 406,000 acres.

2. Sedimentation Surveys

Sediment accumulations were measured in the following reservoirs:

Reservoir	County	State
Fort Carson 1	Pueblo	CO
Fort Carson 2	Pueblo	CO
Fort Carson 3	Pueblo	CO
Fort Carson 4	Pueblo	CO
Fort Carson 5	Pueblo	CO
FPC-1	Las Animas	CO
Sandstone #1	Roger Mills	OK
Sandstone #6	Beckham	OK
Upper Black Bear #64	Noble	OK
Big Wewoka #17	Seminole	OK

CORPS OF ENGINEERS

Southwestern Division

Galveston District

One hundred eighty-five (185) inplace samples were obtained from nine navigation projects and one flood control project. These samples were analyzed to determine the quality of the sediment relative to chemical constituents which would be resuspended during dredging, disposal activities and construction. The projects sampled and the number of samples taken are as follows:

Navigation Project	No. of Samples Taken
Brazos Island Harbor	15
Trinity River and Tributaries	12
Texas City Channel	5
Gulf Intracoastal Waterway	79
Houston Ship Channel	17
Corpus Christi Ship Channel	16
Galveston Channel	8
Sabine-Neches Waterway	17
Chocolate Bayou	10

Flood Control Project	No. of Samples Taken
Taylors Bayou	6

TEXAS-GULF REGION

GEOLOGICAL SURVEY

Sabine Subregion

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

Neches Subregion

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

Trinity Subregion

1. Suspended-sediment data are being collected on a periodic basis at Mountain Creek near Cedar Hill, Tex., Duck Creek near Garland, Tex., and at Kings Creek near Kaufman, Tex., as a part of the Federal CBR program.

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

3. Suspended-sediment data are being collected on a daily or more frequent basis at Trinity River near Oakwood, Tex., in cooperation with the U.S. Corps of Engineers.

4. Suspended-sediment data are being collected on a monthly basis at Trinity River at Romayor, Tex., and at Chocolate Bayou near Alvin, Tex., as a part of NASQAN.

Galveston Bay - San Jacinto Subregion

1. Suspended-sediment data are being collected on a periodic basis at West Fork San Jacinto River near Conroe, Tex., as part of NASQAN. The collection of suspended-sediment data on a periodic basis at Buffalo Bayou at West Belt Dr., Houston, Tex., began May 1, 1979, as part of NASQAN.

Middle Brazos Subregion

1. Suspended-sediment data are being collected at Double Mountain Fork Brazos River at Justiceburg, Tex., and at Stinking Creek near Aspermont, Tex., as a part of the Federal CBR program.

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

Lower Brazos Subregion

1. Suspended-sediment data are being collected on a daily basis at Brazos River at Richmond, Tex., as part of the Federal CBR program and also as part of NASQAN (starting October 1, 1980).

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

3. Suspended-sediment data are being collected on a periodic basis at Berry Creek near Georgetown, Tex., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected on a weekly or more frequert basis at Navasota River near Bryan, Tex., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a monthly basis at Brazos River near Rosharon, Tex., (disc. September 30, 1980) and at Little River near Cameron, Tex., as a part of NASQAN.

Lower Colorado Subregion

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

Lower Colorado-San Bernard Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Walnut Creek at Webberville Road, Austin, Tex., and at Onion Creek at US Hwy 183, Austin, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Colorado River at Austin, Tex., Colorado River at Wharton, Tex., Colorado River near San Saba, Tex., and at San Bernard River near Boling, Tex., as a part of NASQAN. The collection of suspended-sediment data at Llano River at Llano, Tex., began April 1, 1979, as part of NASQAN.

3. Suspended-sediment data are being collected on a daiy basis at Concho River at Paint Rock, Tex. and at Colorado River at Ballinger, Tex., in cooperation with Texas Department of Water Resources.

Central Texas Coastal Subregion

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

Nueces-Southwestern Texas Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Atascosa River at Whitsett, Tex., and at San Miguel Creek near Tilden, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Nueces River near Three Rivers, Tex., and at Los Olmos Creek near Falfurrias, Tex., 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
Federal Building, Room 649
300 East Eighth Street
Austin, TX 78701

SOIL CONSERVATION SERVICE

1. Reservoir sedimentation surveys were made in the following reservoirs during 1980:

Reservoir	Major Drainage	County	State
Site 10, Clear Fork	Trinity River	Parker	TX
Site 37, Chambers Creek	Trinity River	Johnson	TX
Site 101A, Chambers Creek	Trinity River	Navarro	TX
Site 12, Honey Creek	Trinity River	Collin	TX
Lake Amon G. Carter	Trinity River	Montaque	TX

RIO GRANDE REGION

BUREAU OF LAND MANAGEMENT

New Mexico

The BLM continued the funding of basic sediment data collection at three continous-record stations in the Rio Puerco drainage basin, a major sediment producer to the Rio Grande. Gages are operated and reported by the USGS.

Collection of suspended sediment data is being continued as part of the Upper Rio Grande and Red River Water Quality Study. The study is to characterize existing water quality and identify pollution problems for the management of the wild and scenic river. Physical and chemical water quality characteristics are measured monthly at 12 stations on the Rio Grande, Red River, and other tributaries. The study is being conducted in cooperation with the USGS and data are available in WATSTORE.

Areal studies of sediment yield from general soil types in several planning areas have been completed within the region. Total sediment yields were classified using the Pacific Southwest Interagency Committee's (1968) method. This information is being used for general land management planning purposes and environmental impact statements.

A study to evaluate the impact of intensive grazing management on runoff and sediment yield in the Rio Puerco drainage is being initiated in the summer of 1981. Six small watersheds are being instrumented with rainfall-runoff gages and manning automatic water samplers. This study is being conducted in cooperation with the USGS and the Forest Service.

BUREAU OF RECLAMATION

A resurvey of Elephant Butte Reservoir was conducted using the newly acquired hydrographic survey system, and it was found that the power supply for this system could best be obtained from storage batteries being continuously charged by a charger operating from a generator. The underwater resurvey was completed on all the ranges in the upper and lower portions of the reservoir. The last complete resurvey was performed in 1969, and a partial resurvey was done in 1974.

Representatives from the Water and Power Resources Service, Bureau of Indian Affairs, and the San Juan Pueblo inspected sediment conditions at the diversion structure on the Rio Grande to the main irrigation canal of the San Juan Pueblo. A field inspection was also made of eight existing independent structures on the Rio Grande near Espanola, New Mexico. The channel hydraulic and sedimentation aspects of these structures was observed for use in an engineering and hydrological study for possible rehabilitation and improvement.

RIO GRANDE REGION

CORPS OF ENGINEERS

Southwestern Division

Albuquerque District

Sedimentation Surveys.

1. A new area and capacity table was prepared for Santa Rosa Lake which lists area and capacity for each 0.01 foot of elevation. These data were developed using a cubic spline curve fit computer program that the district has established on the Southwestern Division computer system.

2. The degradation ranges below Santa Rosa Dam were surveyed with aerial techniques in March 1980.

Sedimentation Load Measurements. Suspended sediment measurements were made at five stations in the Rio Grande Region. Included in these stations is the Jemez River below Jemez Canyon Dam where the collection of samples was re-established after a one year break in record.

Other Investigations.

1. In December 1980, a technical report was completed for the district by LTC Peter F. Lagasse of the U.S. Military Academy entitled "An assessment of the Response of the Rio Grande to Dam Construction - Cochiti to Isleta Reach". The report presents the results of LTC Lagasse's qualitative assessment of the geomorphic response of the Rio Grande to the construction and operation of Cochiti Dam. The information in this report is based mainly on an analyses of river cross section data and sediment data collected by the U.S. Geological Survey at a system of 37 cross sections located within a 55 mile reach of the Rio Grande below Cochit Dam.

2. The District reimbursed the U.S.G.S. for surveys of the 37 cross sections below Cochiti Dam in January and September 1980. These two surveys established the physical characteristics of the river following two consecutive years of above normal snowmelt runoff.

3. A sediment investigation of the Rio Grande Basin from Elephant Butte Reservoir to Cochiti Lake was initiated in February 1980 and was approximately 81% complete by the end of the year. This work is being performed for the District by Simons, Li and Associates of Fort Collins, Colorado. The investigation includes data compilation, development of watershed, reservoir and sediment routing computer models and a determination of the response of the Rio Grande to a 100 year period of operation of existing and proposed flood and sediment control projects.

4. Abiquiu, Cochiti, Galisteo and Jemez Canyon Dams continued to be operated to control sediment flow in the Rio Grande.

RIO GRANDE REGION

GEOLOGICAL SURVEY

Rio Grande Headwaters Subregion

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

Rio Grande - Elephant Butte Subregion

1. Suspended-sediment data are being collected on a monthly basis at Red River at Fish Hatchery near Questa, N. Mex., in cooperation with the New Mexico Interstate Streams Commission (NMISC).

2. Suspended-sediment data are being collected on a monthly basis at Rio Chama above Abiquiu Reservoir, N. Mex., Rio Chama below Abiquiu Dam, N. Mex., and at Rio Chama near Chamita, N. Mex., in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on a daily basis at Rio Grande at Otowi Bridge near San Ildefonso, N. Mex., and at Rio Grande near Albuquerque, N. Mex., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected on a daily basis at Rio Grande below Cochiti Dam, N. Mex., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a daily basis at Arroyo Chico near Guadalupe, N. Mex., in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on a daily basis at Rio Puerco near Bernardo, N. Mex., as a part of the Federal CBR program.

7. Suspended-sediment data are being collected on a monthly basis at Rio Grande at San Felipe, N. Mex., and at Rio Grande at Isleta, N. Mex., in conjunction with the Water Quality Surveillance Program and financed cooperatively by NMISC.

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

9. Suspended-sediment data for total-load determinations are being collected on a biweekly basis at Rio Grande at Albuquerque, N. Mex., at Rio Grande near Bernardo, N. Mex., at Rio Grande at San Acacia, N. Mex., and Rio Grande at San Marcial, N. Mex., in cooperation with NMISC.

10. Suspended-sediment data are being collected on a daily basis at Rio Grande Conveyance Channel at San Acacia, N. Mex., and at Rio Grande Conveyance Channel at San Marcial, N. Mex., in cooperation with NMISC. This includes bi-weekly determination of total-sediment loads at Rio Grande Conveyance Channel at San Marcial, N. Mex.

11. Suspended-sediment data are being collected on an intermittent basis at Rio Salado near San Acacia, N. Mex., in cooperation with NMISC.

12. Suspended-sediment data are being collected on a monthly basis at Rio Grande below Elephant Butte Dam, N. Mex., as a part of NASQAN.

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

14. Suspended-sediment data are being collected on a monthly and intermittent basis at Pecos River below Sumner Dam, N. Mex. (formerly called Alamagordo Dam), in cooperation with NMISC, and as a part of NASQAN.

15. Suspended-sediment data are being collected on a daily basis at Pecos River at Santa Rosa, N. Mex., and at Pecos River near Artesia, N. Mex., as part of the Federal CBR program.

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

17. Suspended-sediment data are being collected on a monthly basis at Pecos River at Red Bluff, N. Mex., at Rio Grande at El Paso, Tex., and at Rio Grande at Fort Quitmon, Tex., as a part of NASQAN.

18. Suspended-sediment data are being collected on an intermittent basis at Rito de los Frijoles in Bandelier National Monument, N. Mex., in cooperation with the National Park Service.

Rio Grande - Amistad Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Grande at Foster Ranch, near Langtry, Tex., and at Devils River at Pafford Crossing, near Comstock, Tex., as a part of NASQAN.

Rio Grande Closed Basins Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Tularosa near Bent, N. Mex., and at Mimbres River near Mimbres, N. Mex., as a part of NASQAN.

Lower Pecos Subregion

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

Rio Grande - Falcon Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Grande at Laredo, Tex., as a part of NASQAN.

Lower Rio Grande Subregion

1. Suspended-sediment data are being collected on a daily basis at Rio Grande River near Brownsville, Tex., as part of the Federal CBR program.

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

Special Studies

A water quality monitoring plan for the Rio Grande and Red River in Taos County, N. Mex., was initiated in October 1978 by the U.S. Bureau of Land Management. The study objectives are to monitor long-term changes in water quality (chemical and sediment) at 14 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
Box 25046, Mail Stop 415
Denver Federal Center
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
Federal Building
Room 649
300 East Eighth Street
Austin, TX 78701

UPPER COLORADO REGION

BUREAU OF LAND MANAGEMENT

New Mexico

Suspended sediment is included as part of the program funded by the BLM to collect water resources data in support of coal management in the San Juan Basin. Water quality data are being collected at four continuous-record sites. and five partial-record sites. Two sites are equipped with automatic samplers and the remainder with single stage samplers. This monitoring is being done in cooperation with the USGS and is a continuation of the BLM's old EMRIA Program.

Wyoming

Red Creek Drainage: Covers 105 square miles. Erosion control measures will be initiated to correct several of the many sediment source problems identified in the Watershed Management Activity Plan. Investigations will continue with emphasis on developing a joint watershed plan with Utah-BLM.

Under contract the USGS is operating eight stream gages where sediment samples are collected for input to land-use planning and management activities.

BUREAU OF RECLAMATION

A hydrographic survey was performed in the Colorado River Channel immediately downstream of Glen Canyon Dam. The purpose of the survey is to construct a topographic map of the tailwater channel having a scale of 1:600 (1" = 50') and a contour interval of 0.6 m (2 feet) to be used in preparing feasibility designs.

A scour estimate was made for a channel below Steinaker Reservoir Rate of Flow Control Structure for a 100-year peak of 7.6 m^3/s (270 ft^3/s). Local scour of 1.8 m (6 feet) was estimated by average of Lacey's and Blench's Regime Equations. A depth of degradation of 4.3 m (14 feet) for a long term period was also made. However, based on the small amount of armoring material available it was recommended that a potential exists for a long term degradation of 4.3 to 13.1 m (14 to 43 feet).

A sediment transport study was completed for the East Fork of the Smith's Fork River to the Upper Colorado Regional Office. The study was initiated to determine the flow required to flush 360 tonnes (400 tons) of fine sediment from the reach of river just downstream of Stateline Dam. A modified Einstein procedure was used to determine that a flow of 9.9 m^3/s (350 ft^3/s) for a 4-day period would clean the channel except for the larger particles in the immediate Dead Horse Camp area.

A field inspection of the Green River from Flaming Gorge Dam downstream to near Jensen, Utah, was made by helicopter. The purpose of this field trip was to identify critical locations along the river where either inundation or erosion may increase under peaking power operation schemes for the Flaming Gorge Peaking Power Study.

A representative of the Sedimentation Section participated in a field examination of the La Plata River and tributary drainage between the Stateline diversion and the last two diversions in New Mexico. The Animas-La Plata Project operation study indicates extended periods during which all La Plata River flows will be diverted from this reach. A concern has been voiced that sediment from tributary inflow in this reach will no longer be flushed through by larger river flows and cause problems at the terminal diversions. Following the field inspection, a data collection program for hydraulic and sediment information was designed with project office personnel. Two reaches were designated on the La Plata River to analyze sediment transport capability and three of the tributaries will be analyzed for sediment contribution capability. The hydraulic and sediment data were collected by project office personnel.

UPPER COLORADO REGION

GEOLOGICAL SURVEY

Colorado Headwaters Subregion

1. Suspended-sediment data were collected on a daily basis by automatic pumping samplers at West Tenmile Creek at Wheeler Junction, Colo., at Black Gore Creek near Vail, Colo., and Gore Creek at Vail, Colo., in cooperation with the Colorado Department of Highways (discontinued September 30, 1979).

2. Suspended-sediment data are being collected on a monthly basis at Parachute Creek near Grand Valley, Colo., in cooperation with the Environmental Protection Agency.

3. Suspended-sediment data are being collected on a daily basis at Parachute Creek at Grand Valley, Colo., and at Roan Creek near Debeque, Colo., as a part of Federal sedimentation study in oil shale areas.

4. Suspended-sediment data are being collected on a daily basis at East Middle Fork Parachute Creek near Rio Blanco, Colo., and East Fort Parachute Creek near Rulison, Colo., and on a monthly basis at North Water Creek near Anvil Point, Colo., in cooperation with the U.S. Navy.

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

Gunnison Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at the following sites as a part of the USGS Coal Hydrology program:

Anthracite Creek near Somerset, Colo.
Spring Creek near Beaver Hill, Colo.
Spring Creek near Montrose, Colo.

Upper Colorado-Dolores Subregion

1. Suspended-sediment data are being collected on a comprehensive level at Colorado River near Cisco, Utah.

2. Suspended-sediment data are being collected on a monthly basis at Beaver Creek near Norwood, Colo. and San Miguel River at Naturita, Colo., as a part of the USGS Coal Hydrology program.

Great Divide-Upper Green Subregion

1. Suspended-sediment data are being collected on a monthly and storm-evert basis at the following sites as a part of the U.S. Geological Survey Federal Energy program:

Little Sandy Creek above Eden, Wyo.
Salt Wells Creek near South Baxter, Wyo.
Blacks Fork near Lyman, Wyo.

2. Suspended-sediment data are being collected on a daily basis at Green River near Green River, Wyo. as a part of the U.S. Geological Survey Federal Energy program.

3. Suspended-sediment data are being collected at the following sites on a monthly and storm-event basis in cooperation with the Wyoming State Engineer:

Green River near LaBarge, Wyo.
Big Sandy River near Farson, Wyo.
Big Sandy River below Eden, Wyo.
Hams Fork near Granger, Wyo.
Blacks Fork near Little America, Wyo.

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

Bitter Creek near Bitter Creek, Wyo.
Bitter Creek above Salt Wells Creek, near Salt Wells, Wyo.
Dry Canyon near South Baxter, Wyo.
Salt Wells Creek near Salt Wells, Wyo.
Little Muddy Creek near Glencoe, Wyo.
Muddy Creek near Hampton, Wyo.
Vermillion Creek near Hiawatha, Colo.

5. Suspended-sediment data are being collected on a daily basis at Separation Creek near Riner, Wyo. in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on a monthly basis at Vermillion Creek at Ink Springs Ranch, Colo., as a part of the USGS Coal Hydrology program.

White-Yampa Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at Little Snake River near Dixon, Wyo. in cooperation with the Wyoming State Engineer.

2. Suspended-sediment data were obtained on a monthly basis at Yampa River near Maybell, Colo., and at Little Snake River near Lily, Colo., as a part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis at Yampa River near Maybell, Colo., and on a weekly basis at Little Snake River near Lily, Colo., in cooperation with the Colorado River Water Conservation District.

4. Suspended-sediment data are being collected at several sites in the coal mining region of the Yampa River basin. Two stations are equipped with pumping samplers and where the flow is continuous, daily samples are collected. The following stations are operated at the indicated frequencies:

Middle Creek above Foidel Creek, Colo.	Monthly
Foidel Creek at Fish Creek Canyon Road, Colo.	Monthly
Foidel Creek at mouth near Oak Creek, Colo.	Daily
Jubb Creek near mouth, Colo.	Monthly
Taylor Creek at mouth near Axial, Colo.	Monthly
Good Springs Creek near Axial, Colo.	Weekly
Wilson Creek below Taylor Creek near Axial, Colo.	Daily
Stokes Gulch near Hayden, Colo.	Daily

These stations are operated in cooperation with the U.S. Bureau of Land Management.

5. Suspended-sediment data are being collected at several stations in the Piceance Creek basin to monitor the potential impact of the oil shale development project. All stations are equipped with pumping sediment samplers and where the flow is continuous, daily samples are collected. Intermittent stations are designed to sample all significant peaks and low flow samples are collected when possible. The following stations are operated at the indicated frequency:

Piceance Creek below Rio Blanco, Colo.	Daily
Stewart Gulch above West Fork, Colo.	Daily
W. F. Stewart Gulch at mouth, Colo.	Peaks
Sorghum Gulch at mouth near Rio Blanco, Colo.	Peaks
Cottonwood Gulch near Rio Blanco, Colo.	Peaks
Piceance Creek tributary near Rio Blanco, Colo.	Peaks
Scandard Gulch at mouth, Colo.	Peaks
Willow Creek near Rio Blanco, Colo.	Daily
Piceance Creek above Hunter Creek, Colo.	Daily
Black Sulfur Creek near Rio Blanco, Colo.	Daily
Piceance Creek below Ryan Gulch, Colo.	Daily
Piceance Creek at White River, Colo.	Daily
Stake Springs Draw near Rangely, Colo.	Peaks
Corral Gulch below Water Gulch, Colo.	Peaks
Dry Fk. near Rangely, Colo.	Peaks
Box Elder Gulch near Rangely, Colo.	Peaks
Tributary to Box Elder Gulch near Rangely, Colo.	Peaks
Corral Gulch near Rangely, Colo.	Daily
Yellow Creek near White River, Colo.	Daily

These stations are operated in cooperation with the Colorado River Water Conservation District.

6. Suspended-sediment data are being collected on a monthly basis at White River below Meeker, Colo., and White River above Rangely, Colo., in cooperation with the Environmental Protection Agency, and on a weekly basis from May 1 to September 30 at White River above Rangely, Colo., in cooperation with the Colorado River Water Conservation District.

7. Suspended-sediment data are being collected on a monthly basis at North Fork White River at Buford, Colo., and South Fork White River at Buford, Colo., and on a daily basis at Douglas Creek near mouth near Rangely, Colo., in cooperation with the Northwest Colorado Council of Governments.

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

9. Suspended-sediment data are being collected on a comprehensive level at White River near mouth near Ouray, Utah, in cooperation with the U.S. Bureau of Land Management.

10. Suspended-sediment data are being collected on a monthly basis at Yampa River below Diversion, near Hayden, Colo., Yampa River below Craig, Colo., Williams Fork at mouth, near Hamilton, Colo., and at Yampa River below Elkhead, near Craig, Colo., in cooperation with the Environmental Protection Agency.

11. Suspended-sediment data are being collected on a periodic basis at Horse Draw near Rangely, Colo., and at Horse Draw at mouth, near Rangely, Colo., in cooperation with the U.S. Bureau of Mines.

Lower Green Subregion

1. Suspended-sediment data are being collected on a comprehensive level at Green River near Jensen, Utah and at Green River at Green River, Utah.

2. Sediment accumulation in Scofield Reservoir near Scofield, Utah, was surveyed as part of the Coal Hydrology program in cooperation with the U.S. Bureau of Land Management.

Upper Colorado - Dirty Devil Subregion

1. Suspended-sediment data are being collected on a twice monthly basis at Colorado River at Lees Ferry, Ariz., in cooperation with the U.S. Bureau of Reclamation, and as part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Paria River at White House Ruins, Utah, Paria River below Water Pockets, Ariz. and at Paria River at Lees Ferry, Ariz., in cooperation with the U.S. Bureau of Land Management.

San Juan Subregion

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

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

3. Suspended-sediment data are being collected on a daily basis at Animas River at Farmington, N. Mex., and at San Juan River at Shiprock, N. Mex., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected on a monthly basis at La Plata Creek at Colorado-Utah state line and a McElmo Creek at Colorado-Utah State line as a part of the USGS Coal Hydrology Program.

5. Suspended-sediment data are being collected on a comprehensive level at San Juan River near Bluff, Utah.

Special Studies

An energy project "Hydrologic Surveillance of Coal Lease Areas in Northwestern New Mexico" was continued. Sediment stations were established throughout the coal lease areas and are financed by Federal CBR and U.S. Bureau of Land Management funds.

As part of the program for the determining baseline conditions in the areas of potential oil-shale development in the White River basin, Utah, suspended-sediment data continued to be obtained monthly at five sites and during times of flow at four sites. This work is in cooperation with the Environmental Protection Agency, the U.S. Bureau of Land Management and the Utah Department of Natural Resources.

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

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

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

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

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 8002
125 South State Street
Salt Lake City, UT 84138

SOIL CONSERVATION SERVICE

1. Erosion and sediment yield estimates were made on the following:

   a. Public Law-46

Major Drainage	Watershed	County	State
Green River	Burnt Fork	Summit	UT

A report on watershed conditions relative to geology, precipitation, erosion, etc., was completed for the IW-1 Reservoir drainage area in the Indian Wash Watershed, Mesa County, Colorado.

LOWER COLORADO RIVER

BUREAU OF LAND MANAGEMENT

Arizona

Water quality data collection on the Burro Creek Watershed, a tributary to the Bill Williams River is a possibility for this fiscal year and will carry over into FY 82. An intensive survey will include monitoring suspended and total dissolved solids over a 2-year period. Principal purpose of this study is to assess impacts of surface mining on water quality.

Compilation and summarization of 2 years of water quality data collection on the Paria, Virgin and Bill Williams River, which includes suspended sediment and total dissolved solids, should be accomplished this year. Data have been entered on the STORET System.

Burned area rehabilitation was completed on approximately 1,500 acres in the Grand Wash drainage which flows directly into Lake Mead. Approximately 30 miles of roads were maintained as part of the post-fire rehabilitation.

California

Riverside District: See Riverside District under California Region.

Nevada

A 2 year study of salinity loading from arid rangeland watersheds was completed in September 1980 by University of Nevada at Las Vegas under contract to the BLM.

New Mexico

An areal study of sediment yield in Grant, Hidalgo, and Luna Counties, New Mexico, will be completed during 1981 as part of a general water resource inventory. Total sediment yields will be classified using the Pacific Southwest Interagency Committee's (1968) method. This information is being used for general land management planning purposes and environmental impact statements.

BUREAU OF RECLAMATION

Data were collected in the Grand Canyon from Lees Ferry at mile 0 (689)* to Diamond Creek at mile 225 (464)*, for the purpose of determining possible environmental impacts in the canyon with addition of greater power peaking capacity at Glen Canyon Dam. The data collected included (1) surveyed river sections above the rapids near Twenty-Mile Camp, mile 20 (669)*, near Upper Granite Rapid Camp, mile 93.5 (595.5)*, above and below the rapids near Lost China Camp, mile 155.5 (533.3)*, and near Trail Canyon Camp, mile 219 (470)*; (2) samples of the bed sands at the four selected bed areas; (3) water surface profiles at each study area; (4) topography of each bed area; (5) vegetation inventory at each bed area; (6) one river cross section upstream of the Little Colorado River confluence; and (7) thermographic data on the Little Colorado. Underwater sounding charts contained data collected along 23 river sections between Twenty-Mile Camp and Trail Canyon in the Grand Canyon. These data will be used to develop cross sections of the river which will be employed in step-backwater computations for critical reaches of the Grand Canyon. The hydraulic data will then be used to evaluate effects on the river environment due to proposed increased peaking releases from Glen Canyon Dam.

An analysis of local scour of the Salt River in the vicinity of the Salt River Siphon below Granite reef Diversion Dam was made to evaluate the change in the riverbed between 1974 and 1979. A local scour estimate of 3.7 m (12 feet) was made by averaging results from Blench's and Lacey's Regime Equations and Mean Water Depth. A request was made for a resurvey of the five cross sections used in the scour analysis for 1979 conditions to show the effect of the February 1980 flooding. Also, additional cross sections were requested at any locations where bedrock may have been exposed in the study reach. A reanalysis of the scour depth and examination of proposed grade control structure was made. A local scour depth of 7.9 (26 feet) was estimated using the new 100-year flood peak of 6200 m^3/s (220,000 ft^3/s). If a downstream grade control structure is constructed, it was recommended that the top elevation be at least 1.8 m (6 feet) above the top of the siphon and have a downstream apron to protect it from being undermined.

Sedimentation Section personnel discussed the methods to control channel erosion caused by the Hassayampa River along the embankment of the Granite Reef Aqueduct upstream from the Hassayampa River Siphon with representatives of the Division of Design and Construction, and the Arizona Projects Office. The technique considered to best fit the type of erosion occurring would be to install a line of jacks with appropriate dead men to create a new bankline for the river.

*The numbers inside the parenthesis represent the river mile measured from the river mouth.

Information was supplied to Hitachi America, Ltd., the company manufacturing pumps for the Havasu Pumping Plant, concerning concentrations and composition of sediment in the water to be pumped. From a 1971 memorandum which contains information still considered valid, the following was extracted:

> The sediment expected to reach the Havasu Pumping Plant is 69 percent clay, finer than 0.005 mm and 31 percent silt, ranging from 0.005 mm to 0.07 mm. Annually, the average concentration of sediment in the water to be pumped may reach 35 ppm. Sediment concentrations are not expected to exceed 50 ppm, which will occur during the maximum rainfall period, from December through March, with an occasional thunderstorm usually in August.

As a member of an interdisciplinary beach evaluation team, a member of the Sedimentation Section, started on an approximate 12-day raft trip on the Colorado River in the Grand Canyon area. The team resurveyed beaches that Professor Robert Dolan has been studying for several years and will be evaluating the possible inundation of some of the critical beaches in the Grand Canyon area caused by the proposed increase in flows for the Glen Canyon Peaking Power Investigations. The team observed the effects due to the release of approximately 135 m^3/s (47,000 ft^3/s) on June 23, 1980, on 38 of the most popular camping beaches and estimated the long-term effects of proposed increased peaking flows on those beaches. Resurveys were made on 24 beaches formerly surveyed by Professor Dolan, to assess the beach erosion related to the large June release. A report of the results is being prepared by Professor Dolan.

LOWER COLORADO REGION

GEOLOGICAL SURVEY

Lower Colorado-Lake Mead Subregion

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

Virgin River above Halfway Wash near Riverside, Nev.
Muddy River above Lake Mead near Overton, Nev.

2. Suspended-sediment data are being collected at North Fork Virgin River above Zion Narrows, near Glendale, Utah, in cooperation with the Utah Department of Natural Resources.

3. Suspended-sediment data are being collected monthly at Las Vegas Wash near Henderson, Nev., and twice-monthly at Las Vegas Wash near Boulder City, Nev., in cooperation with the U.S. Water and Power Resources Service.

Little Colorado Subregion

1. Suspended-sediment data are being collected on a daily basis in cooperation with the U.S. Corps of Engineers at:

Little Colorado River at Holbrook, Ariz.
Little Colorado River near Joseph City, Ariz.

2. Suspended-sediment data are being collected on a flow event basis at Leroux Wash near Holbrook, in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on a daily basis at Moenkopi Wash near Moenkopi, Ariz. (disc. Jan. 1980).

4. Suspended-sediment data are being collected on a monthly basis at Little Colorado River at Cameron, Ariz., as a part of NASQAN.

5. Suspended-sediment data are being collect on a monthly basis at Zuni River above Black Rock Res., N.Mex., in cooperation with the U.S. Water and Power Resources Service, and at Rio Puerco at Gallup, N.Mex., on a semi-annual basis in cooperation with the New Mexico Interstate Stream Commission (NMISC).

Lower Colorado Subregion

1. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN at:

Colorado River below Hoover Dam, Ariz.
Bill Williams River near Planet, Ariz.

Upper Gila Subregion

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

2. Suspended-sediment data are being collected on a monthly basis at Gila River near Redrock, N. Mex., as part of NASQAN, and at San Francisco River near Glenwood, N. Mex. in cooperation with NMISC.

3. Suspended-sediment data are being collected on a monthly basis at Gila River at Calva, Ariz., as a part of NASQAN.

Middle Gila Subregion

1. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN at:

San Pedro River below Aravaipa Creek, near Mammoth, Ariz.
Gila River at Kelvin, Ariz.
Santa Cruz River near Laveen, Ariz.

2. Suspended-sediment data are being collected on a weekly basis at Santa Cruz River near Nogales, Ariz., in cooperation with the Arizona Water Commission (disc. Sept. 30, 1980).

Salt Subregion

1. Suspended-sediment data are being collected on a monthly basis at Wet Bottom Creek near Childs, Ariz., 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 at:

Salt River below Stewart Mountain, Dam, Ariz.
Verde River below Bartlett Dam, Ariz.

Lower Gila Subregion

1. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN at:

Gila River above diversions, at Gillespie Dam, Ariz.
Gila River near mouth, near Yuma, Ariz.

Sonora Subregion

1. Suspended-sediment data are being collected on a daily basis at San Simon Wash near Pisinimo, Ariz., in cooperation with the U.S. Bureau of Indian Affairs.

2. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN at:

Vamori Wash at Kom Vo, Ariz.
Whitewater Draw near Douglas, Ariz.

Special Studies

Sediment data were collected during periods of flow at two small watersheds in the area of strip mining along Coal Mine Wash and Coal Mine Wash at mouth near Kayenta, Ariz., as part of a study pertaining to the effects of strip mining and rehabilitation of spoil piles on the sediment yield.

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

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

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 227
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
P.O. Box Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

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

SOIL CONSERVATION SERVICE

1. A sediment yield map was completed for the following river basin:

Major Basin	Basin Reported	State
Colorado	Little Colorado River	AZ and NM

GREAT BASIN REGION

BUREAU OF LAND MANAGEMENT

California

Susanville District. Inventorying and monitoring of suspended sediments are being done on selected streams within the District. The clay minerology of suspended sediments and soils is being correlated to aid in identifying the sources of sediments within watersheds. Data are available in the BLM's District files.

BUREAU OF RECLAMATION

A representative of the Sedimentation Section participated in a field inspection of sediment problems at Stoddard Diversion Dam. Sediment diverted at the dam into Gateway Canal is filling the settling basin in only 1 to 1-1/2 months. The basin is 128 m (420-feet) long, has a 9.1 m (30-foot) bottom width, 2:1 side slopes, and is 3.7 m (12-feet) deep, with top width of 229 m (75 feet) at a design discharge of 20.2 m^3/s (715 ft^3/s). After filling the basin, sediment of medium to coarse sand is moved down the canal and is causing problems at both the Gateway Power Plant and at the Water Treatment Plant in Layton, Utah. Some means of cleaning the settling basin during the year to maintain adequate capacity along with possible enlarging or lengthening the basin appeared to be solutions to the problem.

A field inspection was made of Utah Lake bottom sediments with regional and project office personnel for the Utah Lake Pumped Storage Investigation. Samples of the bottom sediments were collected near the shoreline and about 1.6 km (1 mile) from shore at the three proposed Utah Lake inlets. An additional sample was taken about 1.6 km (1 mile) from shore on the Goshen Bay Dike alinement. Group discussion was held on potential sediment and erosion problems associated with alternatives being considered on use of Utah Lake as an afterbay reservoir.

GREAT BASIN REGION

GEOLOGICAL SURVEY

Bear Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at Twin Creek at Sage, Wyo., in cooperation with the U.S. Bureau of Land Management.

2. Suspended-sediment data are being collected on a monthly and storm-event basis at Bear River at Border, Wyo., as a part of the Federal CBR program.

Great Salt Lake Subregion

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

Black Rock Desert-Humboldt Subregion

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

Humboldt River near Carlin, Nev.
Humboldt River near Rye Patch, Nev.
Quinn River near McDermitt, Nev.

Central Lahontan Subregion

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

Walker River near Wabuska, Nev.
Carson River near Churchill, Nev.
Truckee River near Nixon, Nev.

2. Suspended-sediment data were collected at frequencies that varied from monthly to more than twice-monthly at seven sites in the Carson River basin in cooperation with the Nevada Division of Environmental Protection (stations disc. Sept. 30, 1980).

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, Calif.
Martis Creek Lake near Truckee, Calif.
Martis Creek near Truckee, Calif.

4. Suspended-solids data are being collected twice-monthly at the following sites in cooperation with the Lahontan Regional Water Quality Board, California:

Truckee River at Farad, Calif.
Truckee River at Lockwood, Nev.

Central Nevada Desert Basins Subregion

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

Steptoe Creek near Ely, Nev.
South Twin River near Round Mountain, Nev.
Chiatovich Creek near Dyer, Nev.

Special Studies

1. A two-year study of the relationships between fluvial-sediment transport and planned erosion-control measures in Edgewood Creek, Lake Tahoe Basin began in October 1980. Data include streamflow, sediment, and plant nutrients.

2. A one-year data collection program to estimate the fluvial sediment transport to a potential reservoir pool on the South Fork Humbolt River, northeastern Nevada, began in October 1980. This program is in cooperation with the Corps of Engineers. Data include streamflow, suspended-sediment and bedload discharge.

3. A two-year study of the relations between fluvial-sediment transport and engineered rehabilitation of erosion in the First Creek basin of Incline Village, north Lake Tahoe, was begun in October 1979. Numerous data are being collected to evaluate effects of planned erosion-control measures in this urbanized basin. Data include sediment and nutrient concentrations and particle-size distribution of transported sediment. For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 227
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
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

PACIFIC NORTHWEST REGION

BUREAU OF LAND MANAGEMENT

Idaho

Sediment criteria technical advisory committee: This committee was set up by the State of Idaho to establish sediment criteria and possibly Statewide standards. The BLM has had a major role in developing sedimentation criteria for wildland watersheds.

Road erosion technical advisory committee: This committee was set up to evaluate road construction, operation, and maintenance in order to develop best management practices for reducing erosion. The BLM supplied an extensive literature review for this project. Products of the committee will include a practice manual and possibly State regulations.

Remote sensing to identify erosion areas: The Idaho State Office of the BLM is experimenting with various scales of photography for using density analysis to determine eroding areas. The project is also attempting to assess vegetative cover measurement methodologies important in estimating erosion and sedimentation. Several field plots have been examined along with the step-point transect, tape-point transect, and ocular methods for estimating cover. Findings are expected to be submitted for publication in the latter part of FY 1981.

Livestock-aquatic assessment methodology: This study is being conducted by the USFS Forest and Range Experiment Station funded by BLM. The objectives are to determine what characteristics will provide a reasonable assessment of livestock impacts on the aquatic system. Among the characteristics being evaluated are sediment measurements, stream sediment yield, and stream stability. This year's work includes describing the usefullness, validity, measurement error and capability of standardization for 19 characteristics commonly collected in hydrologic and aquatic studies. Most of the characteristics relate to sedimentation. Results of the first phase of the work will be available by the first part of 1982.

Workshop: A BLM workshop was held in December of 1980 to develop a functional procedure for assessing erosion for broad area planning. It will be compatible with the BLM Planning process. The procedure utilizes soil survey, vegetation survey, remote sensing, erosion models, ocular erosion estimates, and land-use inventories. The procedure will be released in draft form during the end of 1981.

Pending Publications: Johnson, Clifton W. and Karl A. Gebhardt 1981, "Predicting sediment yields from sagebrush rangelands." Proceedings of the workshop on rangeland soil loss and sediment yield. Tucson, Arizona, March 3-5, 1981.

Reynolds Creek Experimental Watershed: This is a cooperative research project near Nampa, Idaho, between BLM and the USDA Science and Education Administration. This representative rangeland watershed is used to develop and/or test improved procedures for predicting the effects of livestock grazing management and range improvement practices on rangeland resources and hydrologic response, as well as establising a complete data base of the watershed's basic resources. There are five major subprojects ongoing: (1) precipitation; (2) vegetation; (3) runoff; (4) erosion and sediment; and (5) water quality.

During FY '81, SEA is continuing sediment data collection at four sites within the Reynolds Creek Watershed. Work is being done during FY 81 on evaluating the Universal Soil Loss Equation (and modification thereof) and the Pacific Southwest Interagency Sedimentation Committee (PSIAC) Method. Efforts are underway to extend the runoff and sediment yield relationships developed at Reynolds Creek to other gaged and ungaged areas within the State of Idaho and the Columbia Plateau Province.

Much valuable work has been completed assessing sediment yield from various subwatersheds of Reynolds Creek. Annual progress reports are available as well as numerous publications by the various SEA scientists associated with various aspects of the project. The project is in the third year of the current 5-year contract.

Big Lost River Water Quality Improvement Project: Project is underway on the Big Lost River in Idaho's Salmon District for the purpose of reducing sedimentation and bank erosion. The BLM has provided aerial photography, intepretation, erosion transect data, and has helped install demonstration projects. The cooperative project has various Federal, State, local agencies and private land owners involved. Sedimentation studies are also underway under the direction of the USGS.

Oregon

Streamflow, sediment, chemical, and physical water quality data are being collected on 11 streams through a cooperative effort with county government (Douglas-Coos Co.). Additional data are being collected at four gaged sites and numerous ungaged sites by BLM personnel.

The BLM actively participates in the Oregon Citizens Water Quality Public Advisory Committee, and works closely with the State 208 Program in identification of nonpoint pollution sources and in coordination and development of silvicultural and range management BMP's.

Restoration opportunites are being identified through the Bureau Planning System. Watershed management plans are being developed in two small watersheds. A rangeland restoration project to improve ground cover and control gully development will be completed on Coal Mine Creek this year. Efforts continue for the protection and maintenance of riparian habitats through fencing and plantings. Stockwater reservoirs will be evaluated this year to determine onsite and offsite hydrologic impacts.

BUREAU OF RECLAMATION

A study was conducted at pumping plant sites on the Okanogan River to predict the bottom velocity at the Cordell and Crater Lakes sites for use in preparing an infiltration intake design. Bottom velocities of 0.09 m/s (0.30 ft/s) for the Cordell site and 0.05 m/s (0.15 ft/s) for the Crater Lakes site were recommended. The sediment inflows for the Cordell Pumping Plant was estimated to be 480 tonnes (530 tons) and 318 tonnes (350 tons) for the Crater Lakes Pumping Plant for the irrigation season.

A meeting on the sedimentation aspects of the fishery problem at the Spring Hill Pumping Plant on the Tualatin River was held on January 24, 1980, in Portland, Oregon. Agreement was reached between representatives of the National Marine Fisheries Service, Oregon Department of Fish and Wildlife, and Water and Power Resources Service on removing the existing rock weir across the channel in front of the plant and placing it about 275 m (900 feet) downstream. This should help alleviate the sediment inflow to the plant during the irrigation pumping season by providing storage for the 3700 m^3 (3 acre-feet) of sediment moved as bedload on the Tualatin River during this period.

A bed material sampler, BMH 60, was shipped to the Salem Planning Field Branch for use in obtaining samples from the Tualatin River near the Spring Hill Pumping Plant. A sediment sampling program was developed for the Spring Hill Pumping Plant to be carried out during this seasons pumping period. Suspended sediment samples are to be taken at three different river discharges at the gaging station just below the pumping plant and between the trashracks and the traveling water screens. Discharge measurements along with bed material samples and water temperature are to be taken at the gaging station for a Modified Einstein total load computation for the three discharges. Other periodic suspended sediment samples will be taken through the summer period whenever discharge measurements are made at the gage.

A meeting was held in the project office in Forest Grove, Oregon, with representatives of the regional office, Tualatin Irrigation District Office, City of Hillsboro, and National Marine Fishery Service, to discuss alternatives to be studied for alleviating the sediment problem at the Spring Hill Pumping Plant. The field data were defined that would be needed for the E&R Center to prepare a feasibility design for the alternatives under consideration. Field observations on the Tualatin River at the pumping plant were made on September 3, 1980.

At the proposed intake structure for the Cordell Pumping Plant site ice is not seen as a great threat to the structure since it will be located in the deepest, swiftest portion of the cross section and because the intakes will be submerged during minimum flows. Scour for the proposed

structure during a design flood in the Okanogan River (recurrence interval of 120 years) is estimated to be 3.7 m (12.0 feet). If the upstream face of the structure was sloped 20° or more, the estimate of scour would be 3.0 m (10.0 feet). In order to create the necessary scour near the peak and to limit scour, it was recommended placing riprap starting at a depth of 1.5 m (5.0 feet) below the present streambed and sloping upward and away from the intake structure on a 1-1/2 to 1 slope to streambed level.

From a sedimentation standpoint, the intakes for the Crater Lakes Pumping Plant could be placed in the deepest portion of the Okanogan River at any location along the bend from cross section RS-26 to RS-24. The deepest portion of the river occurs from 25 to 28 m (80 to 90 feet) from the right bank to low flow water surface. Also submitted was a proposed riprap configuration to be placed for creating the necessary scour near to intake pier and for eliminating damage caused by the design flood. In addition, an apron of riprap could extend to the right bank to prevent the Okanogan from creating an alternative thalweg during a discharge as high as the design flood of recurrence interval 120 years. An apron would extend downstream and toward the left for protection from undermining and would go down to a level equal to the design flood scour 3.7 m (12.0 feet) below the natural thalweg.

A representative of the Sedimentation Section participated in an inspection of Snake River in the vicinity of the Bear Trap Canal headworks with representatives of the regional office, field solicitors office, and Bear Trap Canal Company. The problem observed has been that of a meandering river with two channels near the point of diversion. At low river flows the main channel of the Snake River is not flowing past the existing headworks making it difficult to divert adequate water for irrigation.

PACIFIC NORTHWEST REGION

CORPS OF ENGINEERS

North Pacific Division

Portland District

Sedimentation Ranges

Project:	Applegate Reservoir
Activity:	Installing monuments and surveying sedimentation ranges. All 24 designated ranges will be surveyed and tied in by April 1981.
Purpose:	Initial survey of reservoir and upstream and downstream channels for later evaluation of aggradation, degradation, and siltation.
Type of Survey:	Range Survey
Elements measured:	Position of monuments, profile of ground surface and river sections.
Equipment used:	Survey scope

Sedimentation Sampling. Sedimentation samplings were conducted daily at two stations on Rogue River for post-impoundment and for planning and design purposes. For planning and design purposes, samplings were also conducted on Applegate River at Applegate Damsite, Cowlitz River at Kelso and Toutle River at Hwy 99 Bridge.

Synopsis-Mt. St. Helens Sedimentation Activities.

Purpose. The purpose of this plan of study is to answer the following questions.

1. What degree of protection will be afforded by the channel excavation and levee system on the Cowlitz River?

2. What will be the impact of increase in the sediment yield from the Toutle/Cowlitz watershed on maintenance dredging for navigation in the Columbia River and Estuary.

3. Can Mossyrock reservoir be regulated to aid in flushing sediment from the Cowlitz River?

4. Where along the Toutle/Cowlitz Rivers will the amount of deposition in channel be the greatest?

5. How much sediment is expected to pass Highway 99 Gage on the Toutle during future water years?

6. What parameters should be measured during a flood to monitor the movement and deposition of sediment in the Toutle/Cowlitz Rivers? Where should these measurements be taken; when; and how frequently during the runoff hydrograph?

7. Aside from maintenance of the navigation channel, what other problems are anticipated in the Columbia River and Estuary?

8. Can gaps be identified in the current plans for providing flood protection and navigation?

Scope of Plan of Study. The scope of this plan of study focuses on maintaining flood protection and navigation depths and includes the following specific activities:

1. Proposing bounds of the study area.

2. Proposing a long range strategy for returning the system to normal.

3. Identifying sediment sources in the watershed; mechanisms producing erosion; mechanisms transporting sediments out of these areas; the volume of sediment available and the size of particles.

4. The approach for qualitatively establishing the drainage pattern in the severely disturbed areas in the upper watershed of the Toutle.

5. The approach for qualitatively establishing the overall system response to precipitation/runoff.

6. The approach for calculating the rate and quality of sediment-water yield at gages in the watershed.

7. The approach for calculating the rate of and quantity of erosion from the highly disturbed watershed.

8. The approach for calculating the transportation of sediment between gages including erosion and deposition zones created by hydaulic controls.

9. The approach for including tidal currents as an energy source in addition to fresh water runoff.

10. The data collection program for monitoring system behavior both during and between floods, and for providing basic data for forecasting future behavior.

11. The collection of information from similar problems elsewhere in the world.

12. The selection of analytical methods and computational models.

13. The identification of gaps in existing theories for predicting the movement of sediment from such highly disturbed watersheds.

Seattle District

The following table indicates the reservoir sediment range resurveys made in 1980:

Project	Ranges Resurveyed
Libby	17
Wynoochee	19

Walla Walla District

Sediment accumulation studies were made for Willow Creek Lake project, Heppner, Oregon. Study results will be included in Supplement 1, Appendix B, Willow Creek Lake Design Memorandum 2.

Condition surveys were made at the Lower Granite Lake recreation sites to determine sediment accumulation within the recreation and marina areas.

Sediment range monuments were reestablished at the mouth of the Yakima River.

PACIFIC NORTHWEST REGION

GEOLOGICAL SURVEY

Kootenai-Pend Oreille-Spokane Subregion

1. Suspended-sediment data are being collected on a periodic basis from Pend Oreille River at international boundary and at Spokane River at Long Lake, Wash., as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-solids data are being collected at Spokane River at Riverside State Park as part of the National Water Quality Surveillance System in cooperation with the U.S. Environmental Protection Agency.

3. Suspended-sediment data are being collected on a daily basis at Kootenai River near Copeland, Idaho, as part of the U.S. Geological Survey waterways-treaty program.

Upper Columbia Subregion

1. Suspended-sediment data are being collected on a periodic basis at Columbia River at Northport, Wash., at Columbia River at Vernita Bridge, near Priest Rapids Dam, Wash., and at Okanogan River at Malott, Wash., as a part of NASQAN.

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

3. Monthly suspended-sediment data are being collected at Flathead River at Flathead, British Columbia.

4. Bimonthly suspended-sediment data are being collected at the following sites:

   Clark Fork below Missoula, Mont.
   Flathead River at Columbia Falls, Mont.

5. Suspended-sediment data are being collected on a quarterly basis at Columbia River at Richland, Wash., in cooperation with the U.S. Department of Energy.

6. Suspended-sediment data are being collected on a daily basis from irrigation-return flows at three sites and periodically from irrigation delivery flows at 22 sites on the Royal Slope in Washington, as part of a study of best-management practices in cooperation with the Washington State University.

7. Suspended-sediment data are being collected on a daily basis from EL 68 wasteway near Othello, Wash.

Yakima Subregion

1. Suspended-sediment data are being collected on a daily basis at Yakima River at Kiona, Wash., in cooperation with the Washington State Department of Ecology.

2. Suspended-sediment data re being collected periodically at Yakima River near Union Gap, Wash., as part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis from irrigation-return flows at four sites near Sunnyside, Wash., in cooperation with the Washington State Department of Ecology.

Upper Snake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Cache Creek near Jackson, Wyo., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Snake River near Heise, Idaho, as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Blackfoot River above reservoir near Henry, Idaho, Blackfoot River near Blackfoot, Idaho, Portneuf River at Pocatello, Idaho, and at Bruneau River near Hot Spring, Idaho, in cooperation with the Idaho Department of Water Resources.

Middle Snake Subregion

1. Suspended-sediment data are being collected at various flow rates at Snake River at King Hill, Idaho, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Big Jacks Creek near Bruneau, Idaho, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at Mores Creek near Arrowrock Dam, Idaho, and at Weiser River near Weiser, Idaho, in cooperation with the Idaho Department of Water Resources.

Lower Snake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Salmon River near White Bird, Idaho, and Clearwater River at Spalding, Idaho, as part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Lapwai Creek near Lapwai, Idaho, and at Palouse River near Potlach, Idaho, in cooperation with the Idaho Department of Water Resources.

3. Suspended-sediment data are being collected at Snake River at Burbank, Wash., as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic basis at Minam River at Minam, Oreg., as a part of the National Hydrologic Benchmark Network, and at Owyhee River near Owyhee, Oreg., as part of NASQAN.

Middle Columbia Subregion

1. Suspended-sediment samples are being collected on a monthly basis at John Day River near McDonald Ferry, Oreg., at Klickitat River near Pitt, Wash., and at Deschutes River near Biggs, Oreg., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Bear Creek near Prineville, Oreg., in cooperation with the U.S. Bureau of Land Management.

Lower Columbia Subregion

1. Suspended-sediment data are being collected on a monthly basis at Columbia River at Warrendale, Oreg., Lewis River at Ariel, Wash., and at Cowlitz River at Kelso, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Bull Run River near Multnomah Falls, Oreg., South Fork Bull Run River near Bull Run, Oreg., North Fork Bull Run River near Multnomah Falls, Oreg., and at Fir Creek near Brightwood, Oregon, in cooperation with the city of Portland, Oreg., to provide some information needed to define the effects of activities in the basin.

3. Beginning about May 25, 1980, daily suspended-sediment data were collected at Cowlitz River at Castle Rock and Toutle River at State Highway 99 near Castle Rock, Washington. Periodic suspended-sediment sampling was begun at six other sites in the Toutle River basin and on Pine Creek and Muddy River. The above data collection is all part of the Mount St. Helens monitoring program.

4. Suspended-sediment and bed-material samples were collected in August 1980 at various sites in the Cowlitz, Toutle, and Columbia Rivers in cooperation with the U.S. Corps of Engineers, to provide information needed to define changes that occured in the sediment characteristics in the rivers as a result of the May 18, 1980, eruption of Mount St. Helens.

Willamette Subregion

1. Suspended-sediment data are being collected on a monthly basis from Tualatin River at West Linn, Oreg., and at Willamette River at Portland, Oreg., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Rogue River near Agress, Oreg., Umpqua River near Elkton, Oreg., Siuslaw River near Mapleton, Oreg., Alsea River near Tidewater, Oreg., Nehalam River near Foss, Oreg., Chehalis River at Porter, Wash., Willapa River near Willapa, Wash., and at Queets River near Clearwater, Wash., as a part of NASQAN.

3. Suspended-sediment data are being collected at North Fork Quinault River near Amanda Park, Wash., as part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected on a daily basis by an automatic sampler at Carberry Creek near Copper, Oreg., in cooperation with the U.S. Forest Service.

5. Suspended-sediment data are being collected on a daily basis during OctoberApril by automatic samplers at Rogue River below Prospect, Oreg., at South Fork Rogue River, south of Prospect, Oreg., and at Rogue River at McCloud, Oreg., in cooperation with the U.S. Corps of Engineers.

6. Suspended-sediment data are being collected on a daily basis at Cow Creek near Azalea, Oreg., in cooperation with Douglas County, to provide information needed to define the characteristics of sediments in Cow Creek.

Puget Sound Subregion

1. Suspended-sediment data are being collected on a periodic basis at Elwha River at McDonald Bridge near Port Angeles, Wash., Skagit River near Mount Vernon, Wash., Snohomish River near Monroe, Wash., and at Puyallup River at Puyallup, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected during selected storm-runoff periods at three sites in the Bellevue Urban Study area in cooperation with the City of Bellevue, Wash.

Oregon Closed Basins Subregion

1. Suspended-sediment data are being collected on a monthly basis at Donner and Blitzen River near Frenchglen, Oreg., as a part of NASQAN.

Special Studies

1. Suspended-sediment data are being collected on a daily basis in the Rock Creek drainage near Twin Falls, Idaho, in the Marsh Creek drainage near Inkan, Idaho, and in the Cedar Draw drainage near Filer, Idaho.

2. During 1980, suspended-sediment data were collected on several streams in the vicinty of Jackson, Wyo., to determine sediment yield characteristics of small basins pursuant to an Environmental Impact assessment of the Cache Creek-Bear thrust area of concern.

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

District Chief, WRD
U.S. Geological Survey
Box 036
Federal Building, Room 365
550 West Fort Street
Boise, ID 83724

District Chief, WRD
U.S. Geological Survey
301 South Park Avenue
Federal Building, Room 428
Drawer 10076
Helena, MT 59601

District Chief, WRD
U.S. Geological Survey
830 Northeast Holladay Street
Portland, OR 97232

District Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

SOIL CONSERVATION SERVICE

1. Studies of erosion and sediment yields were made for the following:

a. River Basin Investigations

Major Basin	Basin Reported	Study Area	State
Columbia	Upper Snake River	Hazelton Butte	ID
		Sublett	ID
		Big Lost River	ID
		Toponce	ID
		Albion	ID
Columbia	Middle Snake River	Little Valley	ID
		King Hill Irr. Dist.	ID
		Fargo Project	ID
Columbia	Lower Snake River	Lolo Creek	ID
		Salmon River	ID
		Clearwater River, and	ID
		Snake River below Hells Canyon Dam	ID

2. Sedimentation Surveys

Sediment was measured in the Daniels Reservoir (St. Johns Irrigation Co. in Idaho) to calculate gross erosion and check with USLE results. Reservoir sedimentation surveys were made on 5 reservoirs in Adams and Whitman Counties, Washington. These surveys were made to determine sediment yields from volcanic ash covered watersheds. Drainage areas were from 0.03 to 3.52 square miles and sediment accumulation rates ranged from 0.5 to 6.06 acre-feet/square mile/3 months. These rates (ash deposits) were compared with rates as obtained by applying the Modified Universal Soil Loss Equation to pre-ash conditions. The calculations indicate an increase of 2.4 to 6.7 times the normal rate without ash cover.

Sediment accumulations were measured in three reservoirs in Oregon as follows:

Reservoir	Drainage	County	State
Plat I	Sutherlin Creek	Douglas	OR
Cooper Creek	Cooper Creek	Douglas	OR
Wolf Creek	Wolf Creek	Union	OR

3. Nonpoint Pollution Study

There is a five county on-going study in Oregon. Approximately 75 percent of the USLE data has been collected for input into the Linear Program Model developed for the study. Included also is the determination of sediment yield for the five county area.

4. Special Study

"General Erosion" and "Critical Erosion" maps have been printed for the Middle and Lower Snake River Basins in Idaho.

Sediment evaluations were made on Threemile Creek near Hamilton, Montana. The Universal Soil Loss Equation was utilized as part of the evaluation.

CALIFORNIA REGION

BUREAU OF LAND MANAGEMENT

Statewide. The BLM in California is involved in development and review of many proposed actions which can affect soil loss and sedimentation. Modifications and mitigations to decrease sedimentation are routinely included on these management actions.

Susanville District. The Tuledad/Homecamp Grazing Management Program is being implemented, included are practices designed to reduce sedimentation due to grazing. A program to monitor sedimentation of stockpond reservoirs is planned, which will relate sediment accumulations to predictions made with the the Universal Soil Loss Equation (USLE) in order to improve predictive use of the USLE in the future.

Redding District. The Redding District is an active participant in the Trinity River Basin Fish and Wildlife Task Force, which has a goal of reducing sediment problems throughout the Trinity River drainage. This basin is important as an anadromous fishery. BLM activities in the basin are developed or mitigated so that soil loss is kept to a minimum. The timber harvest plan for Sustained Yield Unit 15 (SYU 15) has developed practices and mitigations to control soil loss and sedimentation for a large area of California BLM forests and is in the implementation phase.

The Redding District is also involved with several agencies in Coordinated Resource Plans to proposed and monitor prescribed burns in several areas. An important part of the evaluation is the study of soil loss from burned areas and downstream impacts.

Best Management Practices (BMP's) from the Statewide 208 Water Quality Plan are being implemented, or are planned for implementation. Projects in Redding include work mostly related to controlling erosion from old timber harvest roads.

Bakersfield District. The District is involved with both development and implementation of grazing management plans that will reduce soil erosion and sedimentation. The SYU-15 timber management plan also covers areas in the Bakersfield Distict.

Ukiah District. The timber management plan for Sustained Yield Unit 13 has been completed and BMP's related to 300 parcels are nearing the implementation stage. These BMP's are designed to minimize soil loss and promote or maintain slope stability.

The King Range Management Plan has been developed with reduction of sediments from old logging roads a high priority. Presently on-the-ground examinations of problem areas are being conducted so that site-specific improvement plans can be developed.

The District is on the Geysers-Calistoga KGRA-ARM Program Planning Task Force, which is concerned with mitigation and monitoring of environmental problems associated with development of the geothermal resource.

Riverside District. A contract study monitoring the impacts on soils and vegetation from Off Road Vehicles (ORV) is scheduled for completion this year. Purpose is to develop better guidelines for management of ORV's and protection of the soil resource.

Grazing management plans are being developed which are partly aimed at reducing soil erosion and sedimentation.

BUREAU OF RECLAMATION

In the feasibility design data for Sites, Golden Gate, Oat, and Noonan Damsites, the sediment estimates for the three reservoirs were made using canal inflow plus land contribution yield rates of 95 m^3/km^2/year (0.2 acre-feet/mi^2/year) for Sites Reservoir (Sites and Golden Gate Damsite) and Oat Damsite, and 167 m^3/km^2/year (0.35 acre-feet/mi^2/year) for Noonan Damsite.

The Fredericksen, Kamine, and Associates, Inc. report on the Trinity River Basin Fish and Wildlife Management Program and appendix B on Sediment and Related Analysis were reviewed. The main report and appendix B covered the sedimentation aspects. Water and Power Resources Service sedimentation studies for the Trinity River to be completed in 1981, will provide some verification to the consultants results when they are completed.

CALIFORNIA REGION

CORPS OF ENGINEERS

South Pacific Division

Los Angeles District

Reservoir Sedimentation Data Summary Sheets for eleven basins are completed. These basins are: Bailey Canyon, Beatty, Big Dalton, Big Tujunga, Carter, Englewild, Gordon, Harrow, Little Dalton, Pacoima and Sierra Madre Villa Debris Basins.

Sacramento District

Black Butte Lake, Pine Flat Lake, Lake Kaweah, Success Lake and Isabella Lake. Routine samples of lake outflows were collected and analyzed for suspended sediment during the year.

Sacramento River. Samples for total and suspended sediment were collected at numerous sites in the Sacramento River Basin. Sampling was discontinued 30 September 1980.

Cottonwood Creek. Daily samples for total sediment are collected during periods of high flow through 30 September, from 1 October through 31 December periodic samples were obtained.

San Francisco District

Sedimentation activities during 1980 consisted of obtaining sediment transport and turbidity data in connection with water resources projects being studied, authorized or under construction or in operation. These activities are summarized below:

Sedimentation studies for Water Resources Projects.

1. Six cooperative sediment stations were operational in FY 80, which ended in September. Due to lack of funding, the Eel River at Scotia, Wildcat Creek at Richmond, and Corte Madera Creek at Ross stations had to be terminated at the end of FY 80. Data from the three remaining active stations will be used to evaluate the effects of the Coyote Dam (Lake Mendocino) and Warm Springs Dam (Lake Sonoma) projects on sedimentation and sedimentation-transport characteristics of Dry Creek and the Russian River.

2. A progam designed to monitor the turbidity of the inflow to and released from Lake Mendocino has been in operation since March 1973. Measurements are made biweekly by reservoir-operation personnel with guidance from the U.S. Geological Survey. The data are published in the USGS Water Supply Papers.

3. The turbidity monitoring program being conducted for the Warm Springs Dam-Lake Sonoma Project was continued through September 1980. Water-quality samples were taken four times a year at these stations (which are above the damsite) and analyzed for turbidity to augment turbidity data being gathered at the cooperative Dry Creek near Geyserville sediment-sampling station. Due to the construction activities at the project however, in FY 81 it is necessary to discontinue water-quality monitoring at the three upstream stations. Thus, turbidity at the Warm Springs Dam Project has been monitored only at the Geyserville station since October 1980.

CALIFORNIA REGION

GEOLOGICAL SURVEY

Klamath Northern California Coastal Subregion

1. Lumbering and sawmill operations at the periphery of Redwood National Park, Calif., may load the streams entering the park with sediment and unwanted nutrients. A study is being made to determine the present rates of sediment transport, the chemical quality, and the level of nutrients of the streams at the periphery and within the park, and to provide an overall appraisal of water resources in the park. Two data releases covering the period September 1, 1973 through September 30, 1975, have thus far been published. The study will aid the National Park Service in developing and protecting the water resources and ecological system in the park. Work is being done in cooperation with the National Park Service.

2. The Grass Valley Creek project is a continuing total-load data-collection program in cooperation with the California Department of Water Resources. The study was begun in 1976 to determine the amount of sediment contributed by Grass Valley Creek to the Trinity River below Lewiston Dam.

Sacramento Subregion

1. A report on the trap efficiency of Highland Creek Reservoir near Kelseyville, Calif., has been completed and is published as follows:

Trujillo, L, F. 1980, Trap-efficiency study, Highland Creek flood retarding reservoir near Kelseyville, Calif., water years 1966-77 Menlo Park, Calif., U. S. Geological Survey Open-File Report 80-735, 25 p.

2. The Cottonwood Creek project is a continuing total-load data-collection program for the U.S. Corps of Engineers. Sediment data are being collected to determine sediment discharge at two dam sites and at a site near the mouth of Cottonwood Creek. 3. The Sacramento River Bank Stabilization Project is a data-collection program for the U.S. Corps of Engineers. The purpose of the study is to determine sediment sources and sinks and modes of transport for the Sacramento River and major tributaries of the Sacramento. During 1980, total-load data were collected at 13 sites and suspended-load data were collected at five sites. In addition, one data set was obtained for the Bend Study, a program designed to provide velocity-vector data at a river bend for the U.S. Corps of Engineers.

4. The Delta Turbidity Project is a continuing data-collection program in cooperation with the California Department of Water Resources. The purpose of the project is to determine suspended-sediment discharge and turbidity for the Sacramento and San Joaquin Rivers near their mouths.

5. The Peripheral Canal Sediment Project is designed to provide sediment-transport information in the vicinity of the proposed Peripheral Canal Diversion site near Hood, California. Periodic data were obtained to determine the vertical and lateral variability in velocity, suspended-sediment concentration, and percentage of sand in suspension. The study was made in cooperation with the California Department of Water Resources.

San Francisco Bay Subregion

1. A report on sediment transported by streams tributary to San Francisco Bay, Calif., has been completed and is published as follows:

Porterfield, George, 1980, Sediment transport of streams tributary to San Francisco, San Pablo, and Suison Bays, Calif., 1909-66: Menlo Park, Calif., U. S. Geological Survey Water-Resources Inv. 80-64, 92 p.

2. The Cull Canyon Project is a data-collection program to determine major sources of sediment upstream from Cull Canyon Reservoir. The study is being made in cooperation with the Alameda County Flood Control and Water Conservation District.

3. The Lake Temescal Project is designed to determine sediment yield from various upper-basin sources and major tributaries upstream from Lake Temescal. The study is being made in cooperation with the East Bay regional Park District.

Central California Coastal Subregion

A study to determine the effect of the Marble Cone Fire (August 1977), near Big Sur, Calif., on sedimentation in Los Padres Reservoir near Carmel Valley, Calif., is underway. Reservoir surveys were made in November 1977 and September 1978. Surveys will be continued on an annual or biannual basis to monitor future changes in storage capacity. This study was made in cooperation with the Monterey Peninsula Water Management District and the U.S. Forest Service.

Southern California Coastal Subregion

1. The project, "Effects of river modifications and control structures in the Santa Clara River Basin, Ventura and Los Angeles counties, California," is in progress. The study will document the effects of river control structures and of sand-and-gravel mining on streamflow, phreatophyte growth, channel morphology, and sediment transport in the Santa Clara River basin. Sediment delivery to the shoreline and sediment size, quantity, and relation to beach stability will also be examined.

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

District Chief, WRD
U.S. Geological Survey
855 Oak Grove Avenue
Menlo Park, CA 94025

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for work plans in the following watersheds (Revolon-Beardsley is updated for an old plan):

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Coyote Creek	Lower Silver Creek	Lower Silver Creek	Santa Clara	CA
Willow Slough	Chickahominy-Moody Slough	Chickahominy-Moody Slough	Yolo	CA
Callequas Creek	Revolon Slough and Beardsley Wash	Revolon Slough and Beardsley Wash	Ventura	CA

b. River Basin Investigations

Major Basin	Basin Reported	State
Sacramento River	Red Bank Creek	CA
Sacramento River	Auburn Ravine, Cook Creek, Bunkham Slough, Pleasant Grove Creek, etc.	CA

2. Special Studies

Average annual sediment yield was determined for field examinations in the following watersheds. Existing data for areas in the vicinity were used:

Major Drainage	Watershed	Stream	County	State
Mormon Slough	Potter Creek	Potter Creek	San Joaquin	CA
St. Johns River	Woodlake-Antelope Valley	Antelope Creek	Tulare	CA
Fresno River	Dry-Schmidt Creeks	Dry Creek and Schmidt Creek	Madera	CA

Reservoirs in California with published Reservoir Sedimentation Data Summary sheets (SCS-34) have been located on a 1:1,000,000-scale State map as a reference tool. Because of the large number of Data Summary sheets in Los Angeles County they were located separately on a 1:100,000 scale county map.

A sediment yield study for Grass Valley Creek Watershed in Trinity County, California, was done for the Department of Interior, Water and Power Resources Service. The study defined source areas of sand-sized and finer sediments that are adversely impacting gravel spawning beds in the Trinity River below Grass Valley Creek.

ALASKA REGION

BUREAU OF LAND MANAGEMENT

Erosion and reclamation of past fireline construction and ORV trails have been monitored by photo points for a number of years. From these observations, it is concluded that reclamation of most disturbed areas, by replacing the organic mat, revegetates rapidly and provides an effective cover along with adequate water bars to control erosion. Reclamation of disturbed areas by replacing the organic mat has been more successful in most cases than by seeding and fertilizing.

Disturbance by mining in some areas is being monitored for erosion and sedimentation damage. Stream sampling for water quality and quantity analyses are being conducted.

A draft Technical Report, "Fireline Reclamation on Two Interior Fire Sites" by Larry Knapman, is presently under review.

CORPS OF ENGINEERS

North Pacific Division

Alaska District

The ongoing sediment transport study for the Tanana River near Fairbanks, Alaska, was continued for 1980. This study is being coordinated and documented by the Cold Regions Research and Engineering Laboratory (CRREL) and funded by the Corps of Engineers. Annual reports of the monitoring effort will be prepared by CRREL.

The Bradley Lake hydroelectric project sedimentation program was continued in 1980. This data and all other sediment data collected through the Cooperative Stream Gaging Program will be reported in the USGS publication, Water Resources Data for Alaska.

ALASKA REGION

GEOLOGICAL SURVEY

Arctic Slope Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Kuparuk River near Deadhorse, Alaska, as part of the National Stream Quality Accounting Network (NASQAN). Suspended-sediment data are being collected infrequently at Colville River near Nuigsut, Alaska, as part of NASQAN.

Northwest Alaska Subregion

1. Suspended-sediment data are being collected on a periodic basis at Kobuk River near Kiana, Alaska, as part of NASQAN.

Yukon Subregion

1. A cooperative study with U.S. Corps of Engineers to collect and evaluate sediment-transport and river hydraulic data in the Tanana River near Fairbanks, Alaska, was continued in 1980. Suspended-sediment and bedload data are being collected in the Tanana River at six sites near Fairbanks, Alaska. The Corps of Engineers will use these data in the design and operation of engineering structures on the Tanana River and the regulation of the quarrying of gravel from the river in the vicinity of Fairbanks, Alaska.

Report: Burrows, R. L., Parks, B., Emmett, W. W., 1977-78, Sediment Transport in the Tanana River in the Vicinity of Fairbanks, Alaska, 1979; U.S. Geol. Survey, open-file report 79-1539, 37 p.

Report: Burrows, R. L., 1979, Cross-section, velocity, and bed-load data at two sites on the Tanana River near Fairbanks, Alaska, U.S. Geol. Survey, open-file report 80-699, 32 p.

Report in Preparation: Burrows, R. L., Parks, B., Emmett, W. W., 1977-79, Sediment Transport in the Tanana River near Fairfbanks, Alaska, 1981; U.S. Geol. Survey, open-file report 81-.....

Report in Preparation: Emmett, W. W., Burrows, R. L., 1977-79, Characteristics of Sediment Transport in the Tanana River near Fairbanks, Alaska, U.S. Geol. Survey, WRI.

2. The cooperative study with the Alaska Department of Natural Resources to evaluate the geohydrology of the Delta-Clearwater area in relation to the agricultural development was discontinued in 1980. Suspended-sediment data were collected at Clearwater Creek near Delta Junction, Alaska.

Report: Wilcox, D. E., 1980, Geohydrology of the Delta-Clearwater Area, Alaska, U.S. Geol. Survey, WRI 80-91, 31 p.

3. As part of the Federal Program Energy Water Resources Division, a study to determine the Concentration and distribution of trace metals in the Healy Creek and Lignite Creek basins began in 1980. Suspended-sediment and bed-material samples are being collected at the following sites:

Healy Creek near Usibelli, Alaska
Healy Creek 0.1 mile above French Gulch near Usibelli, Alaska
Healy Creek near Suntrana, Alaska
Sanderson Creek 0.8 miles above Lignite Creek near Usibelli, Alaska
Frances Creek 100 feet above Lignite Creek near Suntrana, Alaska
Lignite Creek 0.5 miles above mouth near Healy, Alaska

4. Suspended-sediment data are being collected on a periodic basis at the Yukon River at Pilot Station, Alaska, as a part of NASQAN.

5. Suspended-sediment data are being collected periodically at the Fortymile River near Steele Creek, Alaska.

6. Suspended-sediment data are being collected periodically at the Tanana River at Nenana, Alaska, as part of NASQAN.

Southwest Subregion

1. Suspended-sediment data are being collected on a periodic basis at Nushagak River at Ekwok, Alaska, as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Kuskokwim River at Crooked Creek, Alaska, as a part of NASQAN.

South-Central Region

1. A suspended-sediment data program funded by Alaska Power Authority, as part of their evaluation of the proposed Watana and Devil's Canyon hydroelectric power sites, was continued through 1980. This was previously funded by the U.S. Army Corp of Engineers. Suspended-sediment data are being collected on a periodic basis at Susitna River near Denali, Alaska, and at Susitna River near Gold Creek, Alaska.

2. The cooperative program with the U.S Army Corps of Engineers was continued through 1980. Suspended-sediment data were collected on Katchemak Creek (entering Bradley Lake) near Homer, Alaska, and Bradley River (Bradley Lake outlet) near Homer, Alaska. These data are in support of a hydroelectric power study by the Corps and will be used in evaluating reservoir storage capacity and structure design.

3. As part of the continuing program with the Municipality of Anchorage, the collection of suspended-sediment samples was initiated in 1980 at the following sites:

South Fork Campbell Creek at canyon mouth near Anchorage, Alaska
North Fork Campbell Creek near Anchorage, Alaska
Little Campbell Creek at Nathan Drive near Anchorage, Alaska
Campbell Creek near Spenard, Alaska

These data will be used in the identification of water-quality problems and calibration of existing water-quality runoff models which the Municipality of Anchorage developed during the "208" water quality management program.

4. The collection of suspended-sediment data on a periodic basis on the Kerai River at Soldotna, Alaska, was funded by the U.S. Army Corps of Engineers.

5. Suspended-sediment data are being collected on a periodic basis at Talkeetna River near Talkeetna, Alaska, as part of the National Hydrologic Benchmark Network.

6. Suspended-sediment data are being collected on a periodic basis at Susitna River at Susitna Station, Alaska, and at Copper River near Chitina, Alaska, as a part of NASQAN.

7. Suspended-sediment data are being collected on a miscellaneous basis at the following sites:

Fourth of July Creek 0.9 miles above mouth near Seward, Alaska
Potter Creek (Upper) near Anchorage, Alaska
Potter Creek at Potter near Anchorage, Alaska
Rabbit Creek at Anchorage, Alaska
Little Rabbit Creek at Nickleen Street near Anchorage, Alaska
Little Rabbit Creek tributary near Anchorage,
Alaska Little Rabbit Creek at Goldenview Drive near Anchorage, Alaska
South Branch South Fork Chester Creek near E. 20th Avenue at
Anchorage, Alaska
Chester Creek at Arctic Boulevard at Anchorage, Alaska
Peters Creek near Birchwood,
Alaska Deception Creek above tributary near Houston, Alaska
Deception Creek tributary near Houston, Alaska
Deception Creek near Willow, Alaska
Unnamed tributary to Deception Creek near Willow, Alaska
Willow Creek at Parks Highway near Willow, Alaska
Peters Creek below Purches Creek near Willow, Alaska
Skwentna River near Skwentna,
Alaska Chuitna River near Tyonek, Alaska

Southeast Subregion

1. As part of the cooperative program with the U.S. Forest Service, suspended-sediment data are being collected on a periodic basis at the following sites:

East Bradfield River near Wrangell, Alaska
Harding River near Wrangell, Alaska
Whipple Creek near Ward Cove, Alaska
Perkins Creek near Metlakatla, Alaska
Big Creek near Point Baker, Alaska
Navy Lake Outlet near Meyers Chuck, Alaska
Creek near Meyers Chuck, Alaska
Sunrise Lake Outlet near Wrangell, Alaska
Zarembo Creek near Wrangell, Alaska
Zarembo Creek near Point Baker, Alaska

Municipal Watershed Creek near Petersburg, Alaska
Hamilton Creek near Kake, Alaska
Rocky Pass Creek near Point Baker, Alaska
Greens Creek above Big Sore Creek near Juneau, Alaska
Big Sore Creek near Juneau, Alaska
Upper West Mine Drainage Creek near Juneau, Alaska
West Mine Drainage Creek above Tributary near Juneau, Alaska
West Mine Drainage Creek near Juneau, Alaska
Greens Creek below West Mine Drainage Creek near Juneau, Alaska
Greens Creek near Juneau, Alaska

2. The cooperative study with the Alaska Department of Environmental Conservation on the hydrology and water quality of the Keta River basin near Ketchikan was continued in 1980. Suspended-sediment data are being collected at the following sites:

Keta River below Red Creek near Ketchikan, Alaska
Keta River above Hill Creek near Ketchikan, Alaska
Hill Creek above White Creek near Ketchikan, Alaska
White Creek near Ketchikan, Alaska
Hill Creek near mouth near Ketchikan, Alaska
Keta River near Ketchikan, Alaska
Beaver Creek near Ketchikan, Alaska

3. Suspended-sediment data are being collected on a periodic basis at the Stikine River near Wrangell, Alaska, and at Skagway River at Skagway, 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
733 West 4th Avenue, Suite 400
Anchorage, AK 99501

HAWAII REGION

GEOLOGICAL SURVEY

Hawaii Subregion

1. Suspended-sediment data are being collected on a monthly basis at Honolii Stream near Papaikou, Hawaii, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at one site in the Wailuku River basin, Hawaii, in cooperation with the State of Hawaii, Department of Land and Natural Resources.

Maui Subregion

1. Suspended-sediment data are being collected on a monthly basis at Kahakuloa Stream near Honokohau, Hawaii, as a part of NASQAN.

Molokai Subregion

1. Suspended-sediment data are being collected on a monthly basis at Halawa Stream near Halawa, Hawaii, as a part of NASQAN.

Oahu Subregion

1. Suspended-sediment data are being collected at the following sites:

(a) Waikele and Kalihi Streams, Hawaii, as a part of NASQAN.
(b) Kamooalii Stream near Kanheohe, Hawaii, in cooperation with the U.S. Corps of Engineers.
(c) Kipapa Stream and Moanalua Valley in cooperation with the State of Hawaii, Department of Land and Natural Resources.

Kauai Subregion

1. Suspended-sediment data are being collected on a monthly 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
P.O. Box 50166
300 Ala Moana Boulevard, Room 6110
Honolulu, HI 96850

CARIBBEAN REGION

GEOLOGICAL SURVEY

Puerto Rico Subregion

1. Suspended-sediment data are being collected on a bi-monthly basis at 49 sites in cooperation with the Puerto Rico Environmental Quality Board.

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

Rio de la Plata at Toa Alta, P.R.
Rio Grande de Manati near Manati, P.R.
Rio Grande de Anasco near San Sebastian, P.R.
Rio Grande de Patillas near Patillas, P.R.
Rio Fajardo near Fajardo, P.R.

3. Suspended-sediment are being collected on a daily basis at Rio Tanama near Utuado, P.R., in cooperation with the Puerto Rico Environmental Quality Board.

4. Suspended-sediment are being collected on a daily basis at Rio Portugues near Ponce, P.R., in cooperation with the U.S. Corps of Engineers.

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

District Chief, WRD
U.S. Geological Survey
G. P. O. Box 4424
San Juan, PR 00936

FOREIGN ACTIVITIES

BUREAU OF RECLAMATION

A representative of the Sedimentation Section provided technical assistance to the Ministry of Agriculture and Water Resources, Government of Mexico, during the period of January 20-31, 1980. With a U.S. Geological Survey engineer, they visited the Rio Grigalva drainage basin near Villahermosa, Mexico, and Rio San Pedro near Tuxpan, Mexico, to collaborate with engineers from Mexico on sedimentation and stability studies for projects under study on these two river systems to help alleviate sediment and flooding problems in these river basins. A report, "Sedimentation and Channel Stability Report for Rio Samaria Channel and Floodway," by Ernest L. Pemberton (Water and Power Resources Service) and Carl F. Nordin, Jr. (U.S. Geological Survey), dated February 29, 1980, was completed and transmitted to Ing. Fernando J. Gonzalez Vallarreal, Executive Director, National Water Plan Commission, under the Ministry of Agriculture and Water Resources in Mexico. A report, "Sediment Problems, Rio San Pedro Flood Control Project, Nayarit, Mexico," by Carl F. Nordin, Jr. (U.S. Geological Survey) and Ernest L. Pemberton (Water and Power Resources Service), dated March 19, 1980, was completed and transmitted to Ing. Fernando J. Gonzalez Vallarreal, Executive Director, National Water Plan Commission, under the Ministry of Agriculture and Water Resources in Mexico.

A representative of the Sedimentation Section attended the final meeting in Wallingford, England, as the United States representative of the Working Group on "Methods of Estimation of Man's Activities on Sedimentation Processes in River Basins." The Working Group made a detailed review of all chapters and corrected the text where necessary. It compiled an almost final version of the report, "Sediment Problems in River Basins," to be sent to the UNESCO Secretariat. Review comments were sent to Mr. W. R. White (United Kingdom) on the final draft copy of the UNESCO report, "Sedimentation Problems in River Basins," prepared by the Special Working Group, under Project 5.3, Methods of Estimation of the Effects of Man's Activities on Sedimentation Processes in River Basins.

At the request of the Office of United States Foreign Disaster Assistance, Agency for International Development, a representative of the Sedimentation Section visited the Ministry of Energy and Mining in Karthoum, Sudan, and Roseries Dam at Damizen on the Blue Nile, to investigate the sediment and debris build-up in front of the powerplant intakes and to recommend remedial measures to the Sudan Government. After returning to Denver, a preliminary report, including assessment of the situation and recommendations, was sent to the Agency for International Development Office in Washington, with the understanding that a final report would be made within 1 month. A final report was completed on "Sediment and Debris Disposal at Roseries Dam on the Blue Nile in Sudan," for transmittal to the Department of State, presenting the results of the observations made during the September field trip. The report summarized observations and recommended remedial measures to the Sudan Government.

BUREAU OF RECLAMATION

Delivery was taken on a boat manufactured by Mon Ark of Arkansas which has been equipped with a Motorola Mini-Ranger III positioning system and other electronic components including a data processor, a Texas Instruments keyboard, a Tektronix tape drive, a Houston Instruments plotter, an Innerspace Technology digitizer, and a Raytheon sounder. A field representative from Motorola came to the E&R Center and trained members of the Sedimentation Section in the use and installation of the system. A short FORTRAN program has been written which will convert data collected using the new hydrographic survey system to data suitable for use with program "PSEUDO."

A representative of the Sedimentation Section presented a paper at the symposium held in Minneapolis, Minnesota, June 2-5, 1980, on "Procedures for Monitoring Reservoir Sedimentation." The symposium was sponsored by the University of Minnesota, ASCE, AGU, and AWRA.

Sample containers were fabricated in the laboratory shops to be used by divers for obtaining clay samples to be tested in a shear testing device at Grand Coulee Project. Two practice samples were obtained to determine the storage life of samples. Critical shear values on future 0.3 m x 0.3 m x 0.15 m (12" x 12" x 6") clay samples will be used to help determine protective requirements for riverbank stabilization.

A 1:80 scale of physical model of the spillway for Dovle Peripa Dam, Ecuador, was used to study scour in the river downstream of the stilling basin.

The final report on the 1:16 model study for the proposed modification for Blanco Diversion Dam to prevent tunnel abrasion was completed. A sequential three trap system was developed that is sluiceable. The report will be distributed about August 1980.

An automated sluice gate controller was designed for Pouder Diversion Dam. The controller was operated to pass all excess flow and bedload through the sluiceway except for higher flood flows. Field personnel reported that the controller reduced the abrasion of the overflow crest considerably.

About 10 requests from EPA, state engineers, and Water and Power Resources Service personnel for the report, "Control of Turbidity at Construction Sites," by E. J. Carlson, were filled this year.

A contract was awarded to Colorado State University on September 26, 1980, for development of a water-sediment routing model using the modified potential flow theory under the concept of streamlines. The work under the contract is being done by Albert Molinas for a 2-year period. The objective in development of a mathematical model by Water and Power Resources Service is for use to compute degradation below dams, to predict channel changes due to sediment diversions at an intake from a river, to compute channel scour during a flood, to compute scour at constrictions, to design channel stabilization measures, to determine aggradation above dams, and to predict morphological changes.

CORPS OF ENGINEERS

Coastal Engineering Research Center

VISUAL SURF AND NEARSHORE CURRENT OBSERVATIONS. The Littoral Environment Observation (LEO) program is a cooperative effort carried out among Corps of Engineer District Offices, CERC, and volunteer observers. Currently, visual surf observations are being made in the Savannah, Los Angeles, Mobile and Galveston Districts. The parameters measured daily include: breaker height, period, direction and type; longshore current speed and direction; wind speed and direction; foreshore slope; rip current and beach cusp spacings. Beach sediment samples are also collected at some locations.

Yearly summaries are prepared and forwarded to appropriate Corps District Offices. A "Regional Data Summary" report is being prepared for Northern California area.

EVALUATION OF SHORE PROTECTION STRUCTURES. Reports on the results of the North Carolina Beaches and Texas Coast Inlets studies have been prepared. The former, prepared under contract, is undergoing review; the latter, prepared in-house, has been submitted for publication. A report entitled "Guidelines for the Design of Weir Jetty Sand By-passing Systems" has been completed and submitted for publication. The final draft of a CETA on the economics of overdesigning structures has been completed and is being reviewed. A report on the shore protection measures that have been taken on Tybee Island, Georgia is being prepared under contract. Monitoring programs are underway at Lakeview Park, Ohio (Offshore Breakwaters), Murrells Inlet, South Carolina (Weir Jetty System), and Little River Inlet, South Carolina (Weir Jetty System). A monitoring program was developed for Tybee Island, Georgia (Beach Fill with Terminal Groin with Weir Section). Data sheets for evaluating low cost shore protection in the field are being developed to result in a loose leaf notebook on the structural characteristics and performance of various low cost shore protection schemes.

LONGSHORE TRANSPORT. A final draft report "Movable-Bed Laboratory Experiments Comparing Radiation Stress and Energy Flux Factor as Predictors of Longshore Transport Rate" has been forwarded for CERC publication. This report summarizes fifteen experiments relating wave conditions to longshore transport rate performed in the Shore Processes Test Basin, at generator angles of 0, 10, 20, and 30 degrees. Measurements include hourly values of wave braker angle, wave height, and longshore current, and four-hourly values of transport rate. The data show considerable variability in all measured quantities. Initial results are similar to past laboratory tests.

NUMERICAL MODELING OF COASTAL SYSTEMS. This study was initiated in 1976 to investigate the feasibility of developing a numerical model that would predict the response of a shoreline to changes in wave energy acting on

it. Initial conclusions are that an approximate model suitable for use in planning studies can be developed that will provide estimates of the effects of various coastal structures on adjacent shorelines. A detailed literature survey of publications relating to mathematical prediction of shoreline evolution was published in 1977 (MR77-10, "Mathematical Modeling of Shoreline Evolution" by B. LeMehaute and M. Soldate.)

Current efforts are being directed toward the development of a numerical computer model based on the equations of longshore sediment transport and the mass balance equation for the sediment. Papers describing on-line mathematical models were published in 1979 and 1980 ("Predicting Beach Planforms in the Lee of a Breakwater" by M. Perling, Coastal Structures 79 proceedings published by the American Society of Civil Engineers, 1979; MR 80-6, "A Numerical Model for Predicting Shoreline Changes" by B. LeMehaute and M. Soldate, 1980). An additional contract report will be published in 1981. An online numerical model is being prepared under contract and will be published in 1982. The eventual product will be a computer program that will permit preconstruction estimates of the effects of proposed coastal structures, the interaction among several coastal structures along a shoreline and a method of estimating the damages attributable to the construction of a given navigation project.

STORM EROSION STUDIES. The purpose of this study is to develop methods for predicting storm-induced beach changes. During the first phase of the study, measured beach changes will be empirically related to storm parameters. Available data include storm changes surveys conducted by this study between November 1975 and March 1978, and similar data collected under CERC's Beach Profiling Program between 1962 and 1977. Attempts were made to isolate storm effects by surveying just before and just after major storms.

Included in the study are 11 East Coast beaches located between Cape Cod and North Carolina. Wave data for the storms occurring before January 1976 have been obtained from the WES East Coast wave hindcast model.

A new field study began in 1981 seeks to investigate nearshore changes due to storms. Two profile lines located at CERC's Field Research Facility are being surveyed bi-weekly and after storms out to a depth of about 10 meters. Surveying will continue for at least one year.

During the second phase of the study, to begin in FY 81, a numerical model of nearshore sand movement will be developed, calibrated, and verified using data collected at CERC's FRF. This is a major effort aimed at understanding and predicting the physical processes which cause storm erosion.

LIMITING WATER DEPTH TO SAND BEACH EROSION BY WAVES. A relatively simple criterion for sand motion by oscillatory flow was reported in "Sand Motion Initiation by Water Waves: Two Asymptotes," which appeared in the August 1980 "Journal of the Waterway, Port, Coastal and Ocean Division,

ASCE." Using appropriate wave theory, the critical peak velocity can be converted into minimum wave height required for sand motion in a given water depth, or into maximum water depth for sand motion with a given wave height.

These conclusions on sand motion and results documented previously (on a shallower limit depth to intense wave effects) have been utilized in a paper title "A Profile Zonation for Seasonal Sand Beaches from wave Climate," to appear in "Coastal Engineering" in early 1981. This zonation defines a nearshore buffer region where expected wave action has neither strong nor negligible effects on the sand bottom during a typical year. Applications are in coastal engineering activities requiring and estimate of the seaward limit to significant sand transport by waves: design of nearshore surveys, marine borrow or disposal, etc.

WAVE-SAND INTERACTIONS IN A WATER TUNNEL. In a CERC-sponsored study, Karl Lofquist of the National Bureau of Standards has continued measurements of oscillatory-flow energy loss due to naturally rippled sand beds. First results were reported at the 17th International Conference on Coastal Engineering in Sydney, Australia, and in the Conference Proceedings in a paper titled "Measurements of Oscillatory Drag on Sand Ripples." The instantaneous drag coefficient is a complicated function of flow phase, peak velocity, and ripple characteristics; however, there are lesser variations in average energy dissipation over a flow cycle. In 1981, data collection with two additional sands will be concluded and a full report prepared for CERC publication.

PROTOTYPE EXPERIMENTAL GROIN, POINT MUGU, CALIFORNIA. The experimental and data collection phase of the study was completed 30 June 1976. All components of the permeable groin were removed by January 1977.

The final hydrographic survey and sediment samples were obtained in May 1976. Approximately 500 sand samples have been analyzed to determine mean particle size distribution and other statistical parameters. These parameters are being studied to determine their relationship to the longshore energy transport, foreshore beach slope and beach firmness.

This information will be included in the report on the functional performance of the experimental groin due to be published in 1981.

BEACH PROFILE STUDIES. The objectives of these studies are to observe the response of beaches to waves and tides of specific intensity and duration and to develop predictive techniques for estimating storm-induced beach changes.

During the 1980 calendar year emphasis continued on the preparation of locality reports summarizing data collected since 1962.

The report "Beach and Inlet Changes at Ludlam Beach, New Jersey" was published as CERC MR80-3. This report provides data on temporal and spatial beach changes along 20 profile lines at Ludlam Beach. The data

show a clear seasonal trend with erosion dominating from November through May. The seasonal range of sand volume change was significantly reduced within the Sea Isle City groin field. The groins appear to have their greatest effect on the downdrift coast by deflecting the north-to-south transport of littoral drift in the offshore direction. This seaward deflection results in a shadow zone where less than the normal amount of sediment moved offshore is returned.

A final draft report "Evaluation of Beach Profile Data from Long Beach Island, New Jersey" was submitted for CERC publication. In addition to evaluating changes in shoreline position and sand volume, this study also used empirical eigenfunction analysis to determine the temporal and spatial beach profile changes. The data show a great deal of variability along the beach with adjacent profiles showing changes in opposite directions due to a single event. Sand volume on the beach increased for several years after construction of groins and then became stable, indicating that shore protection structures built along the beach since 1962 have been generally effective in trapping sand and stabilizing the shore face.

A final draft report "Coastal Changes Eastern Shore Lake Michigan, 1970-1974" was submitted for CERC publication. This analysis of bluff recession and volumetric losses at 17 profile lines concluded that recession tended to increase with lake level, but the seasonal peak in recession coincided with the September to April storm period. Lake ice was found to be an effective shore protection agent during the most stormy months of January, February and March.

A study of the coastal processes and sediment budget at Virginia Beach, Virginia was completed for the Norfolk District. The study included an analysis of 25 years of beach profile survey data and the effectivenes of a continuous beach nourishment project at Virginia Beach. The results show that on the average the study area is undernourished in the winter and spring and overnourished in the summer and fall, with nourishment closely balancing the erosion losses. The grain size distribution of the beach sand has been getting finer, resulting in larger nourishment requirements with time.

WEIR JETTY ORIENTATION AND ELEVATION. A three phase study to investigate the functional and hydraulic behavior of weir jetty systems was initiated in late 1976. The research study includes two sets of laboratory experiments and a prototype data collection program.

A series of movable-bed laboratory tests were done to quantify the distribution of sediment transport across a weir section for various wave conditions. A second series of tests using tracer material in a fixed bed model determined relative volumes of sediment carried over the weir section and around the jetty and monitored the response of the updrift shoreline of a number of weir jetty systems to changes in wave direction. The prototype data collection program measured the distribution of

sediment transported across the weir sections of currently existing systems. Reports on all three studies are in preparation.

Expected output from this study will permit designers to use the empirical data to evaluate proposed weir jetty system designs and to establish optimum weir crest elevation, orientation and length.

SHORE RESPONSE TO OFFSHORE DREDGING. This work unit addresses the problem of determining when offshore dredging is likely to adversely effect adjacent beaches. Data on recent nearshore dredging operations were collected from each of the Corps' coastal districts. This data set will be useful to indicate the present extent of the problem, and to form a basis for selecting project sites for follow-up study. Field studies were begun at two sites the first year. A series of surveys were conducted to monitor the movement of sand dumped opposite St. Augustine Beach in the winter of 79/80. Surveys were also made of the offshore borrow site at Redondo, CA; to determine how much beach fill, over the long term, was being washed back into the offshore borrow pit. A short article was prepared for "Civil Engineering" to report that Redondo's offshore borrow site was gradually filling with sand moving in from offshore. The beach itself moves on and offshore with storms and seasonally, but does not move far enough seaward to get trapped in the borrow pit.

Beach Fill Sediment Criteria

1. Guidelines for the Design of Beach Fills. Guidance for fill specification, prediction of fill performance, borrow source and beach sampling, and granulometric description of sediments are provided by (1) CERC TM 60 "Techniques in Evaluating Suitability of Borrow Material for Beach Nourishment" by James, (2) CERC TP 77-6 "Review of Design Elements for Beach-fill Evaluation" by Hobson and, (3) CERC CETA 79-7 "Meeting and Use of Phi Grade Scale" by Hobson.

2. Monitoring Beach Fill Performance. The first field monitoring study to test proposed beachfill models was completed at Imperial Beach, CA, and analysis of those data is nearing completion. Monitoring of the fill project at Surfside/Sunset Beach, CA was begun and a third monitoring site will be selected soon. These long-term projects will provided data for field validation as modification, if necessary, of the Renourishment and Fill Factor models presented in the Shore Protection Manual.

3. Evaluation of Potential Nearshore Borrow Sources. Offshore sand bodies may become an important future source for beach fill sediment. Ebb tidal delta complexes are commonly found along the East Coast and one such delta at New River, NC, was core sampled and surveyed to generally assess its fill potential. Results from this study and from additional studies to be carried out at other "typical" sand bodies will provide a basis for generally evaluating the fill potential of these kinds of sand resources.

4. Handling Loss Experiments. Three experiments were conducted in North Carolina and New York to evaluate modifications to sediment texture caused by dredging and handling operations. Results from these experiments reported by R.D. Hobson at three engineering conferences were that winnowing losses generally improved the predicted performance of dredged sediments as beach fill, and that a mathematical model shows promise which estimates potential handling losses by comparing textural attributes of sedimentary materials.

5. Other Ongoing Studies. (A) Core sampling studies across the active profile are providing the depth component of beach sediment textural variability for use in improving beach sampling guidelines. (B) Analysis of sediments core-sampled from a sand trap feature at Channel Islands, CA, will provide data to estimate the winnowing function of the renourishment beach fill model, to document the textural filling history of the sand trap, and will serve as a basis for evaluating the relative merits of core sampling versus surface sampling of nearshore sediments. (C) Cores taken across the active profile of an East coast barrier island (Topsail Island, NC) have documented the internal stoneface stratigraphy, provided modern and ancient equilibrium profile shapes and have shown the middle stoneface to be the active "cutting edge" of a migrating barrier island.

1980 BISS SEDIMENTATION INPUTS - Coastal Sediments

Analyses and interpretation of seismic and sedimentary core data from the Atlantic, Lake Erie and Pacific coasts continued during 1980. A total of almost 500/cm of high resolution seismic reflection and side-scan sonar data were collected along nearshore portions of southern California, extending from Oceanside to the border with Mexico. These data were examined to select sites for coring in 1981 to be done by contract.

Also, a major new effort was started to study the origins and evolutionary behavior of barrier islands. Field studies are underway at several sites along the Atlantic with the main attention on the Delmarva coast. These efforts are broad in scope but basically involve collecting sediment samples, making maps, conducting aerial surveys and running offshore surveys to study the geological nature of the shoreface.

1. Reports and papers published in FY 80 follow:

a. "A device for Cutting Sediment Core Liners," CERC, Coastal Engineering Notebook - Meisburger

b. "Sediment Sample Card," CERC, Coastal Engineering Notebook - Meisburger

c. "Data Collection Methods for Sand Inventory Type Surveys," CERC CETA 80-4 - Prins

d. "Sand Resources on the Inner Continental Shelf of the Cape May Region, New Jersey," CERC MR 80-4 - Meisburger and Williams

e. "An Apparatus for Cutting Core Liners," Journal Sedimentary Petrology, Vol. 50, No. 2, June 1980 - Meisburger, Williams and Prins

2. The following reports are in various stages of draft form and will be published as inhouse CERC reports or in technical journals in the near future:

a. Sand and Gravel Resources and Geologic Character of Central Lake Erie - Conneaut, Ohio to Erie, PA.

b. Regional Geology of the Southern Lake Erie Bottom Between Conneaut and Marblehead, Ohio - A Seismic reflection and Vibracore Study

c. Sand Resources on the Inner Continental Shelf Off the Central New Jersey Coast

d. Morphologic Variations and sediment Transport in Crenulate Bay Beaches, Kodiak Island, Alaska

e. Holocene Stratigraphy and Geomorphology of the Hills Beach/Fletcher Neck Tombolo System Biddeford Maine

f. Barrier Island Sedimentation Studies Program

g. The Influence of Man on the Sediment Budget of a Barrier Island

h. Sand Resources of Southern Lake Erie Between Conneaut and Toledo, Ohio

i. Regional Geology and Sand Resources of Long Island Sound

j. Sea Bed Morphology, Sediments and Shallow Sub-bottom Stratigraphy of the Eastern Irish Sea

k. A Cretaceous - Tertiary Depositional Sequence On the Submerged Coastal Plain Off North Carolina

l. Recent Rise in Sea Level

m. Beach Sampling Procedures

n. Coring Techniques for Back-Barrier Marshes

o. An Inexpensive Hand-Held Coring Device

p. Use of Vibratory Coring Samplers For Shallow Marine and Great Lakes Sand and Gravel Assessment Surveys

q. An Inexpensive Portable Vibracoring System For Shallow Water and Land Application: Further Modifications

CORPS OF ENGINEERS

The Hydrologic Engineering Center

Work at the Hydrologic Engineering Center (HEC) continued to focus on improvement to the mathematical model HEC-6, "Scour and Deposition in Rivers and Reservoirs."

Development of the capability to simulate gravel mining operations was completed for the Kansas City District. Further testing and improvements have recently been made to that portion of the code. Along with gravel mining, a graphics display package was developed. Both of these new capabilities are now available within the library version of the code. In June 1980, the HEC was asked to discuss these new modeling capabilities at the "Mined Land Reclamation Workshop" that was held at the University of California, Davis campus. The title of the presentation was "Computer Modeling of In-Stream Mining Activiites."

Training document No. 13, "Guidelines for the Calibration and Application of Computer Program HEC-6," was completed late in CY 1980 and will be available for public distribution early in CY 1981. A training course entitled "Sediment Transport" was conducted at the Hydrologic Engineering Center from 17-21 November 1980. The theory and usage of HEC-6 as an analytical tool were stressed.

Additional work has included participation with the Sacramento District with their "Sacramento River and Tributary Bank Protection and Erosion Control Investigation" as well as continued cooperation with the Waterways Experiment Station in Vicksburg, Mississippi.

Several districts and divisions are beginning to use minicomputers for their daily work load in hydraulic analysis. Because of this, work is continuing to develop and test a version of the HEC-6 code that will be compatible with these kinds of machines.

CORPS OF ENGINEERS

Waterways Experiment Station

Title of Study:

New Dredging Concepts

Conducted by:

U. S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The New Dredging Concepts project is a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program, funded by the Office, Chief of Engineers. The objective of the project is to develop procedures and techniques for applying recently developed dredging equipment to estuarine, riverine, and reservoir shoaling problems.

Accomplishments during Calendar Year 1980 include:

1. Completion of the majority of work on gathering information for a study of agitation dredging techniques, including monitoring an air-bubble agitation system tested at Harbour Town Marina, SC.

2. Initiation of work on compiling an annotated bibliography of dredging-related literature.

3. Construction of a small test facility to gather data on pipeline friction losses for the flow of high-density slurries.

Future work will include the following:

1. Publication of the dredging bibliography, in several volumes, as an ongoing effort over the life of the project.

2. Investigation of mechanical dredging equipment and techniques for use in U. S. maintenance dredging work.

3. Evaluation of small, portable dredges.

Title of Study:

Offshore Dredging Systems

Conducted by:

U. S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The Offshore Dredging Systems project is a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program, funded by the Office, Chief of Engineers. The objective of the project is to develop preliminary engineering designs for new systems and existing equipment modifications for recovery of sand from offshore sources and placement on adjacent beaches.

Accomplishments during Calendar Year 1980 include completion of two reports describing the offshore environments and project characteristics likely to be encountered by dredging systems working offshore of the continental U. S. for beach nourishment purposes. The engineering characteristics of 20 example beach nourishment projects are described in one report and the other quantifies the wave environmental for 10 of the 20 projects at both the borrow area and project site.

Future efforts will include a study to determine which items of existing and proposed offshore dredging equipment will best suit the requirements of the 20 example projects and the initiation of contracts to perform nourishment system engineering development.

Title of Study:

Sediment Traps for Reduced Shoaling

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

Sediment Traps for Reduced Shoaling study is a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program, funded by the Office, Chief of Engineers. The objective of the study is to develop methods that will allow effective sediment traps to be designed to reduce maintenance dredging in estuarine navigation channels and turning basins.

Accomplishments during Calendar Year 1980 include the following:

1. Evaluation and problem assessment were completed with information identified and compiled. A continuing literature survey has found few sediment traps reported.

2. Experiment design to define the sedimentation processes in using sediment trap schemes and their effects on channel shoaling was begun.

Future work will include the continuing literature survey and the completion of the numerical model experimental work. Data analysis and conceptual model design will be undertaken. The technology transfer portion of the study will include a report on present sediment trap utilization and methods and a report with recommended sediment trap utilization.

Title of Study:

Advance Maintenance for Entrance Channels

Conducted by:

U. S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The Advance Maintenance for Entrance Channels study is a unit of the Improvement of Operations and Maintenance Technqiues (IOMT) program, furded by the Office, Chief of Engineers. The objective of the study is to develop rational criteria for the use of advance maintenance dredging, i.e., overwidth and/or overdepth dredging, for entrance channels by evaluating the effect of depth and width on dredging frequency. Corps-dredged entrance channels have been identified, and those to which advance maintenance is applied have been so designated. Specific projects have been analyzed to determine the effect of channel depth and width on dredging frequency and volume. The analysis was conducted using an empirical technique based on historical dredging records.

Accomplishments during 1980 include the following:

1. A literature survey to determine the state-of-the-art was conducted.

2. Corps-dredged entrance channels using advance maintenance were identified.

3. The process of determining which of these channels have adequate data available for the analysis of the effectiveness of advance maintenance was initiated.

4. The analysis of some site specific projects in the Mobile and Galveston Districts was initiated.

Future work includes completion of the selection of advance maintenance entrance channels to be evaluated and analysis of the selected projects. An investigation into the feasibility of using physical, numerical, analytic, and empirical models to prèdict the effectiveness of advance maintenance in reducing dredging frequency and/or costs in entrance channels will be conducted.

The final objective of the study is the publication of a series of technical reports and ETL on new estuarine procedures applied to entrance channels. These reports will (a) identify current and previous advance

maintenance entrance projects and (b) evaluate the effect of advance maintenance on these projects through use of an empirical technique based on historical dredging records.

Title of Study:

Oregon Inlet Shore Processes Numerical Model

Conducted By:

U. S. Army Engineer Waterways Experiment Station

Conducted For:

U. S. Army Engineer District, Wilmington, N.C.

Water Resources Region:

South Atlantic - Gulf

Location:

Oregon Inlet, North Carolina

Summary of Accomplishments:

The purpose of this study is to develop state-of-the-art numerical models to simulate the shore processes in the vicinity of Oregon Inlet, North Carolina. The models will be used to evaluate the effects of proposed jetties for Oregon Inlet on the movement of littoral materials in the vicinity of the inlet. In addition, they will be used to evaluate the impact of various sand bypassing schedules on shore processes. The models will determine complete wave fields, water elevations and currents due to tides and storm surges, wave-induced currents (including littoral and rip currents), wave set-up, and littoral and onshore-offshore movement of sediment.

The study was initiated in April 1980 and during CY 80 a wave-induced current numerical model employing an alternating-direction implicit solution scheme was developed, models for littoral and onshore-offshore movement of sediment were formulated, and a model for wave interaction with solid structures was completed.

Title of Study:

Definition of Cause of Navigation Channel Shoaling

Conducted by:

U. S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The objective of this research is to develop a coherent approach for the solution of estuarine navigation channel shoaling problems. This is being accomplished by classifying estuarine shoaling problems and showing how these problems should be solved, detailing step-by-step procedures. Areas requiring further research have been identified. Literature surveys to isolate available information on the processes causing significant shoaling in navigation channels and ongoing research have been conducted. A detailed review of pertinent literature on 43 Corps projects was also initiated to determine characteristics and magnitude of dredging at these sites. The following have been defined as subtasks of this study:

1. Evaluation and extent of shoaling problems nationwide.

2. Survey and evaluation of shoaling volume determination.

3. Hydraulic research on causes of navigation shoaling.

4. Research on prediction of sediment transport, deposition, erosion, and resuspension.

5. Research on techniques to reduce shoaling cost.

6. Data management.

The objective of each of these subtasks has been formulated. Information derived from these subtasks will be used to generate an instructional report which will describe how to approach and solve navigation channel sedimentation problems.

A detailed outline of a report was prepared on the six subtasks of the project, field studies were formulated for various Corps projects, areas where research is needed were identified, all literature reviews previously completed were updated, and the planning phase for an instructional report for field offices to use in solving shoaling problems was initiated. A preliminary research plan addressing needs identified from the literature survey was formulated.

During 1981, a report will be written describing how to approach and solve navigation channel sedimentation problems using existing field data. Results will be used to revise EM 1110-2-1607, Tidal Hydraulics, and contribute to a new EM on Channel Design.

CORPS OF ENGINEERS

Federal Inter-Agency Sedimentation Project
St. Anthony Falls Hydraulic Laboratory
University of Minnesota
Minneapolis, Minnesota

Annual project report for Calendar Year 1980 is described below. Laboratory Research, Work in Progress. During 1980 a variety of bedload samplers were tested in a special facility at St. Anthony Falls Hydraulic Laboratory. Three runs with 2.1mm bed material and three runs with 23mm material were completed. For the Helley-Smith samplers, preliminary data indicates sampling efficiency is a function of bedload transport rate.

The D-77 suspended-sediment sampler was modified to expand its range of application. To permit accurate sampling in deep water, the sampler was equipped with a flexible-bag sample-container and an electrically operated sampling-valve. In the laboratory compensating tests are being conducted on devices to insure accurate sampling over a wide range of fluid temperatures.

New requirements for both chemical and biological sampling of wadeable streams have produced additional constraints on equipment design. To meet these constraints, design of a new sampler, termed the D-80, was started.

For sampling high concentrations on Mount St. Helens streams, the project made comparative tests of progressive-cavity and peristaltic-type sampling pumps. Ultimately a special peristaltic was designed and seven automatic pump-samplers were shipped to the site.

In an effort to facilitate particle size and concentration measurements on suspended-sediment samples, two commercial instruments were tested. By different means instruments detect minute changes in the density of a water-sediment mixture. One instrument measures the pressure in a column that holds the test sample and the other measures the frequency of a vibrating member that contains the test sample. For each instrument sources of measurement errors are being isolated and techniques for error compensation are being devised.

Equipment Supply - Supply, repair, and calibration a variety of sediment samplers and analyzers was continued. During 1980, sales and inventory were as follows:

Instrument		Sold since 1940	Sold during 1980	Inventory, Dec. 1980
DH-48	Hand sampler	3146	236	343
DH-75P	Hand sampler	124	25	18
DH-75Q	Hand sampler	124	16	29
DH-59	Hand-line sediment sampler	1259	128	92
DH-76	Hand-line sediment sampler	337	102	21

Instrument		Sold since 1940	Sold during 1980	Inventory, Dec. 1980
D-49	Depth-integrating sampler	900	0	0
D-74	Depth-integrating sampler	410	135	55
D-74AL	Depth-integrating sampler	139	33	13
P-61	Point-integrating sampler	261	43	25
P-63	Point-integrating sampler	44	5	1
P-72	Point-integrating sampler	46	16	22
BMH-53	Bed-material hand sampler	356	31	44
BHM-60	Bed-material hand sampler	277	42	42
BM-54	Bed-material sampler	212	33	5
SA	Particle-size analyzer	90	5	2
PS-67	Pumping sampler	42	0	0
PS-69	Pumping sampler	345	25	17
CS-77	Chickasha pumping sampler	35	0	2
SS-72	Sampler splitter	36	3	0
BP-76	Power supply	128	16	8

For the above equipment a catalog and manuals are available by request.

EPA REGION V

WATER DIVISION

EPA, Region V, located in Chicago, Illinois, has conducted the following sedimentation activities for calendar year 1980.

The Indiana Heartland Model Implementation Project (MIP) is an accelerated joint effort of EPA and USDA to control nonpoint pollution through use of financial incentives. This work included a computer modeling program, water quality monitoring, chemical and biological assessment, soil characteristics evaluation, land use data collection, spatial analysis, and BMP implementation. In addition to EPA, 21 other organizations were involved in this project. A water quality model developed by EPA--the ANSWERS model--proved effective in estimating the distribution of sediment yields for various BMP's at alternate locations. During 1980, chisel plowing, minimum tillage and no-till acreages were increased. Best Management practices have been applied in the MIP watershed on a total of 508 sites. Of the 1,431 farms in the project area, 28% have utilized ACP financial assistance. This project has shown that BMP's can be located through modeling. Financial incentives alone are not as effective as a combination of both educational programs and financial incentives combined.

Black Creek

The EPA funded Black Creek Project has as a primary goal elucidation of the relationship between various land treatment practices and their effect on water quality. This project also developed the ANSWERS model which is designed as a planning tool for nonpoint source pollution control. Some of the results include: runoff volumes, sediment yields, and nutrient loadings keyed to land use practices and BMP installation. The project also had as a key finding the fact that a 40% reduction in rainfall results in a 60% reduction in runoff, a 400% reduction in sediment yield and a 500% reduction in nutrient loadings. Moreover, it was determined that of the nutrients running off the land, 90% of the phosphorus and 50% of the nitrogen were sediment-bound. Most of the sediment and sediment-bound nutrients originate from the land surfaces. Only 2% of the sediment came from tile drains. Of all the BMP's evaluated, no-till made the largest reduction in soil erosion.

RCWP Projects

Three RCWP projects were underway in 1980. They included Saline Valley, Michigan, Highland Silver Creek, Illinois, and Lower Manitowoc River, Wisconsin. All three of these projects have identified sedimentation as a problem. All three of these projects increased the number of agreements signed and BMP's installed. The BMP's will reduce sedimentation if other factors remain constant.

For additional information contact Mike MacMullen, Chief, WQPS, 230 South Dearborn Street, Chicago, Illinois 60604.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Rural Nonpoint Source Section, Washington, D.C.

1. Erosion and Sediment Control Seminar Program

More than 16 States have enacted laws and are conducting regulatory programs to prevent, or control construction-related nonpoint source pollution, particularly sediments. The Environmental Protection Agency has been involved in a seminar program to encourage other States to enact effective laws authorizing programs for control of such pollution sources. These seminars were conducted in eleven States during 1980 under a grant program funded by EPA and carried out by the National Association of Conservation Districts. At the State seminars, awareness of the problem of nonpoint source pollution from sediment generated by activities on construction sites by participants was good. However, they felt that the general public and many public officials in government were not yet fully aware that any problems exist. Technology was generally considered available to deal with sediment problems but the need for innovative control measures to meet pollution control was stressed, particularly to adapt traditional "agricultural soil conservation measures" to the unique needs of construction projects. State governments, county and municipal governments, soil conservation districts, impacted homebuilders and contractors, engineers, and environmental groups were essential participants in successful program development and operation. Although several States will pursue a voluntary approach with emphasis on information and education, technical assistance, and some inspection from the industry and conservation districts, most will move towards a regualtory program. Several bills are being prepared for introduction in legislatures in 1891. In addition, the number of ordinances at the county and municipal level are growing quite rapidly.

Construction

For additional information, contact Robert E. Thronson, EPA Water Planning Division (WH-554), Washington, D.C. 20460. Telephone (202) 755-9233.

Region II, New York, New York

The Water Division in Region II is not currently conducting or proposing studies on sedimentation activities. However, both New Jersey and the Virgin Islands have developed programs for Construction Sediment Control. These programs are to be evaluated during FY'81, utilizing FY'81 Section 208 funds, to determine the need for program management modifications.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Region VI, Dallas, Texas

Sediment Alert Levels

1. Introduction

Region 6 has finalized the sediment alert levels for pesticides, metals and several organic and other pollutants of concern. These alert levels have been derived from the 1980 water quality criteria for 65 priority pollutants and "Red Book" criteria for nutrients. Since the water quality criteria for toxics have been developed from the most up-to-date toxicity information and the methodology used for deriving the aquatic life numbers is the state-of-the-art in determining what is necessary to protect aquatic biota in the water column, Region 6 EPA believes that application of these criteria as sediment alert levels for interstitial and elutriate water is a good screening mechanism.

The intent of this information is not for regulatory or enforcement actions. The main objective is to provide for the first time a concise and comprehensive evaluation mechanism for assessing impacts of nonpoint and point sources on water, fish and sediments. Not all of the information contained on these tables is applicable in every case. This is left up to the decision maker evaluating the available information at hand or planning to obtain additional information. If water column data does not indicate a pesticide problem yet the decision maker suspects a problem, he or she may want to request a sediment and fish tissue sampling program. This type of sampling is a more sensitive mechanism and indicator of pesticide pollution. If sediment samples are available in a number of areas, then the Region 6 sediment alert levels can be used to evaluate and rank these areas in order of their severity of potential impacts.

Another evaluation approach for determining a potential hazard of toxics in sediments is to use some factor times the Region 6 sediment alert limits, as long as this factor does not allow the chosen limit to significantly exceed the LC50 of the parameter of concern. There are potentially many other uses of the information contained on the following tables that may be acceptable in assessing and prioritizing NPS and point source problems. Region 6's main objective is to provide a starting point for the identification, prioritization, and evaluation of effectiveness of BMPs of NPS problems. Agencies such as SCS, COE and USFWS have suggested that having an alert level to compare sediment data of various locations is an important step in getting a handle on toxics in sediments. This will help in prioritizing resources to those areas where other information confirms the alert level screening process. It must be kept in mind that these alert levels are a decision making tool. They are not intended to be used by themselves. Other information such as biological data and risk assessment/bioassay approaches must also be used before any management or regulatory activities can begin.

2. Description of Tables

The following tables are a compilation of Federal water quality criteria, fish tissue and sediment levels summarized by Region 6. The first three tables, titled "Toxic Criteria," list the new U.S. EPA aquatic life toxicity criteria recommendations for 20 of the 65 priority pollutants obtained from Federal Register, vol. 45, no. 231, Friday, November 28, 1980. Toxic criteria are also included for those substances not listed in the above document, but covered in EPA's Quality Criteria for Water (the "Red Book," July 1976). Also included are detection limits, USGS alert levels for water and sediments established on August 22, 1977, FDA levels for fish and shellfish published on June 1978, and Region 6 alert levels for sediments, both elutriate and interstitial. "Red Book" criteria were not listed if both a maximum permissable level and 24-hour average was provided. The Region 6 alert levels for sediment represent the 24-hour average for water listed in the Federal Register mentioned previously or in the "Red Book." If a 24-hour average level was not available, the maximum level was used. Since these sediment alert limits are not based on infield testing, another list of data is offered for comparison. This data is contained in the next three tables which list the lowest acute LC50 (lethal concentration that kills 50 percent of test organisms) and lowest chronic levels (determined by life cycle or partial life cycle tests) for warmwater fish, invertebrates, and freshwater aquatic life. Values for warmwater fish and invertebrates were taken from U.S. EPA summaries of aquatic-based and health-based criteria for individual pollutants (EPA 440/5-80-015 thru EPA 440/5-80-079). Data for the bluegill (Lepomis) or fathead minnow (Pimephales) were used to determine lowest toxicity values for warmwater fish. Data for the cladoceran Daphnia or amphipod Gammarus were used to determine lowest toxicity values for the invertebrates. These organisms were chosen for two reasons: (1) their ranges include areas in Region 6 and (2) they are used extensively in acute and chronic toxicity testing. Concentrations of 150-300 mg/l as $CaCO_3$ were considered hard and concentrations <75 mg/l as $CaCO_3$ were considered soft ("Red Book," July 1976). Other concentrations, >300 mg/l and 75-100 mg/l as $CaCO_3$, were not included on the tables because little toxicity data is available at these hardness values.

For additional information contact Jim Lazorchak or Anna Crothers at U.S. Environmental Protection Agency, Region 6 (6W-PS), 1201 Elm St., Dallas, Texas 75270.

SUGGESTED MATERIALS AND METHODS REFERENCES

Interstitial and Elutriate Sampling and Analysis

1. Glass, G.E., "A Study of Western Lake Superior: Surface Sediments, Interstitial Water and Exchange of Dissolved Components Across the Water - Sediment Interface," U.S. Environmental Protection Agency, National Water Quality Laboratory, Duluth, Minnesota. 1973.

2. Environmental Effects Laboratory, "Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Waters," Miscellaneous Paper D-76-17, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss. 1976.

3. Brannon, J.M., et al., "Selective Analytical Partitioning of Sediments to Evaluate Potential Mobility of Chemical Constituents During Dredging and Disposal Operations," Technical Report D-76-7, Environmental Laboratory. 1976.

Water Analysis - Interstitial and Elutriate Waters and Water Column.

1. U.S. Environmental Protection Agency, "Methods of Chemical Analysis of Water and Wastes," EPA-600/4-79-020, Office of Research and Development, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. 1979.

2. U.S. Environmental Protection Agency, "Analysis of Pesticide Residues in Human and Environmental Samples," Environmental Toxicology Division, Health Effects Research Laboratory, Research Triangle Park, N.C. 1977.

3. Sherman, J., "Manual of Analytical Quality Control for Pesticides and Related Compounds in Human and Environmental Samples," EPA-600/1-79-008, Office of Research and Development, Health Effects Research Laboratory, Research Triangle Park, N.C. 1979.

TOXIC CRITERIA AND ALERT LEVELS FOR METALS IN FRESHWATER & SEDIMENTS

NEW EPA CRITERIA
FOR FRESHWATER (ug/l)

Parameter	Detection Limit (ug/l)	24-Hour Average	Maximum Level	Red Book Criteria Maximum Level (ug/l) Soft	Hard	USGS Alert Levels for Water (ug/l)	FDA Action Levels (ug/Kg) F/S Tissue*	USGS Alert Levels in Sediments (ug/Kg)	Proposed Guidelines for Dredge Sediments Disposal (ug/Kg)	Region 6 Alert Levels for Sediment (ug/l) Interstitial/Elutriate
Antimony	--	--	--	N/A		50	--	500,000	--	--
Arsenic	2	--	440(As^{+3})	(50)		50	--	200,000	5,000	440(As^{+3})
Barium	30	--	--	(1,000)		1000	--	2,000,000	--	--
Beryllium	5	--	--	11	1,100	11	--	200,000	--	--
Boron	100	--	--	(750)		1000	--	--	--	--
Cadmium	2.0	$e^{\dagger 1}$	$e^{\dagger 2}$	N/A		10	--	20,000	2,000	24 hr. avg.
Chromium	20	(III) -- (VI) 0.29	$e^{\dagger 3}$ 21	N/A		50(t)	--	200,000(t)	100,000(t)	Max. level 0.29
Copper	10	5.6	$e^{\dagger 4}$	N/A		1000	--	2,000,000	50,000	5.6
Cyanide $^{\dagger 11}$	20	3.5	52	N/A		.02 dissolv.	--	100,000	--	3.5
Iron	20	--	--	(1,000)		1000 dissolv.	--	--	--	--
Lead	50	$e^{\dagger 5}$	$e^{\dagger 6}$	N/A		200	--	500,000	50,000	24 hr. avg.
Manganese	10	--	--	(50)		200 dissolv.	--	--	--	--
Mercury	.2	.00057	.0017	N/A		2.0	1,000	20,000	1,000	.00057
Nickel	20	$e^{\dagger 7}$	$e^{\dagger 8}$	N/A		100	--	2,000,000	50,000	24 hr. avg.
Selenium	2.0	35***	260***	N/A		10	--	20,000	--	35***
Silver	10	--	$e^{\dagger 9}$	(.01x96 hr. LC50)		50	--	1,000,000	--	Max. level
Thallium	--	--	--	--		--	--	--	--	--
Zinc	5.0	47	$e^{\dagger 10}$	N/A		5000	--	5,000,000	75,000	47

* F/S Tissue = Fish/Shellfish Tissue
*** As inorganic selenite
(t) = total chromium

†1 = (1.05 ln (hd)-8.53)
†2 = (1.05 ln (hd)-3.73)
†3 = (1.08 ln (hd)+3.48)
†4 = (0.94 ln (hd)-1.23)
†5 = (2.35 ln (hd)-9.48)
†6 = (1.22 ln (hd)-0.47)
†7 = (0.76 ln (hd)+1.06)
†8 = (0.76 ln (hd)+4.02)
†9 = (1.72 ln (hd)-6.52)
†10 = (0.83 ln (hd)+1.95)
†11 = expressed as free cyanide (CN) HCN + CN

e = Base of natural logarithm (2.71828)
ln = natural logarithm
(hd) = hardness

TOXIC CRITERIA AND ALERT LEVELS FOR PESTICIDES IN FRESHWATER AND SEDIMENTS

Parameter	Detection Limit (ug/l)	NEW EPA CRITERIA FOR FRESHWATER (ug/l) 24-Hour Average	Maximum Level	Red Book Criteria Maximum Level (ug/l)	USGS Alert Levels for Water (ug/l)	FDA Action Levels (ug/Kg) F/S Tissue	USGS Alert Levels in Sediments (ug/Kg)	Region 6 Alert Levels for Sediments (ug/l) Interstitial/Elutriate
Aldrin	.001-1	--	3.0	.003*	.01	300	20	3.0
Chlordane	.001-1	.0043	2.4	N/A	.01	--	20	.0043
Chlorophenoxy Herbicides								
2, 4-D	1	N/A	N/A	100	100	--	20	--
2, 4, 5-T								
2, 4, 5-TP (Silvex)	1	N/A	N/A	10	10	--	20	--
DDT	.001-1	.0010	1.1	N/A	.10	5000	20	.0010
Dementon	.001-1	N/A	N/A	.1	--	--	--	--
Dieldrin	.001-1	.0019	2.5	N/A	.01	300	20	.0019
Dioxin (2, 3, 7, 8-TCDD)				N/A	N/A	--	--	***
Endosulfan	.001-1.0	.056	.22	N/A	.01	--	--	.056
Endrin	1.0	.0023	.18	N/A	.01	300	20	.0023
Guthion	1.0	N/A	N/A	.01	--	--	--	--
Heptachlor	1.0	.0038	.52	N/A	.01	300	20	.0038
Heptachlor Epoxide	1.0	N/A	N/A	N/A	.01	300	20	.005
Kepone	--	N/A	N/A	N/A	N/A	300	--	--
Lindane	1.0	0.08	2.0	N/A	.01	--	20	0.08
Malathion	1.0	N/A	N/A	.1	.1	--	20	--
Methoxychlor	.001-1	N/A	N/A	.03	.03	--	20	--
Mirex	.001-1	N/A	N/A	.001	.01	100	20	--
Parathion	.001-1	N/A	N/A	.04	.04	--	20	--
Toxaphene	.001-1	.013	1.6	N/A	1.0	5000	20	.013

*Listed as aldrin/dieldrin
**F/S Tissue = Fish/Shellfish Tissue
***A value has not been developed for Dioxin at the present time. However, a criterion will be finalized in the near future.

TOXIC CRITERIA AND ALERT LEVELS FOR MISCELLANEOUS POLLUTANTS IN FRESHWATER AND SEDIMENTS

Parameter	Detection Limit (ug/l)	NEW EPA CRITERIA FOR FRESHWATER (ug/l) 24 Hour Average (ug/l)	Maximum Level (ug/l)	Red Book Criteria (ug/l)	USGS Alert Levels in Water (ug/l)	FDA Action Levels (ug/Kg) F/S Tissue	USGS Alert Levels (ug/Kg) Sediments	Proposed Region 6 Alert Levels for Sediment (ug/l) Interstitial/Elutriate
PCBs	.1.-1.0	.014	--	.001	.1	5,000	20	.014
Phenol	5.0	--	--	1.0	5	--	--	1.0
Nitrate as N	40	N/A	N/A	10,000	10,000	--	--	10,000
Ammonia as Unionized	--	N/A	N/A	20				--
Total Phosphorus	10	N/A	N/A	25 (lakes or reservoirs)		--	--	25
				50 (streams entering reservoirs		--	--	50
				100 (streams)		--	--	100
$NO_2 + NO_3$	--	N/A	N/A	N/A	10,000	--	10	10,000
NO_2 as N^3	--	N/A	N/A	N/A	1,000	--	1	1,000

F/S Tissue = Fish/Shellfish Tissue

LOWEST ACUTE AND CHRONIC VALUES FOR METALS IN FRESHWATER

PARAMETER	ACUTE VALUES (ug/l)					CHRONIC VALUES (ug/l)				
	WARMWATER FISH		INVERTEBRATES		FRESHWATER AQUATIC LIFE	WARMWATER FISH		INVERTEBRATES		FRESHWATER AQUATIC LIFE
	HARD	SOFT	HARD	SOFT		HARD	SOFT	HARD	SOFT	
Antimony	(22,000)		(9,000)		9,000	(7.5 using trioxide)*		(5,400)		1,600
(+3)	(15,370)		(812)		(40)	(690)		(912)		--
Arsenic										
(+5)	--		(7,400)		--	--		--		--
Barium										
Beryllium	12,000	150	2,500	--	130	--	--	5.3	--	5.3
Boron										
Cadmium	2,000	520, 630	49	3.5	--	46	--	0.44	0.15	--
(+3)	27,000	5,070	51,400	2,000	--	1,020	--	66	445	44
Chromium										
(+6)	26,000	17,600	67	22	--	1,990	368*	(10)		--
Copper	430	23	25, 27.3	5,724	--	21.9	14, 9.3*	9.5	6.1	--
Cyanide	(74)		(83)		--	(14)		(18)		--
Iron										
Lead	442,000**	2,400	1,910	124	--	--	46*, 92	128	12	--
Manganese										
Mercury	(150)		(5)		--	--	--	(1.27)		--
Methyl Mercury	--		(150)		--	--	--	(1.0)		--
Nickel	25,000	2,916	2,409	510	--	527	109*	354	14.8	--
(+4)	(1,620)		(430)		--	(113)		(92)		--
Selenium										
(+6)	(11,000)		--		760	(2,000)***		--		--
Silver	4.8	3.9	45	0.39	--	--	--	5.2	2.6	0.12
Thallium	(860)		(2,180)		1,400	(<20)*		--	--	40
Zinc	2,610	600	655	40	--	--	106	47	84.5	--

* E-L = embryo-larval test; all others are life cycle

** Very hard water (>300 mg/l as $CaCO_3$)

*** 48-day LC50

( ) Indicates no hardness data available on test solutions

LOWEST ACUTE & CHRONIC VALUES FOR PESTICIDES IN FRESHWATER

PARAMETER	ACUTE VALUES (ug/l) WARMWATER FISH	ACUTE VALUES (ug/l) INVERTEBRATES	ACUTE VALUES (ug/l) FRESHWATER AQUATIC LIFE	CHRONIC VALUES (ug/l) WARMWATER FISH	CHRONIC VALUES (ug/l) INVERTEBRATES	CHRONIC VALUES (ug/l) FRESHWATER AQUATIC LIFE
Aldrin/Dieldrin	Dieldrin 9.0 Aldrin 4.6	Dieldrin 130 Aldrin 28	--	--	Dieldrin 57 --	--
Chlordane	22.0	26	--	1.6	16.2	--
Chlorophenoxy Herbicides						
2, 4, D	--	--	--	--	--	--
2, 4, 5, T	--	--	--	--	--	--
Silvex (2, 4, 5 TP)	--	--	--	--	--	--
DDT	1.2	.36	--	0.74	--	--
Demeton**	70.0	27.0	--	--	--	--
Dioxin (2, 3, 7, 8 TCDD)	0.0	0.0	.000056	--	--	--
Endosulfan	.29	5.8	--	0.28	4.3	--
Endrin	0.26	1.3	--	0.187	--	--
Guthion**	4.0	0.10	--	0.7	--	--
Heptachlor	26.0	29.0	--	1.26	--	--
Heptachlor epoxide	26.0	29.0	--	1.26	--	--
Kepone	--	--	--	--	--	--
Lindane***	2.0	1.0	--	>9.1 and <23.5	>4.3 and <8.6	--
Malathion	110.0	1.0	--	--	--	--
Methoxychlor**	7.5	.6	--	.125	--	--
Mirex	--	--	--	--	--	--
Parathion**	0.5	0.4	--	0.04	0.08	--
Toxaphene	2.4	6.0	--	0.037	0.09	--

** Values taken from "Red Book"

***Values taken from Macek et al., 1976. Chronic Toxicity of Lindane to Selected Aquatic Invertebrates and Fishes. Ecological Res. Series, No. EPA-600/3-76-046.

LOWEST ACUTE AND CHRONIC VALUES FOR PCBs AND PHENOLS IN FRESHWATER

	ACUTE VALUES (ug/l)			CHRONIC VALUES (ug/l)		
PARAMETER	WARMWATER FISH	INVERTEBRATES	FRESHWATER AQUATIC LIFE	WARMWATER FISH*	INVERTEBRATES	FRESHWATER AQUATIC LIFE
Phenol	(11,500)	(9,600)	(10,200)	2,560 (ELS)	(3,074)	(2,560)
PCBs						
Aroclor 1221	--	--	--	--	(105)	--
Aroclor 1232	--	--	--	--	(105)	--
Aroclor 1242	(15 newly hatched)	(10)	--	(9.0)	(4.9)	--
Aroclor 1248	(4.7) 30d LC50	(29)	--	(0.2)	(1.4),(3.3)	--
Aroclor 1254	(7.7) newly hatched	(2,400)	--	(2.9)	(0.73),(2.1)	--
Aroclor 1260	(3.3) 30d LC50	--	--	(2.3)	(27)	--
Aroclor 1262	--	--	--	--	(31)	--
Aroclor 1268	--	--	--	--	(182)	--

( ) Indicates no hardness data available on test solutions
*ELS = early life stage

U.S. ENVIRONMENTAL PROTECTION AGENCY

Region VII, Kansas City, Missouri

Sediment and associated nutrients have been identified as the major water quality problems in many water bodies in EPA Region VII.

In cooperation with other local, state and Federal agencies, EPA has instigated several projects to control sedimentation of lakes and streams.

IOWA

Green Valley Lake in Union County, Iowa, was rapidly catching sediment from the highly erodible loessial soils which make up its watershed. Most of the land within the watershed is rolling to steep and is used for the production of corn and soybeans. Annual soil erosion rates range from three or four tons per acre to 30 tons or more depending on conservation measures being applied and slope of the land.

EPA, the Iowa Conservation Commission, the Iowa Department of Soil Conservation, the Union County Soil Conservation District, and Soil Conservation Service (SCS) and Agricultural Stabilization and Conservation Service (ASCS) joined forces to attack the problems. The project began in 1980, and is expected to reduce sediment and phosphorus delivery to the Lake by 70% within five years. Section 314 funds are being used for cost sharing land treatment practices in the watershed as well as for in-lake restoration measures such as dredging, which are being delayed until sediment sources are controlled.

KANSAS

Sediment delivery to the Wakarusa River, its tributaties and ultimately to Clinton Reservoir is being attacked by several cooperating agencies via the Upper Wakarusa Experimental Rural Clean Water Project in Wabaunsee, Shawnee and Osage Counties, Kansas. ASCS, SCS, Cooperative Extension Service, EPA, the three affected Soil Conservation Districts, Kansas Department of Health and Environment and the Kansas Fish and Game Commission have jointly undertaken to apply best management practices (BMP's) on critical areas within the watershed to control sediment and other non-point source pollutants. Sedimentation of streams and lakes is expected to be reduced by 55% within ten years.

NEBRASKA

In 1978, EPA, ASCS, SCS, the Nebraska Department of Environmental Control, Lower Elkhorn Natural Resource District, University of Nebraska, and USDA-Science and Education Administration (SEA) teamed up to test institutional arrangements and the effectiveness of selected BMP's in control of agricultural non-point source pollutants, principally sediment.

The project area selected for this Mode Implementation Project (MIP) was Upper Maple Creek watershed near Clarkson, Nebraska.

Institutional arrangements involving Federal, state and local agencies were worked out early in the project. The high degree of success in the project already clearly shows that local, state, and Federal agencies can work well together to solve problems of mutual concern.

Installation of BMP's is progressing significantly faster than was originally anticipated since one of the criteria on which the project was selected was the low level of participation by local farmers in existing soil conservation programs.

Evaluation of the BMP's effectiveness is inconclusive to date. Continued efforts will be needed.

MISSOURI

During the 208 planning process in Missouri, the Salt River Basin was selected as one of the highest priority watersheds in the state. Primary agricultural non-point source pollutants identified were sediment and associated nutrients, chiefly phosphorus.

Missouri Department of Natural Resources (MDNR), ASCS, SCS and EPA cooperatively undertook a special project on the Middle Fork of Salt River watershed in Monroe County. Land treatment cost shares are being provided from ASCS's Agricultural Conservation Program (ACP). Technical Assistance is provided by SCS through the Monroe County Soil Conservation District. EPA and MDNR are cooperatively evaluating water quality impacts of the project. Diminution of sediment delivery to streams and to the Clarence Cannon Reservoir is expected to be the primary water quality benefit of the project.

For additional information contact Mr. Lee Duvall, Acting Chief, Water Quality Planning Branch, Region VII, 324 East 11th Street, Kansas City, Missouri 64106.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Region VIII, Denver, Colorado

1. Agricultural Nonpoint Source Monitoring and Evaluation in Snake Creek watershed, Utah

A Section 208 grant is being used to support monitoring and evaluation of agricultural best management practices in the Snake Creek watershed of Wasatch County, Utah. A municipal water supply is adversely affected by bacteria, nutrients, and sediment from upstream dairies and irrigated agricultural areas. Best Management Practices are being implemented as part of the Snake Creek Rural Clean Water Project, and should be completed in 1982. For additional information contact Bruce Lindahl, 8W-PM, EPA Region VIII, 1860 Lincoln St., Denver, Colorado 80295.

2. Agricultural Nonpoint Source Control Projects in Montana

Section 208 grants are being used to support monitoring and evaluation of agricultural best management practices in the Muddy Creek and Bluewater Creek watersheds of Teton and Cascade counties and Carbon County, Montana. Both watersheds have irrigated crop land that produces large volumes of irrigation return flows and system spillage. These seasonal flows induce high streambank erosion downstream. Irrigation system improvements are being carried out with funds from ACP, the Old West Regional Commission, and the State Stream Preservation Fund, and other support has been obtained from Water and Power Resources Service, Soil Conservation Service, and the Cooperative Extension Service. For additional information contact Robert Fox, EPA, Federal Office Building, Drawer 10096, 301 S. Park, Helena, Montana 59626.

3. Agricultural Nonpoint Source Control Projects in North Dakota

Section 208 grants support monitoring and evaluation and watershed coordination for implementation of agricultural best management practices in the following watersheds: Spiritwood Lake (Stutsman County), Sweetbriar Lake (Morton County), Brewer Lake (Cass County), and Edmore Coulee of Devil's Lake (Ramsey County). Sediment and associated nutrients are primarily from non-irrigated crop land where fall plowing and summer fallow are common practices. Special ACP and State Fish and Game funds are being used to implement BMP's such as conservation tillage, protective winter cover, and animal waste management systems. A Section 208 grant is also supporting a Cooperative Extension Service study of sediment/nutrient yields and crop yields under no till agriculture in five counties: Benson, Bottineau, McLean, Ransom, and Williams. Special ACP funds are used to cost-share no till equipment rental on some 5900 acres. For additional information contact David Shanks, 8W-PM, EPA Region VIII, 1860 Lincoln St., Denver, Colorado 80295.

4. Agricultural Nonpoint Source Control Projects in South Dakota

Section 208 grants support monitoring and evaluation and watershed coordination for implementation of best management practices in the following watersheds: Lake Herman (Lake County), Mina Lake (Edmunds, Brown, McPherson Counties), Pierre Creek-Lake Hanson, Wall Lake (Minnehaha County), Oakwood-Pointsett Lakes (Brookings, Codington, Hamlin, Kingsbury Counties), Lake Kampeska (Codington County), and Pickeral Lake (Day County). Sediment and nutrients cause widespread lake eutrophication and filling, and come primarily from non-irrigated crop land and livestock concentrations. Special ACP funds are targeted to certain lake watersheds, along with regular ACP and Great Plains Conservation Program funds for such BMP's as grassed waterways, conservation tillage, and terraces. Sediment/nutrient control structures have been funded in part by Clean Lakes Program grants. Monitoring results are furthest along in the Lake Herman watershed, where BMP installation is nearly complete. For additional information contact David Shanks, 8W-PM, EPA Region VIII, 1860 Lincoln St., Denver, Colorado 80295.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Region IX, San Francisco, CA.

1. Erosion Control Training Program: As a result of the 208 Grants Program, the Santa Cruz County Resource Conservation District (RCD), in cooperation with the Soil Conservation Service, has developed a highly successful erosion control training program in the Association of Monterey Bay Area Governments (AMBAG) designed 208 planning area. The purpose of the program is to provide training to persons implementing erosion and control practices. Each participant who pases an optional written exam and agrees to comply with a code of ethics is eligible to have their name included on a register of successful course graduates. The demand for this erosion control training program has become so great in Santa Cruz County (classes are filled months in advance) that the course is now being offered in the local community college. Training sessions have been covered by the local and national media, and other Resource Conservation Districts are planning on sponsoring similar courses modeled after the Santa Cruz County Program. Additionally, in August 1981 the Santa Cruz County RCD will offer an Advanced Erosion Control Training Course. The County of Santa Cruz has indicated that it will recognize the advanced - course graduates as qualified preparers of erosion control plans. In response to local, national and international interest in designing similar training programs, the RCD prepared a document entitled "How to Develop an Erosion Training and Registration Program." Further erosion control information and copies of the above referenced document may be obtained by contacting: District Conservationist, Santa Cruz County RCD, P.O. Box 263, Soquel, California, 95073, (408) 477-1303.

2. Erosion Control Ordinance No. 2982: Passed and adopted in September 1980, this ordinance amended the Santa Cruz County Code on Erosion Control. It requires control of all existing and potential conditions of accelerated (human-induced) erosion and provides for project planning, preparation of erosion control plans, runoff control, land clearing, and winter operations as well as for thier administration.

3. Soil & Water Conservation Program: AMBAG coordinated a program to encourage local farmers to implement soil and water conservation practices. With the help of the project, Monterey Bay farmers invested over $250,000 in farming methods designed to decrease soil erosion and conserve water. A $40,000 water recovery system that diverts irrigation runoff into a holding pond where sediment settles out, then recycles the water into the farm's irrigation networks was so successful that a neighboring RCD has cooperated to expand the program.

4. Erosion Control Study: AMBAG's 208 funded Erosion Control study identified water quality problems due to sediments, identified sources of erosion, found existing control programs inadequate and recommended certain remedial measures to the Regional Board. In October 1980, the Board passed resolution No. 79-09 and adopted an ordinance that is enforcing the mitigation of ongoing development impacts and is repairing existing erosion problems around the county.

5. Erosion Repaire Identification: Monterey County has completed a problem identification and plan development report for numerous erosion repair projects throughout the County. More than $250,000 has already been spent on repair projects in the San Miguel District alone. The County is currently conducting an inventory and planning for the second of five districts.

6. Restoration of Lake Temescal: Lake Temescal in Oakland, California was built as a reservoir for drinking water in the late 1980's and in some spots measures nearly 80 feet deep. However, after decades of housing and road construction in the hills above, this favorite "swimming hole" (which attracts more than a half million bathers each year), had become so shallow it averaged only 5 feet deep. Via the Clean Lakes Program, the Environmental Protection Agency, Region IX has awarded over $375,000 to the East Bay Regional Parks District for the restoration of Lake Temescal. The work undertaken has included dredging the lake of sediment and debris (mainly from construction caused erosion) and a new holding pond was constructed which is successfully absorbing much of the runoff sediment. However, as streets and homes go higher into the Oakland hills, the potential for erosion continues. In response to the lack of public awareness about the problems, the Park District has published erosion control pamphlets which are being actively distributed to contractors, active construction sites and residents in the lake watershed. In February of this year, the Park District met with the City of Oakland and contractors of a large construction project in the impact area to discuss site-specific methods in implementing erosion control techniques. An erosion control plan was subsequently adopted and is currently being implemented. Further, this meeting brought to the attention of the inspectors the necessity to continually monitor building sites even though an erosion control plan has been adopted; adequate assessment of the contractor's ongoing implementation efforts can then be made. Fortunately, today's lake restoration and erosion control efforts will see Lake Temescal swell with swimmers during the coming summer days and for many more summers thereafter. For additional information, contact East Bay Regional Park District, 11500 Skyline Blvd., Oakland, California 94619, (415) 531-9300.

7. California State Assistance Program (SAP): The Clean Water and Water Conservation Bond Law of 1978 (Proposition 2) contained pro-

visions for the expenditure of $50 million to fund water pollution control, water conservation and wastewater reclanation needs in California. The State Water Resources Control Board designated this as the State Assistance Program (SAP). It was the State Board's intention to use these funds for essential projects for which normal funding sources (Federal, State, or local) were unavailable or inadequate. Each project was evaluated on its individual mertis and the degree of local financial support was a deciding factor in the State Board's approval of the project. No funds were allocated for "pure" planning studies or for project operation and maintenance. One half of the SAP grant dollars will fund projects that were identified in EPA financed 208 plans; total capital expenditures of over $39 million to implement programs that have the potential to substantially benefit water quality. Descriptions of a few of the SAP projects are outlined below (a, b, c, d). For additional information on SAP, contact State Assistance Program Manager, State Water Resources Control Board, P.O. Box 100, Sacramento, California 95801, (916) 914-2454.

a. Desilting System and Appurtenant Works - San Diego Creek: This proect will provide for the construction of a "desiltation system" to aid in the preservaion of Upper Newport Bay State Ecological Reserve. The system will be an element of a larger program that will include BMPs, and desiltation of San Diego Creek. The main problem is caused by sedimentation which results in a loss of the tidal prism in the Upper Bay. The Bay is on the Pacific flyway and is an important habitat for numerous varieties of birds, including rare and endangered species. The primary benefits of the project will be to enhance the ecological reserve. The project will also enhance beneficial uses in the lower bay.

b. Spanish Grant Drainage District and Crow Creek Watershed: BMPs, as described in the 208 Plan, will be applied in the Spanish Grant Drainage District and Crow Creek Watershed (6,960 acres) to reduce suspended solids in drain water (discharged to the San Joaquin River) from 1,500 mg/l to 300 mg/l or less and to conserve irrigation water. Project results will be applicable to other areas. Benefits include reduced sediment and toxics in the San Joaquin River and water conservation. Operation and maintenance will become the responsibility of individual property owners.

c. Gloria Resource Conservation District (RCD) Clean Water Program: Sediment, fertilizers and pecticides from cropland, rangeland and urban development affect the San Antonio Reservoir and approximatly 100 miles of the Salinas River including the Salinas groundwater basin, the Salinas River estuary and Monterey Bay. The groundwater basin is utilized by 125,000 people as a primary source of water. The sediment deposited in the Salinas River inhibits recharge in the groundwatr basin.

The sediment, fertilizers and pecticides adversely affect the quality of the river, estuary and bay. Beneficial uses adversely affected by this degradation of water quality are municipal, agricultural and industrial water supply; fish and wildlife habitat; groundwater recharge; and recreation. Water quality objectives not being met at some point in the watershed include total dissolved salts of chlorides, sulfates, boron, sodium, and nitrogen. This project wil assist the RCD and property owners in implementing a wide variety of BMPs on approximately 144,000 acres within the watershed over a 10-year period. Typical BMPs are buffer strips, contour grading, seeding bare areas, channel stabilization and water management. Project benefits are expected to reduce sedimentation in surface waters, annual energy savings of 14,000 bbl. of oil and 165 million ft^3 of natural gas, water conservation, and fuller realization of impaired beneficial uses. The RCD applied for a Rural Clean Water grant for the 10-year project (total cost: $3,860,880). The project was not high enough on USDA's priority list to receive a grant this year, but will be considered in future years. USDA has indicated that State participation in this project will enhance changes of future Federal funding. Property owners are prepared to pay approximately 50 percent of the project cost ($11/acre) with the remaining 50 percent coming from other sources.

d. Lake Tahoe Remedial Erosion and Urban Runoff Control Projects: The Lake Tahoe Draft 208 Plan describes actions that must be taken to protect the extraordinary water quality in Lake Tahoe. This grant, compled with other matching sources of funds (i.e., EPA recently awarded a Clean Lakes Grant to the SW&CE for $946,934) will provide control on 90 percent of all pollulant loads that can be controlled by remedial measures.

For additional information on activities in Region IX, contact Lauren Volpiel, USEPA, Region IX, 215 Fremont Street, San Francisco, California 94105.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Environmental Monitoring and Support Laboratory, Cincinnati

Cincinnati, OH. The Quality Assurance Branch of EMSL-Cincinnati has prepared natural sediment samples containing Aroclor 1242 and/or 1254, at three different levels. The sediments were collected from naturally-polluted environments. then screened, blended, ground and freeze-dried for stability and homogeneity. The samples are provided with instructions and reference values for use in intralaboratory quality control programs. The sediments are available on written request from the Quality Assurance Branch, EMSL-Cincinnati, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Corvallis Environmental Research Laboratory

A Streams Systems Evaluation - An Emphasis on Spawning Habitat for Salmonids

This study was completed in October, 1979 and was published in No. EPA-600/3-79-109. Salmonid fishes spawn in streams, burying their eggs in gravel beds and leaving them unattended during incubation. During the development period, which lasts several weeks, the embryos and larval fish are very susceptible to sedimentation which clogs interstitial spaces and reduces water circulation in the gravel. This study examined the cause and effect relationship between sedimentation and survival of salmonid larvae to the time when they emerge into the overlaying water. A unifying substrate statistic, the geometric mean particle diameter (dg), was identified and used to develop a cause/effect curve from literature data relating survival to degree of sedimentation. Spawning gravel sampling procedures and a method for assessing localized and streamwide impacts are also described. For additional information contact Mostafa A. Shirazi, U.S. E.P.A., 200 SW 35th St., Corvallis, Oregon 97330.

Effects of Sediment - Trophic Interactions on Coldwater Stream Communities

This study is being conducted by Oregon State University (Norman H. Anderson, Principal Investigator) through a grant from the Corvallis Environmental Research Laboratory. Sediment may have differential effects on different functional components of stream ecosystems. Effects of sediment on invertebrate and vertebrate populations may depend on the trophic state of the system, a function of the relative inputs and retention of autochthonous and allochthonous food sources. The overall objective is to determine the mechanism by which trophic state and sediment interact to affect population growth and abundance and community organization. The data generated from this study will provide a basis for a more adequate evaluation of environmental degradation resulting from sedimentation in streams. The data will also permit an appraisal of the general effectiveness and limitation of assessment methodologies based on invertebrate communities. This project is in its third year and the final report is scheduled for September, 1981. For additional information contact the project officer, Kenneth W. Malueg, U.S. E.P.A., 200 SW 35th St., Corvallis, Oregon 97330.

Effects of Suspended Solids and Sediment on Reproduction and Early Life of Warmwater Fishes - A Review

This study was conducted by Iowa State University (Robert J. Muncy, Principal Investigator) under the sponsorship of the Corvallis Environmental Research Laboratory and was published in EPA-600/3-79-042. The relationship between specific kinds and quantities of suspended solids or sediments and biological effects such as egg or larval mortality has been described for only a few warmwater fishes of North America. Searches of the literature base generally revealed laboratory and tank studies during the 1930-40's, limited field studies and speculation on the ecological effects of turbidity on fish populations in the 1950-60's, and laboratory bioassays and field studies in 1970's as the result of renewed interest in the effects of dredging, shoreline erosion, quarrying, and stream alteration. Although unequivocal experimental evidence demonstrating causal relationship between suspended solids and sediment on reproduction of warmwater fishes is scarce, generalizations from an overwhelming body of independent observations suggest that most warmwater fish assemblages have been affected and species

composition altered because of sediment effects on the more sensitive species. Aquatic communities in total; plankton, macroinvertebrates, as well as fish; have been altered. Populations and communities have been seriously affected and species diversity diminished. Overall faunal impoverishment has taken place, contributing to the expanding lists of endangered and threatened fauna and flora. For additional information contact the project officer, Jack F. Gakstatter, U.S. E.P.A., 200 S.W. 35th St., Corvallis, Oregon 97330.

Determine Extent to Which Toxics Transported and/or Accumulated by Sediment Impact Freshwater Lake Ecosystems

The purpose of this CERL inhouse project is to determine the extent to which sedimented toxic substances occur in freshwater lakes at concentrations lethal or inhibitory to functional processes of various trophic levels of aquatic organisms. This will be accomplished through the use of a sediment bioassay procedure and an assessment of the bioaccumulation potential of substances suspected of contributing to organism mortality. A Prater type bioassay apparatus is being used as a test chamber. Daphnia magna, a water flea, and Hexagenia, a burrowing mayfly, are presently being used as test organisms. In addition, Selenastrum (an alga) assays are being performed using the Standard Algal Assay Procedure on water removed from the Prater type apparatus. Final selection of test organisms has not been made. Sediment chemistry will include selected physical and chemical parameters. Emphasis will be placed on priority pollutants. This project will begin at a pilot scale with the collection of sediment samples from five to ten midwestern urban lakes in the spring of 1981. Depending upon the results of the pilot-scale operation, the project may be expanded. For additional information, contact Kenneth W. Malueg, U.S. E.P.A., 200 S.W. 35th St., Corvallis, Oregon 97330.

Development of Bioassay Techniques to be Used for Assessing Effects of Toxicants on Sediment-Dwelling Organisms

A cooperative agreement between the Corvallis Environmental Research Laboratory and the Department of Water Science and Engineering, University of California at Davis (Dr. A.W. Knight) is in progress to develop new freshwater sediment bioassay test methods with invertebrate animals, to refine and finalize proposed methods, and to conduct validation tests with significant energy-related toxic chemicals. This project is in direct response to the Agency's request for new invertebrate methods for screening toxic materials in sediments. A standardized method will be developed and validated and made available for routine use. Tests are currently underway with a Chironomid, the clam Corbicula, and Gammarus, with other invertebrate species under consideration. These are animals which ingest detritus and substrate particles, live in intimate contact with the snostrate, and may be sensitive to toxic materials. For additional information, contact Dr. Alan Nebeker, Freshwater Division, CERL, Corvallis, Oregon 97330 (503-757-4875).

U. S. ENVIRONMENTAL PROTECTION AGENCY

Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma

1. On-Farm Improvements to Reduce Sediment and Nutrients in Irrigation Return Flow

This research is being conducted within the Quincy Columbia Basin Irrigation District on the Royal Slope near Royal City west of Othello, Washington, by agricultural engineering research staff of the Washington State University. The primary objective of this research is to assist in developing and implementing a program for reducing the negative impacts of irrigation return flow on water quality. It is recognized that reduction of pollution from these sources is most effectively achieved by improving water management and cultural practices on individual farms. The project will provide a framework for implementation of improved management practices for irrigated agriculture to control sediment and nutrient pollution in return flows. Technical assistance and capital improvements will be utilized to effect the changes in farming practices. The reduction in pollutants will be quantified and evaluated on a cost-effective basis. Information dissemination to the agricultural community will be stressed. For additional information, contact Dr. James P. Law, Jr., EPA, Box 1198, Ada, OK, 74820, telephone (405) 332-8800 or FTS 743-2300.

2. Model Implementation Program - Monitoring

In September, 1977, USDA and EPA entered into an agreement to cooperate in the application of best management practices in order to show how the nonpoint sources portion of water quality management plans can be implemented. The joint effort, called the Model Implementation Program (MIP), began by the designation of seven areas where MIP plans were approved and implemented. One of these was in the Sulphur Creek drainage basin in Yakima County, Washington. This research project is conducted by the Environmental Quality Section of the Washington Department of Ecology and was designed to: (1) determine the extent and design of monitoring system needed to relate in-stream water quality to the quality of on-farm irrigation return flows; (2) determine whether completion of farm management agreements result in improved water quality; and (3) determine the correlation between total sediment concentration and settleable solids concentration determined with the Imhoff cone. The results of this study will be utilized for measuring progress in implementation of sediment control plans. For additional information, contact Dr. James P. Law, Jr., EPA, Box 1198, Ada, OK, 74820, telephone (405) 332-8800 or FTS 743-2300.

FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) concentrated its activities on five major areas: control of culvert outlet erosion, control of local scour around bridge piers, control of stream instability at highway crossings, 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 (HP&R) and in the National Cooperative Highway Research Program (NCHRP).

Control of Culvert Outlet Erosion - The objectives of these studies are to investigate the various flow conditions and the forces involved at the outlet area, the material necessary to resist the erosion, and the special design of energy dissipators and stilling basins to control the erosion.

A. The University of Akron completed the study, sponsored under the HP&R program by the Ohio Department of Transportation (ODOT), on "Field and Laboratory Evaluation of Energy Dissipators for Culvert and Storm Drain Outlets." This study is directed toward two dissipator concepts that can be precast for culvert installations that do not require field concrete work. One is the modular basin which can be precast in components and assembled in the field by a maintenance crew; the other is the concrete pipe roughness ring which can also be precast and bolted into regular culvert sections. Another important aspect for this study is the evaluation of the ODOT procedures for providing channel protection for culvert outlets that do not require dissipators. The evaluation focuses on the so-called "Cincinnati Method" for designing rip-rap protection and will involve some 400 field sites. Draft final reports were reviewed. The final reports will be published in 1981.

B. Colorado State University continued the study, sponsored by FHWA, to investigate scour at culvert outlets in various bed materials. The study includes four bed materials; a uniform sand, a uniform gravel, a sand-gravel mixture, and a sand-silt-clay mixture. The study includes tests with various culvert diameters ranging from 4 to 15 inches to test the adequacy of modeling assumptions in developing design guidelines for much larger field installations. Most of the original tests were completed in 1979. The study was modified for additional tests to determine the effects of tailwater and to strengthen the relationship for part full culvert flow. Procedures for estimating culvert outlet scour in various bed material were developed in 1980.

Control of Local Scour Around Bridge Piers - The objectives of these studies are to investigate the mechanics of this dynamic process, the methods of accurate prediction of its magnitude, the adequate means of controlling its damaging effect to bridge piers, and the stream-related hazards to highways and bridge.

A. The contract study on the study of Scour Around Bridge Piers was completed by West Virginia University. The objectives of this study were to collect parameters which influence scour depth around bridge piers on rivers with noncohesive soils, and to test existing methods and/or to provide an improved method for predicting the scour depth. The researchers experimented with instrumentation and monitored three bridge sites in the

mid-continent--Shreveport (Louisiana), Homochitto (Mississippi), and Richmond (Texas)--for approximately 5 years. The portable, truck-mounted scour monitor was found very helpful as backup to the fixed monitors which had been used previously. The final report titled "Scour Around Bridge Piers," FHWA-RD-79-103, was published in 1980. It is available through NTIS, PB80195449.

B. Tye Engineering Inc. started a study, sponsored by FHWA, to deduce scour data from the Hydrologic Survey team records in Louisiana. The Hydrologic Survey team in Louisiana routinely monitors streambed cross sections at approximately 90 bridge sites. Their records provide a valuable source of field data for scour around bridge piers. The study was completed. The final report titled "Scour Around Bridge Piers - Field Data from Louisiana Files," FHWA-RD-79-105, was published in 1980. It is available through NTIS, PB80195613.

C. The Mississippi Highway Department Started a long range HP&R study to monitor scour around bridge piers at a Homochitto River crossing. The study has a secondary objective of evaluating equipment for monitoring scour in the field.

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, and to provide guidelines for measures to mitigate stream instability at highway stream crossings.

A . The U.S. Geological Survey completed a research study for FHWA titled "Stability of Relocated Stream Channels." This study evaluates the channel stability or erosion associated with stream relocations done for the purposes of highway construction. The results indicates; where the stream channel is generally stable before highway construction, relocation does not significantly change stream length or channel slope, and sufficient time allows vegetation to reestablish along the constructed bankline or countermeasures are incorporated, channel relocation is a viable alternative which will not result in stream damage. The final Report titled "Stability of Relocated Stream Channels," FHWA report number FHWA/RD-80/158 was published in 1980. In addition to the final report a slide tape presentation depicting the major aspects of the research is being developed.

B. An FHWA contract titled "Methods for Assessment of Stream-Related Hazards to Highways and Bridges" was completed by Colorado State University. The study resulted in a systematic evaluation approach for determination of hydraulical conditions at a stream crossing, giving consideration to the entire stream environment including its geology, geomorphology and land use on the flood plain. By using this approach, the hydraulic or bridge engineer is less likely to overlook a hydraulic problem and completed his site evaluation with greater ease and confidence. The research report which has the same title as the study and the report number FHWA/RD-80/160 was published in 1980. It is available through NTIS.

C. The Sutron Corporation completed the FHWA research study on "Stream Channel Degradation and Aggradation: Causes and Consequences to Bridges." The severity of degradation and aggradation nationwide and the factors associated with these processes are documented in an Interim report with the same title as the study, and numbered FHWA/RD-80/038. The final report focuses on methods for evaluating gradation changes, how aggradation or degradation affect highway design, and methods for protection against the effects of stream channel degradation or aggradation. The title of the final report is "Stream Channel Degradation and Aggradation: Analysis of Highway Impacts," Report number FHWA/RD-80/159. Both the interim and the final reports were published in 1980.

D. As a result of the "Countermeasures" study completed in 1978 protective measures were identified that could benefit from additional evaluation and laboratory testing. One of these protective measures was spur or dike constructed along stream banklines. Although spur have been applied nationwide there was no general guideline for their construction in application to protection of highway right-of-way. The Sutron Corporation in cooperation with the Pennsylvania State University are presently conducting an FHWA study titled "Flow Control Structures for Highway Stream Crossings." The research will evaluate present application of spur and conduct laboratory flume studies to refine design guidelines for use by highway engineers.

E. A key to the proper design of a highway crossing or utilization of protective measure is a clear understanding of stream stability. A stream classification scheme is provided in the FHWA research report titled "Countermeasures for Hydraulic Problems at Bridges" Report Number FHWA/RD-78/162. To make utilization of this stream classification scheme more readily usable by highway engineers the USGS is preparing a FHWA research report titled "Stream Channel Stability Evaluation for Highway Engineers." The report will identify in a step-by-step manner the operations necessary to make a good evaluation of stream stability and what this may mean in terms of highway design.

F. The USGS continued the FHWA study on "Roughness Coefficients in Vegetated Flood Plains." The study took advantage of data collected by completed HP&R studies in the Gulf Coast States of Louisiana, Mississippi, and Alabama. Detailed data will be used to field validate methods of roughness coefficient estimation which have been developed theoretically and only laboratory tested. The study will strive to attain quantitative methods that are relatively simple to apply and result in accurate estimates; at a minimum it will provide comparative methods that will make present estimates more consistent.

G. The University of Akron has completed an HP&R study for the Ohio Department of Transportation on "Roughness Characteristics of Rock Lined Channels." Based on approximately 100 field measurements, the investigators observed manning's "n" values that ranged from 0.021 to 0.098. They recommended maximum design values of 0.04 for riprap in large channels and of 0.06 for riprap in smaller channels. The draft final report was reviewed, and the final report will be published soon.

Control of Sediment Produced by Highway Construction - This problem consists of two stages: during construction and just after construction.

A. It is important that during the construction of highways, the sediment produced by roadway excavation and embankment construction must be controlled so it will not pollute the natural streams. Sponsored by the Pennsylvania Department of Transportation, the Pennsylvania State University and the U.S. Geological Survey completed the cooperative research study titled "Prediction of Sediment Flow from Proposed Highway Construction Sites." This study capitalizes on the extensive work of others by utilizing modified Universal Soils Loss Equation which has incorporated a factor for surface runoff. The study produced a computer program that can be accessed from any of the State's district offices and allows the engineer to try numerous sediment control methods mathematically before attempting to use any measures in the field. The final report was reviewed and approved. It will be published soon.

B. The U.S. Geological Survey Hawaii District, through the sponsorship of Hawaii Department of Transportation, continued its study on Rainfall-Runoff and Rainfall-Sedimentation Discharge Relations in Hawaiian-type Watersheds. The objective of this study is to determine the effects of highway construction on the rainfall-runoff and rainfall-sedimentation discharge relations of a watershed in Moanalua Valley, Oahu, considering all significant basin characteristics. The results obtained will be used as a basis for deriving similar relations for other basins in Hawaii. Data collection and analysis were continued in 1980. The draft final report was being prepared.

C. The Utah State University, under National Cooperative Highway Research Program administered by the Transportation Research Board, completed a 2-year study on Erosion Control During Highway Construction in FY 1977. The objective is to develop more effective techniques and materials to control erosion during highway construction activities. It consists of three major parts: to assess the effectiveness of methods presently being used throughout the United States, to develop a manual of recommended techniques and design criteria for the control of erosion, and to identify research needs. An experimental research study was also conducted in 1978 in the Utah Water Research Laboratory using a rainfall simulator and test bed to determine the validity of the Wischmeier's water-caused erosion equation on steep slopes, and to test the effectiveness of selected erosion control products. The final reports consists of three volumes: Volume I - a summary of the research, Volume II - an erosion control manual, and Volume III - bibliography. Volumes I and II were revised and published in 1980.

Israelsen, C. E., et al, "Erosion Control During Highway Construction - Research Report," NCHRP Report 220, Transportation Research Board, Washington, D.C., April 1980.

Israelsen, C. E., et al, "Erosion Control During Highway Construction - Manual on Principles and Practices," NCHRP Report 221, Transportation Research Board, Washington, D.C., April 1980.

D. Another NCHRP study which synthesized existing information on "Design of Sedimentation Basins" was completed by W. O. Ree of stillwater, Oklahoma. The final report with the same title as the study was published in June 1980 as a NCHRP Synthesis of Highway 70 by the Transportation Research Board, Washington, D.C.

E. The USGS, district office at Harrisburg, Pennsylvania, completed a research project titled, "Field Evaluation of Erosion Control Measures used in Highway Construction" under the HP&R program. The object of this study is to evaluate different types of erosion and sediment control measures to determine the ability of each measure to prohibit sediment from entering a stream system, and to determine if sediment concentrations and discharges return to their preconstruction levels onee the construction has ended. The study area consists of five basins. Sediment ponds built on and off streams, small rock dams, seeding, mulching, and erosion control measures used before the issuance of erosion-control guidelines were compared with the use of sediment and discharge measurements. Sediment load and turbidity were shown to be much higher in the drainage basin protected by the onstream ponds than that protected by offstream ponds. The final report will be published soon.

F. The Virginia Highway Research Council continued work on "Efficiency of Erosion Control Practices" for the Virginia Department of Highways and Transportation (VDHT) under the HP&R program. Current VDHT erosion and sediment control practices were evaluated. Optimum erosion and sediment control will be determined using the highest practical design and construction procedures and maintenance of control technology.

G. A case study under the HP&R program was continued by South Carolina Department of highways to determine the "Effects of Highway Construction on Stream Turbidity and Suspended Solids." Turbidity and suspended solids were monitored upstream and downstream of a highway project before, during, and after construction. These data will be evaluated with construction schedules and practices.

H. It is equally important that upon completion of highway construction, immediate and adequate protection against erosion be provided for slopes and other roadside areas affected by grading. In most regions of the country this has been accomplished with the establishment of proper management of vegetative cover. In 1980, 15 States were conducting studies designed to improve vegetation establishment techniques and subsequent management practices. The participating States were Alaska, Alabama, California, Georgia, Indiana, Louisiana, Maryland, Massachusetts, Minnesota, Montana, New Jersey, Rhode Island, Texas, Washington, and West Virginia. Hawaii and Wyoming completed their studies and published the final reports.

Ludeman, W., et al, "Wood Fiber Residues for Mulching Newly Constructed Roadsides in Wyoming," Wyoming Highway Department, Cheyenne, Wyoming 82001, September 1980.

Choy, G. C. P., et al, "Effective Methods of Establishing Vegetative Ground Covers for Highway in West Central Oahu," Hawaii Department of Transportation, Honolulu, Hawaii, February 1979.

Control of Highway Water Quality - The objectives of these studies are to monitor the highway water pollution parameters and to devise cost effective means to control them.

A. An FHWA study on pollutants in highway runoff was completed in 1979 by the Environmental Research Center of Rexnord, Milwaukee, Wisconsin 53214. For most study sites, more the 25 runoff events were monitored over a period of at least one year. The final report composed of six volumes will be published in 1981.

B. The FHWA research study on "Sources and Migration of Highway Runoff Pollutants," was continued by the Environmental Research Center of Rexnord, Milwaukee, Wisconsin 53214. Monitoring had been completed in Milwaukee, Wisconsin and Sacramento, California; and was underway in Harrisburg, Pennsylvania.

C. The third phase of FHWA's research on highway runoff quality was initiated in 1980 with the Engineering Research Center of Rexnord, Milwaukee, Wisconsin 53214. The objective of this study is to determine the impact of highway runoff on receiving waters.

D. The University of Arkansas completed the HP&R study on "The Effects of a Channel Relocation Project on the Ecosystem of Little Sugar Creek, Benton County, Arkansas" for the Arkansas State Highway and Transportation Department. This highway construction associated research evaluated the effects on aquatic populations, water quality, and other plant and animal communities. The final report was published in 1980.

Tyler, R. E., "The Effects of Channel Relocation on the Ecosystem of Little Sugar Creek, Benton County, Arkansas," Arkansas State Highway and Transportation Department, Little Rock, Arkansas 72203, 1979.

E. The California Department of Transportation continued the HP&R study on "Long Range Effects on Aquatic Ecosystems from Adjacent Highway Construction." This study investigates the effects on the aquatic environment from channel alterations resulting from highway construction on perennial streams and evaluates selected mitigation techniques employed to minimize these impacts.

F. The Pennsylvania State University, sponsored by the Pennsylvania Department of Transportation, continued the HP&R study on "The Impact of Stream Relocation of Fish Populations - Bull Creek." This research studies fish populations, bottom fauna, and water quality in Bull Creek before, during, and after stream relocation for construction of the Allegheny Valley Expressway.

G. The California Department of Transportation continued the HP&R study on "Modeling of Transportation Pavement Runoff." This study will use data developed on the completed California study "Water Pollution Aspect of Particles which Collect on Highway Surface."

H. The California Department of Transportation continued another HP&R study on "Mitigation of Highway Related Chemical Water Quality Pollutants." This study evaluates the effectiveness of three mitigation measures.

I. The University of Washington in Seattle continued the HP&R study on "Highway Stormwater Runoff Quality" sponsored by the Washington Department of Transportation.

If more information is desired about these research studies, inquiries should be addressed to the sponsoring agencies.

GEOLOGICAL SURVEY

NR80-107 Cumulative Impacts of Sediment Due to Coal Mining

WRD Project No: NR 80-107
Project Chief: Osterkamp, Waite R.
Headquarters Office: Reston, Virginia
Field Location: Topical Research

Problem: The acquisition and meaningful interpretation of sediment data is probably one of the most deficient areas spelled out in the regulations of Public Law 95-87, the "Surface Mining Control and Reclamation Act of 1977) (SMCRA). The act requires the acquisition of hydrologic information in mine-permit and adjacent areas as well as in the general area of mining where impacts may be cumulative. This information and data must be sufficient to allow an assessment to be made by the regulatory authority (Federal or State) of the probable cumulative impacts of all anticipated mining in the area upon the hydrology of the area. Increased sediment yields from refuse piles, haul roads and strip-mined and reclaimed areas is one of the largest problems being addressed in the regulations.

Objective: The project is designed (1) to predict the movement of sediment from drainage basins affected by surface coal mining, and (2) to assess existing techniques and develop new ones based on geomorphic principles and the application of statistics to the limited data avilable as aids in improving our interpretive capabilities.

Approach: Field investigations are being conducted to evaluate available techniques such as those used by the Department of Agriculture in predicting sediment yields. Of particular interest are the Universal Soil Loss Equation and modifications of it. Research is to be conducted to develop technology for determining (1) pre-mining sediment delivery ratio (proportion of gross erosion that appears as sediment yield at some point in the watershed) based on factors such as land use, contributing drainage area, runoff, basin morphology, and relief, (2) sediment yields during mining, which are influenced by sediment-control measures used during mining, and (3) sediment delivery ratio for the post-mining period. In cooperation with other agencies and field offices of the Geological Survey, available sediment and related hydrologic data are being acquired and interpreted to develop techniques and possibly models to aid in the prediction of sediment impacts from mining.

FY-1980 Progress: The project began in July 1980. Initial progress was confined to planning, literature and basic hydrologic data review, and reconnaissance field investigations. Previously acquired data were used to develop approaches of investigation.

FY-1981 Plans: Preliminary investigations will be made of the applicability of soil-loss equations to mining spoils. These will include rill-erosion studies by means of a rainfall simulator on soils in various degrees of a disturbed condition. Stream channels draining both mined and unmined basins are to be monumented and surveyed periodically to determine morphology changes attributable to mining. Mobility studies of different particle sizes on hillslopes are to be initiated to determine sediment delivery ratios for coarse, highly disturbed material.

Completed Reports:

Osterkamp, W.R., 1980, Sediment-morphology relations of alluvial channels: Proceedings, ASCE Symposium on Watershed Management, Boise, Idaho, v. 1, p. 188-199.

_____, 1981, Bimodal particle-size distributions and sorting processes of alluvial-channel banks, in Particle motion and sediment transport measurement techniques and experimental results, ed. A. Muller: Institut fur Hydromechanik und Wasserwirtschaft, Zurich, Switzerland, p. 52.1-52.7.

Osterkamp, W.R., and Harrold, P.E., 1981, Dynamics of alluvial channels--a process model: Proceedings, International Symposium on Rainfall-Runoff Modeling, Mississippi State University, Mississippi (in press).

GEOLOGICAL SURVEY

CR75-102 Sediment Movement in Rivers

WRD Project No.: CR75-102
Project Title: Sediment Movement and Channel Changes in Rivers
Project Chief: Meade, Robert H.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: Sediment moves through river systems in response to specific events and changing conditions in drainage basins. These events and conditions are both natural (floods, climate changes) and artificially-induced (accelerated erosion, reservoirs, diversions, channelizations). The response often takes place over periods measurable in decades or longer. The morphology of the river channels changes as sediment moves through the system.

Objective: To assess: (1) changes in river sediment loads over periods of decades or longer, and the factors (natural and artificial) that cause the changes; (2) rates at which rivers change their courses, shapes, and other morphologic features, both in their natural state and in response to artificial influences; (3) effects of infrequent catastrophic events or large-scale human influences on the "equilibrium" sediment movement and channel morphology in rivers; (4) sources, pathways, and sinks of sediment in rivers.

Approach: Basically a historical approach, using available records and making some first-hand field studies. Records include sediment-load data previously collected by USGS and other agencies; changes in channel morphology are interpreted by comparing old and new maps plus available aerial photographs of selected rivers in the Upper Missouri basin. Field studies include repeated surveys of selected channels and tracer studies of sediment movement.

FY-1980 Progress and Results: As a first approximation, the movement of bedload in the East Fork River of western Wyoming can be described as a wave. In contrast to earlier studies wherein wave-like movement of bedload has been inferred from observed changes of bed elevation at one or two cross sections, our study is based on the changes in bed elevation measured daily through two runoff seasons at about 40 cross sections in a 3.3-kilometer reach. During the weeks of most active runoff, the crests of the waves of bedload moved downriver at velocities of 10 to 20 meters (0.5 to 1.0 channel widths) per day. Thus, in streams where transportable bed material is not uniformly distributed along the channel, bedload transport might be realistically modeled as a moving wave.

Planimetric changes in a 90-kilometer reach of Powder River in southeastern Montana were recorded by comparing six sets of aerial photographs that were taken in the years 1939, 1944, 1954, 1967, 1973, and 1978. The river lengthened itself by about 6 kilometers, mainly through the growth of meanders, in the study reach between 1939 and 1973. After the (50-yr?) flood of 1978, in which several meanders were cut off at their necks, the same reach of the river was shortened by several kilometers.

FY-1981 Plans: Continue annual resurvey of cross sections on Powder River. Participate in NSF-sponsored research on movement of sediment and organic carbon in Amazon River.

Completed Reports:

Meade, R.H., Nordin, C.F., Jr., Curtis, W.F., and others, 1979, Transporte de sedimentos no rio Amazonas: Acta Amazonica, v.9, no.3, p.543-547.

Nordin, C.F., Meade, R.H., Curtis, W.F., and others, 1980, Size distribution of Amazon River bed sediment: Nature, v.286, p.52-53.

Emmett, W.W., Myrick, R.M., and Meade, R.H., 1980, Field data describing the movement and storage of sediment in the East Fork River, Wyoming. Part I. River hydraulics and sediment transport, 1979: U.S. Geological Survey Open-File Report 80-1189, 43 p.

Meade, R.H., Myrick, R.M., and Emmett, W.W., 1980, Field data describing the movement and storage of sediment in the East Fork River, Wyoming. Part II. Bed elevations, 1979: U.S. Geological Survey Open-File Report 80-1190, 171 p.

Meade, R.H., Emmett, W.W., and Myrick, R.M., 1981, Movement and storage of bed material during 1979 in East Fork River, Wyoming, USA, *in* Davies, T.R.H., and Pearce, A.J., editors, Erosion and sediment transport in Pacific rim steeplands: International Association of Hydrological Sciences Publication 132, p.225-235.

Nordin, C.F., Jr., and Meade, R.H., 1981, The flux of organic carbon to the oceans: some hydrologic considerations, *in* Flux of organic carbon by rivers to the oceans: U.S. Department of Energy, Office of Energy Research, CONF-8009140, p.173-218.

GEOLOGICAL SURVEY

CR74-097 Estuarine Intertidal Environments

WRD Project No.: CR74-097
Project Title: Hydrology of Estuarine Intertidal Environments
Project Chief: Glenn, Jerry L.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: Estuaries are subject to natural and artificial stresses that combine to threaten their continued utility to man. Many estuaries are filling with sediments from external (rivers and the ocean) and internal (shore erosion and biological production) sources. As a result, navigation often is difficult or impeded, maintenance of navigational channels is costly and continually necessary, and the value of recreational and commercial fisheries is diminishing. Estuarine intertidal and supratidal environments are particularly subject to man-induced stresses which directly alter valuable nursery and feeding grounds for many desirable forms of estuarine life.

Objective: (1) To establish and to evaluate qualitatively and quantitatively the sources of sediments in estuaries, with initial emphasis on the intraestuarine (intertidal and supratidal) source(s); (2) to characterize the nature and composition of sediments in, from, and beneath intraestuarine sources as an aid to understanding erosional, transportational, and depositional phenomena; (3) to document changes in intraestuarine sources as a result of man-induced stresses and to relate the changes to causative factors; (4) to provide data for making more intelligent predictions of the effects of nature and man in estuaries.

Approach: Aerial photographs and hydrographic and topographic data will be combined with field observations and samples in a reconnaissance survey of sedimentologic, geomorphic, and biologic attributes of intraestuarine sources. The stratigraphy of source areas will be investigated to aid in reconstructing the course of events that produced the present environments and in predicting the future course of events. Detailed field studies of modern sediment erosion, transport, and deposition in selected source areas will follow the stratigraphic phase and will be accompanied by laboratory determinations of the nature and composition of surface, subsurface, and suspended sediments.

FY-1980 Progress: Field work was discontinued and limited office efforts were devoted to interpreting some parts of available data.

FY-1981 Plans: All work on this project will be deferred.

Completed Reports:

Frye, Wayne Herschel, 1976, Stratigraphy and Petrology of Late Quaternary Terrace Deposits around Tillamook Bay, Oregon: MS Thesis, University of Oregon, Eugene, Oregon, 112 p.

Glenn, J.L., 1978, Sediment sources and Holocene sedimentation history in Tillamook Bay, Oregon: Data and Preliminary Interpretations: U.S. Geological Survey Open-File Report 78-680, 64 p.

Niem, Wendy A. and Glenn, J.L., 1980, Results of heavy-mineral analyses of surface sediments in Tillamook Bay, Oregon [abs.], *in* Abstracts with programs, 76th Annual Meeting of the Cordilleran Section: Geological Society of America, v.12, no.3, p.144-145.

Glenn, J.L., 1980, Holocene Sedimentation in the Tillamook Embayment, Oregon [abs.], *in* Abstracts with programs, 76th Annual Meeting of the Cordilleran Section: Geological Society of America, v.12, no.3, p.107.

GEOLOGICAL SURVEY

CR79-252 Upper Platte River Study

WRD Project No.: CR79-252
Project Chief: Hadley, Richard F.
Headquarters Office: Lakewood, Colorado
Field Location: Platte River basin, Colorado, Wyoming, and Nebraska

PROBLEM: The Department of the Interior has specific responsibilities for implementing migratory bird treaties and the Endangered Species Act. Of special concern, in this respect, are the habitats of sandhill cranes, whooping cranes, and other migratory bird species found along the Platte River in central Nebraska. The channels of the Platte River and its major tributaries, the North Platte and South Platte Rivers have undergone major changes in hydrologic regime since the late 19th century. Information and data were needed on streamflow and sediment transport characteristics of the Platte River, how these are affected by upstream activities and ground-water withdrawals, and especially on the interrelationships between flow and wildlife habitat.

OBJECTIVES: Determine specific flow and channel characteristics for selected locations along the Platte River and tributaries; (2) establish statistical properties of streamflow; (3) determine channel-maintaining discharge characteristics; (4) analyze stochastic models for flow projection; (5) determine surface-ground water relationships to wet meadow environment and streamflow; (6) determine sediment-transport characteristics and bedform processes and morphology.

APPROACH: Basic data on streamflow will be compiled including station histories, computation of statictics, and establish of projections for future flows based on planned development. For selected reaches, channel changes will be documented by using aerial photographs, maps, reports, rating curves, flow-duration curves, and other available material. Sediment-transport characteristics will be determined at selected locations by measuring suspended-load, bedload, and bed material. The characteristics of channel morphology will be related to bed and bank material, flow dynamics, and riparian vegetation. Selected sites will be instrumented to determine the hydrologic effects of changing flows, ground water levels on selected wetland areas.

FY 1980 PROGRESS: Field work was completed during the summer months of 1980. Data were collected on total sediment loads at selected sites on the Platte River and North Platte and South Platte Rivers. An interpretive report on changes in streamflow and sediment transport and analysis of flow duration and sediment transport curves are being completed. A report on the phase of the study concerning channel geometry and discharge required to maintain contemporary channel form is being completed. Field studies of the formation and movement of large-scale sedimentary bedforms in the Platte River channels have been completed and an interpretive report is being prepared.

A trigonometric linear model of the monthly precipitation series for Gothenburg, Kearney, and Grand Island, Nebraska for the period 1934-1978 has been developed. The model may be used to determine probabilities of within-year droughts and probabilities of drought duration for a 50-year simulation period. A stochastic model of streamflow in the Platte River in the reach from Cozad to Grand Island, Nebraska has been developed using monthly flow data. The model will be used to predict monthly flows over a 50-year simulation period.

Ground-water studies are being conducted to determine what effects that changes in streamflow and ground water withdrawal would have on ground-water levels in the Platte River valley in the reach between Cozad and Grand Island, Nebraska. The study has two parts: (1) development of a management-type model, and (2) determination of ground-water-surface-water relations at Mormon Island, near Grand Island, Nebraska as they relate to wet meadow management.

FY 1981 PLANS: Reports on all aspects of the hydrologic studies -- surface water, ground water, sediment transport, and channel morphology -- will be released to the open-file for timely distribution to cooperating agencies and interested parties. These reports will be incorporated into a final report on the Upper Platte River study. It is planned that these individual reports will be published in the Professional Paper series.

COMPLETED REPORTS:

Petsch, H.E., Rennick, K.B., and Nordin, C.F., Jr., 1980, Statistical summaries of selected streamflow data: South Platte River in Colorado and Nebraska; North Platte and Platte River in Nebraska: Geological Survey Open-File Report 80-679, 278 p.

GEOLOGICAL SURVEY

CR74-098 Sediment Transport Phenomena

Project Title: Measurement and Prediction of Sediment Transport Phenomena
WRD Project No.: CR74-098
Project Chief: Hubbell, David W.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: In alluvial streams, for every different hydrologic condition, the bed configuration, sediment transport, and hydraulic characteristics mutually change to achieve a quasi-equilibrium. The 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 perform a variety of other similar functions. As yet, the relationships 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 man-induced alterations to the flow regime can not be predicted with reliability. As a result, optimum utilization and management of a waterway usually is not assured and, often, modifications intended to enhance the utility of a waterway are ineffective or have adverse effects.

Objective: To provide a more complete understanding of sedimentation phenomena in alluvial streams and the response of such streams to imposed changes through a better understanding of the relationships between hydraulic and sedimentologic variables, particularly (1) the relationships between the factors that most influence the formation and alteration of bed forms and the transport of bedload and bed-material load and (2) the interrelationships between bed-form characteristics and the transport of bedload and bed-material load.

Approach: Initially, existing data will be analyzed to relate bed-form characteristics and hydraulic and sedimentologic variables, and one or more bedload samplers will be developed to permit accurate measurements of bedload transport. Later, data on bed-form characteristics, sediment transport, and other pertinent variables will be collected, as required, to meet specific needs; acoustic instrumentation, including side-scan sonar, will be employed to measure bed configuration and movement, and suitable bedload samplers, as well as suspended-load samplers, will be used to define transport rates. Tracer techniques also may be applied. Finally, data will be analyzed to define criteria for predicting bed form and to provide a better understanding of sediment transport phenomena. Both sand-bed and gravel-bed streams will be studied.

FY-1980 Progress: A procedure was developed for comparing the distribution of rates determined from individual samples collected with test bedload samplers to the distribution of true transport rates measured at the bedload trap of the calibration facility at SAFHL. The technique provides a calibration curve for each sampler rather than a singular sampling efficiency. Assumptions implicit in the procedure are substantiated using relations between bed elevation and bedload transport rate. The development and

defined calibration curves are based on data collected during six different hydraulic conditions (runs) with 6.5 mm material; different calibration curves may be defined for different bed materials. The curves permit individual samples to be accurately corrected to represent actual bedload transport rates at the time and place of sampling and define sampling efficiencies at all rates. Tested Helley-Smith samplers having nozzles with 3 in. by 3 in. entrances and exit-to-entrance area ratios equal to or less than 1.4 have sampling efficiencies closest to 100 percent over a wide range of bedload transport rates.

FY-1981 Plans: Data from calibration runs with 2.1- and 23-mm bed material will be analyzed to (1) verify that the analytical procedure is valid for different bed materials, (2) define calibration curves for all tested samplers for these materials, and (3) analyze differences that may exist between the various calibration curves for a given sampler.

Completed Reports:

Hubbell, D.W., Stevens, H.H., Jr., Skinner, J.V., and Beverage, J.P., 1980, Progress Report No. 2, Development and calibration of bedload samplers: U.S. Geological Survey Administrative Report released to the Technical Committee of the Subcommittee on Sedimentation, Interagency Advisory Committee on Water Data, April 1980, 30 p.

Stevens, H.H., Jr., Lutz, G.A., and Hubbell, D.W., 1980, Collapsible-bag suspended-sediment sampler: American Society Civil Engineers Proceedings, Hydraulics Division Journal, v.106, no.HY4, Technical Notes, p.611-616.

Hubbell, D.W., Stevens, H.H., Jr., Skinner, J.V., and Beverage, J.P., 1980, Progress Report No. 3, Development and calibration of bedload samplers: U.S. Geological Survey Administrative Report released to the Technical Committee of the Subcommittee on Sedimentation, Interagency Advisory Committee on Water Data, October 1980, 30 p.

GEOLOGICAL SURVEY

CR75-186 Bedload Samplers

Project Title: Bedload Samplers for Sediment in Streams: Development and Calibration
WRD Project No.: CR75-186
Project Chief: Hubbell, David W.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: Virtually all physical processes involving the removal of mineral resources from the earth's surface or from underground disturb the soil mantle, which, in turn, results in changes in surface erosional patterns. Mining resources for energy development very likely will result generally in increased erosion and delivery of sediment to existing stream channels. Much of the sediment will be transported in channels as bedload. Currently, there are no existing samplers that are completely satisfactory for measuring bedload transport. Measurements of this kind are essential for assessing the effects of changes in the occurrence and movement of sediment on channel geometry, water quality, and stream ecology.

Objective: To develop an acceptable sampler(s) for measuring the discharge of sediment particles that range in size from about 2 to 64 millimeters and are transported in streams as bedload, so as to permit the effects of energy development, particularly surface and subsurface mining activities, on streams to be monitored.

Approach: Initially, laboratory facilities capable of prototype testing of a variety of bedload samplers will be designed and constructed. Following this phase, existing promising samplers will be calibrated to define their efficiencies in sampling different particle sizes under various conditions. Then, as necessary, existing samplers will be modified and/or new samplers will be developed and subsequently calibrated and extensively tested. Based on laboratory results, the most satisfactory samplers will be recommended for use.

FY-1980 Progress: Experimental runs with different flow conditions and a bed material of 2.1-mm sand were completed in the bedload sampler calibration facility at SAFHL; a total of five runs were made with this material. Concurrently, 300 tons of cobbles were sieved to produce a reasonably uniform bed material having a median size of 23 mm. Following completion of the sand runs, three runs were made with the 23-mm bed material. Six versions of the Helley-Smith bedload sampler were tested in all runs except runs 4 and 5 with 2.1 mm sand; two wide-entrance versions were excluded from these runs. In addition, a prototype BTMA (Arnhem) sampler was tested in two sand runs and one 23-mm run, and a half-scale modified version of the VUV sampler was used in one 23-mm run. In each run, approximately 60-80 samples usually were collected with each individual sampler and true bedload transport rates were measured every six seconds at the bedload trap. In addition, detailed hydraulic and sedimentologic data associated with each separate flow condition (run) was obtained, including records of bed elevation along the channel and at several fixed points.

FY-1981 Plans: Calibration studies of the six versions of the Helley-Smith sampler and the BTMA and VUV samplers will continue using 23-mm material. Runs will be made with both the existent 23-mm material, which has been modified in size and gradation by crushing within the sediment-return system, and replacement 23-mm material. Bed material having a median diameter of 50 mm will be prepared and used in runs with selected versions of the samplers.

GEOLOGICAL SURVEY

PROJECT TITLE: Sedimentation and Geomorphology
WRD PROJECT No.: CR 4661-105
LOCATION: Worldwide
PROJECT CHIEF: Garnett P. Williams
HEADQUARTERS OFFICE: Lakewood, CO

The general project as of June, 1981 has two parts or sub-projects: (a) Channel Changes Below Dams, and (b) Paleohydrological Methods for Fluvial Environments.

SUBPROJECT A -- CHANNEL CHANGES BELOW DAMS
(Being coauthored with Prof. M. Gordon Wolman, Johns Hopkins University)

PROBLEM: Installation of a dam on a river traps the sediment load and alters the pattern of the water discharge. The channel downstream reacts to these imposed changes, sometimes drastically.

OBJECTIVE: To determine how a channel is likely to change downstream from a dam on an alluvial stream.

APPROACH: Analysis is being made of aerial photographs and resurveyed cross sections of river channels below some 44 damsites. Features of special interest are changes in mean bed elevation, channel width, and vegetation. Records of water discharge, for the pre-dam and post-dam periods, show the change in flow.

PROGRESS AND RESULTS: Mean bed elevation generally can be expected to decrease in the reach immediately below a dam, unless the dam retains virtually all the water and makes no significant releases. A model equation is derived to express the trend of bed degradation with time, at a cross section. The zone of degradation migrates (lengthens) downstreamward with time. The channel width may or may not change below a dam. In some cases the same river may show an increase, no change and also a decrease in width, from one section to another along the river. Large reductions in width seem to characterize the reach below dams which have retained and rerouted much of the former flow for irrigation purposes. Below the latter dams remarkable amounts of vegetation have taken over that part of the former channel which is not under water in the reduced post-dam flows.

COMPLETED REPORTS, 1978-1979 (Including related studies):

Williams, G.P., 1978, Hydraulic geometry of river cross sections -- theory of minimum variance: U.S. Geol. Survey Prof. Paper 1029, 47 p.

_____, 1978, The case of the shrinking channels -- The North Platte and Platte Rivers in Nebraska: U.S. Geol. Survey Circ. 781, 48 p.

_____, 1978, Bankfull discharge of rivers: Water Resources Research, Vol. 14, No. 6, p.1141-1154.

_____, 1978, Historical perspective of the Platte Rivers in Nebraska and Colorado In Graul, W.D., and Bissell, S.J., (tech. coord.), Lowland river and stream habitat in Colorado: A symposium (Greeley, Colorado, (October 4-5, 1978): Colorado Chap. Wildlife Soc. and Colorado Audubon Council, p.11-41.

Rhodes, D.D., and Williams, G.P. (eds.), 1979, Adjustments of the fluvial system (Proc. 10th Annual Binghamton Geomorphology Symposium); Dubuque, Iowa, Kendall/Hunt, 372 p.

SUBPROJECT B -- PALEOHYDROLOGICAL METHODS FOR FLUVIAL ENVIRONMENTS (Being coauthored with Prof. Åke Sundborg, Uppsala University. Sweden)

PROBLEM: Reconstruction of the flow regimes on former channels can be very useful in the flow of present rivers. However, reliable methods presently are not available for estimating the water discharges and mean velocities that used to flow along channels presently abandoned. The same is true to a lesser extent for present rivers which are ungaged, and the same processes and principles apply to both cases.

OBJECTIVE: To assess previous approaches to fluvial paleohydrology and develop new methods for practical application.

APPROACH: The Project Chief was invited by Sweden and Uppsala University to spend six months, all expenses paid, as a Guest Research Scientist in Sweden to study the many excellent paleohydrology environments resulting from the post-pleistocene meltwater runoff. This visit took place during October 1980 - March 1981. Field measurements were made and aerial photos have been analyzed. Certain modern rivers in Sweden also were studied to establish relations usable for past environments. The various aspects being studied are the formation of ice-margin channels, the flows capable of carrying cobbles and boulders in channels, the flows associated with river meanders of varying sizes, and the deposition of fine-grained sediments.

PROCESS AND RESULTS: All data have been collected and analyzed. First draft of manuscript is nearly completed. Bankfull discharge of abandoned channels can be estimated from the channel slope and bankfull cross-sectional flow area. Relations have been established between the size (intermediate diameter) of cobbles and boulders and the flow (unit stream power, bed shear stress and mean velocity) capable of transporting that particle size. These flow estimates, along with certain measurable channel features, can

then be used to estimate the associated water discharge and other hydraulic variables. An approximate estimate of mean annual discharge and average annual peak flow on meandering rivers can be obtained from the average radius of curvature of the meanders. Water velocities of rivers can be reconstructed by analyzing downstream changes in grain sizes of fine-grained deposits of sediment that was carried as suspended load.

GEOLOGICAL SURVEY

CR81-266 Estuary Sedimentation and Eutrophication

WRD Project No.: CR81-266
Project Title: Sedimentation and Eutrophication in the Potomac Estuary
Project Chief: Glenn, Jerry L.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: Sediments that contain elevated concentrations of nutrients and trace metals are accumulating rapidly in parts of the tidal Potomac River, the Potomac Estuary, and the adjacent marginal embayments. The sediments decrease channel depths and widths to the detriment of commercial and recreational interests, and 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 levels of dissolved oxygen. Sedimentation and eutrophication problems in the Potomac are a consequence of essentially uncontrollable natural and potentially manageable 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. The rate of development probably accelerated when white man began to clear adjacent forests for farms and cities and when agricultural, municipal, and industrial waste began to exceed the natural assimilative capacity of the evolving tidal river-estuary system.

Objective: (1) To identify modern sources of sediments and nutrients. (2) To establish changes with time in sources or supply rates due to natural and anthropogenic influences. (3) To determine sediment and nutrient transport and deposition patterns. (4) To compute rates of accumulation and amounts of sediments and nutrients in selected hydrologic and geomorphic divisions of the Potomac system. (5) To compare supply and accumulation rates for prehistorical periods with contemporary rates from concurrent transport studies.

Approach: Areal and stratigraphic distributions of sediments, nutrients, and trace metals will be determined by a combination of direct sampling (surface and core) and remote sensing (side scan sonar and subbottom profiling). Sediment and samples will be analyzed for indicators of sources (particle size, mineralogy, nutrient and trace metal concentrations and accumulation rates (^{210}Pb, ^{14}C, pollen concentrations and distributions). Sediment contributions from the shoreline source will be estimated by a combination of field mapping, monitoring, and sampling at selected sites, and by laboratory measurements from available air photographs and maps. Data will be integrated with results from measurements and models of modern sediment and nutrient transport to provide past and present sediment and nutrient budgets for selected Potomac reaches.

FY-1980 Progress: A program to obtain cores 12-meters long was initiated and completed successfully.

FY-1981 Plans: Selected cores and samples will be analyzed to determine changes in deposition rates with time and sites of trace metal and nutrient accumulations.

Completed Reports:

Glenn, J.L., 1979, Variations in nutrient and sediment concentrations in the Potomac Estuary: Abstract, Program for the Southeastern Section of the Geological Society of America, 28th Annual Meeting, v.11, no.4, p.180.

Glenn, Jerry L., 1979, Temporal and spatial variations in nutrient and sediment concentrations in the Potomac estuary *in* Seminar on Water Quality in the Tidal Potomac River, December 1978, Bennett, James P. (ed.): U.S. Geological Survey Open-File Report 79-1588, p.12-13.

Martin, E. Ann, 1979, Sedimentation Rates and Stratigraphic Distribution of Trace Metals in Pb-210 Dated Cores from the Potomac River and Estuary: Geological Society of America Abstracts with Programs, v.11, no.7, p.472.

Knebel, Harley J., Martin, E. Ann, Glenn, J.L. and Needell, Sally W., 1980, Sedimentary Framework of the Potomac River Estuary: Geological Society of America Abstracts with Programs, v.12, no.7, p.464.

DeFries, Ruth S., 1980, Sedimentation Patterns in the Potomac Estuary since European Settlement: A Palynological Approach: PhD Dissertation, Johns Hopkins University, Baltimore, Md., 164 p.

GEOLOGICAL SURVEY

CR75-187 Bedload Transport Research

WRD Project No: CR75-187
Project Chief: Emmett, William W.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

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 knowledge is available regarding the hydraulic and mechanics of bedload transport. Before continuing advances in river channel behavior can be made, some understanding of the behavior of bedload sediment must be made.

Objective: (1) Define spatial and temporal variations in bedload transport rate for a single stage of flow; (2) define change in average magnitude of transport rate over a range in hydraulics of flow; (3) define change in average magnitude of transport rate over a range in channel geometry; and (4) analyze the data to evaluate the applicability of available bedload equations, suggest new coefficients for the existing equations, or propose new relations for predicting rates of bedload transport.

Approach: To use the conveyor-belt bedload-transport facility on the East Fork River near Pinedale, Wyoming, as a control to evaluate variability factors in bedload transport and to field calibrate the Helley-Smith bedload sampler; to use the calibrated Helley-Smith sampler in the systematic collection of bedload samples, along with the concurrent measurements of streamflow hydraulics, 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.

Initiate at the conveyor-belt bedload-trap research facility a tracer study utilizing fluorescent particles to evaluate (1) residence time of sediment, (2) average speed of particles, (3) depth of bed material involved in transport, (4) dispersion of bed material, (5) short-term channel changes accompanying sediment transport, (6) influence of availability of sediment on transport rate, and other related aspects of sediment transport.

FY-1980 Progress: Completed field data collection on East Fork River as related to fluorescent tracer study. Daily bedload measurements at frequently spaced sections along a reach of river demonstrate significantly different relations of bedload to discharge from one section to another. Collected and overviewed collection of bedload data from a variety of rivers to provide data base necessary to evaluate universality of East Fork River behavior. Data reduction of 1979 data to usable form is nearly complete.

FY-1981 Plans: Complete reduction of 1979 data and all 1980 data except fluorescent concentrations which require greater time. Continue to use image analyzer to determine particle sizes and concentration of fluorescent particles in (1) samples collected describing the stationary environment and (2) samples collected describing the material in transport. Use the Helley-Smith bedload sampler at a variety of rivers to enlarge the data base necessary to extrapolate the specific information of the East Fork River tracer study to a universal application. Prepare major interpretative report on bedload transport, East Fork River. Prepare report discussing comparison of detailed data for East Fork River with less detailed data from other rivers.

Completed Reports:

Emmett, W.W. and Seitz, H.R., 1973 (1974), Suspended and bedload sediment transport in the Snake and Clearwater Rivers in the vicinity of Lewiston, Idaho - March 1972 through June 1973: U.S. Geological Survey Basic-Data Report, 78 p.

_____, 1974, Suspended and bedload sediment transport in the Snake and Clearwater Rivers in the vicinity of Lewiston, Idaho - July 1973 through July 1974: U.S. Geological Survey Basic-Data Report, 76 p.

Emmett, W.W., 1974, Channel aggradation in western United States as indicated by observations at Vigil Network sites: Zeitschrift fur Geomorphologie, Suppl. v.21, p.52-62.

_____, 1974, Channel changes: Geological Society of America, Geology, v.2, no.6, p.271-272.

_____, 1974, Channel aggradation in western United States: Abstract, Proceedings, Twelfth Annual Engineering Geology and Soils Engineering Symposium, p.273.

_____, 1974, Hydrologic environment of the upper Salmon River area, Idaho: Abstract, Transactions American Geophysical Union, v.55, no.2, p.77.

_____, 1975, The channels and waters of the upper Salmon River area, Idaho: U.S. Geological Survey Professional Paper 870-A, 116 p.

Leopold, L.B., and Emmett, W.W., 1976, Bedload measurements, East Fork River, Wyoming: Proceedings, National Academy of Sciences, v.73, no.4, pp.1000-1004.

Emmett, W.W., 1976, Bedload transport in two large, gravel-bed rivers, Idaho and Washington: Proceedings, Third Federal Interagency Sedimentation Conference, pp.4-101 to 4-114.

Druffel, L., Emmett, W.W., Schneider, V.R., and Skinner, J.V., 1976, Laboratory hydraulic calibration of the Helley-Smith bedload sediment sampler: U.S. Geological Survey Open-File Rept. 76-752, 63 p.

Mahoney, H.A., and others, 1976, Data for calibrating unsteady-flow sediment-transport models, East Fork River, Wyoming, 1975: U.S. Geological Survey Open-File Rept. 76-22, 293 p.

Leopold, L.B. and Emmett, W.W., 1977, 1976 Bedload measurements, East Fork River, Wyoming: Proceedings, National Academy of Sciences, v.74, no.7, pp.2644-2648.

Emmett, W.W. and Leopold, L.B., 1977, A comparison of observed sediment-transport rates with rates computed using existing formulas: *In* Geomorphology in Arid Regions (D.O. Doehring, Ed.), Proceedings, 8th Annual Geomorphology Symposium, State University of New York, Binghamton, New York, Sept. 23-24, 1977, pp.187-188.

Emmett, W.W., 1978, "Overland Flow" *In* Hillslope Hydrology (M.J. Kirkby, Ed.), John Wiley and Sons, pp.145-176.

Emmett, W.W., Burrows, R.L., and Parks, Bruce, 1978, Sediment transport in the Tanana River in the vicinity of Fairbanks, Alaska, 1977: U.S. Geological Survey Open-File Rept. 78-290, 28 p.

Emmett, W.W., and Thomas, W.A., 1978, Scour and deposition in Lower Granite Reservoir, Snake and Clearwater Rivers near Lewiston, Idaho, U.S.A.: Journal of Hydraulic Research, v.16, no.4, pp.327-345.

Emmett, W.W., 1979, A field calibration of the sediment trapping characteristics of the Helley-Smith bedload sampler: U.S. Geological Survey Open-File Rept. 79-411, 96 p.

_____, 1979, Aspects of bedload transport in rivers (abstract): Program with abstracts, 32nd Annual Meeting, Rocky Mountain Section, Geological Society of America, v.11, no.6, p.271.

Burrows, R.L., Parks, Bruce, and Emmett, W.W., 1979, Sediment transport in the Tanana River in the vicinity of Fairbanks, Alaska, 1977-78: U.S. Geological Survey Open-File Rept. 79-1539, 37 p.

Emmett, W.W., 1980, A field calibration of the sediment trapping characteristics of the Helley-Smith bedload sampler: U.S. Geological Survey Professional Paper 1139.

Emmett, W.W., 1980, Bedload sampling in rivers: International Symposium on River Sedimentation, Chinese Society of Hydraulic Engineers Preprint, Beijing, China, March 24-29, 1980, pp.E8-1 to E8-24.

Emmett, W.W., Myrick, R.M., and Meade, R.H., 1980, Field data describing the movement and storage of sediment in the East Fork River, Wyoming. Part I. River hydraulics and sediment transport, 1979: U.S. Geological Survey Open-File Report 80-1189, 43 p.

Meade, R.H., Myrick, R.M., and Emmett, W.W., 1980, Field data describing the movement and storage of sediment in the East Fork River, Wyoming. Part II, Bed elevation, 1979: U.S. Geological Survey Open-File Report 80-1190, 172 p.

Meade, R.H., Emmett, W.W., and Myrick, R.M., 1981, Movement and storage of bed material during 1979 in East Fork River, Wyoming, USA: Erosion and Sediment Transport in Pacific Rim Steeplands, International Association of Hydrological Sciences Publication 132, pp.225-235.

Emmett, W.W., 1981, Measurement of bed load in rivers: Sediment and Erosion Transport Measurement, International Association of Hydrological Sciences Publication 133, pp.3-15.

GEOLOGICAL SURVEY

CR80-261 Sediment and Solute Transport Modeling

WRD Project No: CR80-261
Project Chief: Sayre, William W.
Headquarters Office: Lakewood, Colorado
Field Location: Topical Research

Problem: Mathematical models for predicting the dynamic response of rivers to various natural and manmade inputs are increasingly needed to achieve an optimum balance among society's conflicting demands. Rivers with self-formed, movable boundaries pose an important and challenging set of modeling problems. There is a special need for two- as well as one-dimensional (i.e. transverse in addition to longitudinal) transport and dispersion models for sediment that account for the exchange of sediment between suspension in the flow, and storage in and transport along the bed, and also the uptake and release of solutes by sorption reactions.

Objectives: In summary, the objectives are to improve and continue the development of mathematical models that simulate one- and two-dimensional transport and dispersion of bed-material and wash-load sediment in rivers. Particular attention is focused on the bed- and suspended-load transport, transverse mixing, deposition, bed armoring, scour, and resuspension mechanisms; the accounting procedures for bed composition and level; residence times in the bed; and the uptake and release of solutes by suspended and bed sediments.

Approach: This project, building on data and information from several past and ongoing studies to extend and modify existing computer programs and analytical methods, is directed toward solving the continuity and momentum equations for water, and the time-dependent advection-diffusion equations, with appropriate coupling terms, for suspended and bed sediments, and for solutes that may be taken up and released. Available field data together with special studies as needed are used for calibration and verification. Formulations of the governing equations are mainly deterministic, however, stochastic formulations may be adopted for selected mechanisms.

Progress in 1980: Reviewed and studied several existing sediment and solute transport and dispersion models for rivers. Began modifying Bennett-Nordin model for simulation of sediment transport and armoring for application to Toutle-Cowlitz River system. Selected reaches of Toutle-Cowlitz River system to be modeled, and outlined field sampling and data acquisition needs for calibrating and verifying sediment transport and armoring model. Began preparing state-of-the-art paper for modeling solute and sediment transport in rivers.

Plans for 1981: Complete state-of-the-art paper. Continue reviewing and studying existing sediment and solute transport models. Complete adaptation and modification of Bennett-Nordin sediment transport and armoring model for application to the Toutle-Cowlitz River system to the point where it is operational. Begin processing available channel geometry and flow and sediment data for calibration of model.

Completed Reports: None.

Project title: Stream channel behavior
WRD Project No.: WR 76-153
Project Chief: Brice, J. C.
Headquarters Office: Menlo Park, CA

Problem: Stream channel behavior is defined as changes in the form and position of a channel with time and the response of a channel to natural and man-induced variables. Channel stability, as determined by rates of bank erosion or degradation, is an aspect of behavior. Channel behavior is a potentially important factor in the design and protection of bridges and other engineering works on streams, but neither experience with channel behavior nor the factors that determine stability have been well enough documented to be of much use.

Objectives: (1) to determine the properties and behavior of a wide variety of stream channels; (2) to estimate the future bahavior of a channel from its past behavior, with allowance for man-induced variables; (3) to relate channel behavior to channel type; and (4) To relate channel type to major formative variables, including discharge, valley slope, and size of bed material.

Approach: Channel properties and behavior are to be determined from case histories of hydraulic problems at bridges, case histories on the performance of relocated channels, time-sequential aerial photographs taken during the past 45 years, and field study. Channels are to be classified on the basis of descriptive properties that have genetic significance. The relations of channel type to channel behavior and to formative variables are to be analyzed by statistical methods.

Progress and results in calendar year 1980: Case histories have been prepared and analyzed for 103 stream channels in the U.S. that were relocated for purposes of highway construction. The factors by which channel width and channel length were artificially changed showed no consistent relation to channel stability. Factors identified as critical to stability are: growth of vegetation on banks (40 sites); bank revetment (33 sites); stability of prior channel (19 sites); and erosional resistance of bed-bank materials (15 sites).

Project Title: Rehabilitation Potential of Energy Lands
Project No : CR75-104
Project Chief: Shown, Lynn M.
Headquarters Office: Lakewood, Colorado
Field Location : Topical Research

Problem: Hydrologic information with respect to rehabilitation potential, including erosion and sediment yields, is needed by local, State, and Federal governments and energy companies prior to decisions on leasing and mining of coal and oil shale. The information is needed on a timely basis; thus, reconnaissance techniques must be used to obtain much of the necessary data. The two facets of the problem are: (1) Definition of the conditions as they exist prior to mining, and (2) assessment of the potential for rehabilitation of land-water systems after mining.

Objectives: The objectives of this project related to erosion and sedimentation are to develop, refine, and apply reconnaissance techniques that will provide data to define baseline conditions and rehabilitation potential. Data collected include reservoir sediment yields, hillslope and exposure effects on erosion, slope changes in reconstructed topography, and channel erosion and aggradation.

Approach: The reconnaissance techniques used to characterize drainage basins include: (1) Relation of percent bare ground to runoff and sediment yield, (2) estimates of sediment yield using drainage basin and channel characteristics and reservoir sediment surveys, and (3) hillslope and channel erosion and sedimentation monitoring by surveys of monumented transects.

Progress and Results (FY1980): Present-capacity and sediment-content surveys of five stock ponds were completed in the Prairie Dog Creek basin, Big Horn County, Montana. This was done in cooperation with the Bureau of Land Management and the Montana District, Water Resources Division, and included measurements of bulk density of sediment in two ponds and characterization of the watersheds. A precipitation-runoff model is being adapted to this basin by the Montana District so that hydrologic effects of potential coal mining can be evaluated. A comprehensive report emphasizing hydrologic methodology, data analyses and information useful for determining impacts of surface mining was prepared for a potential mine site in a small basin in northwestern Alabama. The Universal Soil Loss Equation and sediment-delivery ratios were used to evaluate slope erosion and sediment yield for premining and assumed postmining and reclamation conditions. The complete network of slope-erosion transects and channel cross sections were resurveyed in the Piceance Creek basin; statistical analyses were performed on all data from prior surveys.

FY1981 Plans: Four small reservoirs at the Boco Mountain sagebrush-to-grass conversion study area will be resurveyed to determine what effect grazing has had on sediment yields from the basins. Bulk densities of the soils, vegetation-cover and grazing records of the basins will be obtained to aid in interpreting the sediment-yield data. Remaining work

on a sediment-yield map of Campbell County, Wyoming will be completed so that the map can be published. Preparation will begin on a report about a sediment-yield prediction equation for small rangeland watersheds in the central Powder River basin. Analyses and interpretation of the slope and channel-erosion data for the Piceance Creek basin will be completed and a report preparation will begin.

Published Reports:

Hadley, R. F., Frickel, D. G., Shown, L. M., and Miller, R. F., 1981, Methodology for hydrologic evaluation of a potential surface mine: the East Trail Creek basin, Big Horn County, Montana: U.S. Geological Survey Water Resources Investigations/Open-File Report 81-58, 73 p.

Shown, L. M., Frickel, D. G., Hadley, R. F., and Miller, R. F., 1981, Methodology for hydrologic evaluation of a potential surface mine: the Tsosie Swale basin, San Juan County, New Mexico: U.S. Geological Survey Water Resources Investigations/Open-File Report 81-74, 57 p.

Frickel, D. G., Shown, L. M., Hadley, R. F., and Miller, R. F., 1981, Methodology for hydrologic evaluation of a potential surface mine: the Red Rim site, Carbon and Sweetwater Counties, Wyoming: U.S. Geological Survey Water Resources Investigations/Open-File Report 81-75, 65 p.

Shown, L. M., 1981, Sediment yields, *in* Resource and Potential Reclamation Evaluation—Beulah Trench Study Area, North Dakota: U.S. Bureau of Land Management EMRIA Report No. 10, p. 53-55, 62, plates 35 and 36.

Shown, L. M., 1980, Sediment yields, *in* Resource and Potential Reclamation Evaluation—White Tail Butte Study Area, Wyoming: U.S. Bureau of Land Management EMRIA Report No. 13, p. 83-85, 98.

FEDERAL INTER-AGENCY SEDIMENTATION PROJECT

St. Anthony Falls Hydraulic Laboratory
University of Minnesota
Minneapolis, Minnesota

1.-During 1980 a variety of bedload samplers were tested in a special facility at the St. Anthony Falls Hydraulic Laboratory. Three runs with 2.1mm bed material and three runs with 23mm material were completed. For the Helley-Smith samplers, preliminary data indicates sampling efficiency is a function of bedload transport rate.

2.-The D-77 suspended-sediment sampler was modified to expand its range of application. To permit accurate sampling in deep water, the sampler was equipped with a flexible bag sample-container and an electrically operated sampling-valve. In the laboratory, compensating tests are being conducted on devices to insure accurate sampling over a wide range of fluid temperatures.

3.-New requirements for both chemical and biological sampling of wadeable streams have produced additional constraints on equipment design. To meet these constraints, design of a new sampler, termed the D-80, was started.

4.-For sampling high concentrations on Mount St. Helens' streams, the project made comparative tests of progressive-cavity and peristaltic-type sampling pumps. Ultimately a special peristaltic was designed and seven automatic pump-samplers were shipped to the site.

5.-In an effort to facilitate particle size and concentration measurements on suspended-sediment samples, two commercial instruments were tested. By different means instruments detect minute changes in the density of a water-sediment mixture. One instrument measures the pressure in a column that holds the test sample and the other measures the frequency of a vibrating member that contains the test sample. For each instrument sources of measurement errors are being isolated and techniques for error compensation are being devised.

6.-Supply, repair, and calibration of a variety of sediment samplers and analyzers was continued. During 1980, sales and inventory were as follows:

Instrument		Sold since 1940	Sold during 1980	Inventory, Dec. 1980
DH-48	Hand sampler	3146	236	343
DH-75P	Hand sampler	124	25	18
DH-75Q	Hand sampler	124	16	29

	Instrument	Sold since 1940	Sold during 1980	Inventory, Dec. 1980
DH-59	Hand-line sediment sampler	1259	128	92
DH-76	Hand-line sediment sampler	337	102	21
D-49	Depth-integrating sampler	900	0	6
D-74	Depth-integrating sampler	410	135	55
D-74AL	Depth-integrating sampler	139	33	13
P-61	Point-integrating sampler	261	43	25
P-63	Point-integrating sampler	44	5	1
P-72	Point-integrating sampler	46	16	22
BMH-53	Bed-material hand sampler	356	31	44
BMH-60	Bed-material hand sampler	277	42	42
BM-54	Bed-material sampler	212	33	5
SA	Particle-size analyzer	90	5	2
PS-67	Pumping sampler	42	0	0
PS-69	Pumping sampler	345	25	17
CS-77	Chickasha pumping sampler	35	0	2
SS-72	Sample splitter	36	3	0
BP-76	Power supply	128	16	8

For the above equipment a catalog and manuals are available by request.

For additional information contact:

Project Leader
Federal Inter-Agency Sedimentation Project
St. Anthony Falls Hydraulic Laboratory
Hennepin Island & Third Avenue S.E.
Minneapolis, Minnesota 55414

OFFICE OF SURFACE MINING

1. Credits for Pertinent Erosion and Sedimentation Control Measures on Mine Sites.

   This contract project will identify the most pertinent hydrologic, soil, vegetative, and other factors which allow accelerated soil erosion and sedimentation to occur, and estimate the degree of importance of each of these factors. A list of various erosion and sediment control measures which may be effectively used to reduce onsite erosion and sedimentation will be provided. A system of credits for the erosion and sediment control systems will be developed to be used in decreasing the volume of the sediment storage requirements for primary settling basins.

2. Analysis of Environmental Impacts of Maintaining and/or Removal of Sediment Control Structures.

   This contracted study will identify and evaluate the environmental impacts associated with removal of 'temporary' sedimentation ponds during the closure process on surface mined lands. Actions will also consider impacts associated with changing ponds from 'temporary' to 'permanent' status under certain approved conditions.

   For additional information, contact Richard E. Dawes, Assistant Regional Director, Technical Services and Research Division, Office of Surface Mining, 818 Grand Avenue, Scarritt Building, Kansas City, Missouri 64106.

3. Changes in MUSLE's K Factor.

   The soil erodibility factor (K) is a parameter used in both the Universal Soil Loss Equation (USLE) as well as the Modified Universal Soil Loss Equation (MUSLE). Research is being conducted through Simons, Li and Associates (Fort Collins, Colorado) to field test whether the soil erodibility factor, K, has the same value for soils on premining lands and reclaimed lands. If the five-member soil erodibility nomograph does not accurately predict K for reclaimed lands, a new predictive method will be developed.

   For additional information, contact John Nadolski, OSM, Region V, 1020 15th Street, Denver, Colorado 80202.

1. Credits for Pertinent Erosion and Sedimentation Control Measures on Mine Sites.

This contract project will identify the most pertinent hydrologic, soil, vegetative, and other factors which allow accelerated soil erosion and sedimentation to occur, and estimate the degree of importance of each of these factors. A list of various erosion and sediment control measures which may be effectively used to reduce onsite erosion and sedimentation will be provided. A system of credits for the erosion and sediment control systems will be developed to be used in decreasing the volume of the sediment storage requirements for primary settling basins.

2. Analysis of Environmental Impacts of Maintaining and/or Removal of Sediment Control Structures.

This contracted study will identify and evaluate the environmental impacts associated with removal of 'temporary' sedimentation ponds during the closure process on surface mined lands. Actions will also consider impacts associated with changing ponds from 'temporary' to 'permanent' status under certain approved conditions.

For additional information contact Richard E. Dawes, Assistant Regional Director, Technical Services and Research Division, Office of Surface Mining, 818 Grand Avenue, Scarritt Building, Kansas City, Missouri 64106.

3. Changes in MUSLE's K Factor.

The soil erodibility factor (K) is a parameter used in both the Universal Soil Loss Equation (USLE) as well as the Modified Universal Soil Loss Equation (MUSLE). Research is being conducted through Simons, Li and Associates (Fort Collins, Colorado) to field test whether the soil erodibility factor, K, has the same value for soils on pre-mining lands and reclaimed lands. If significant changes do occur in the K value, the five-member soil erodibility nomograph will be tested to see the predictive accuracy for reclaimed lands. If the five-member soil erodibility nomograph does not accurately predict K for reclaimed lands, a new predictive method will be developed.

For additional information, contact John Nadolski, OSM, Region V, 1020 15th Street, Denver, Colorado 80202

SCIENCE AND EDUCATION ADMINISTRATION

ARIZONA

Research activities at the Southwest Rangeland Watershed Research Center in Tucson, Arizona include the following:

1. A literature review and interpretation of the relations between channel morphology and sediment yield in small channels was conducted and a manuscript was prepared. The assessment of the state of the art included a summary and interpretation of past research and a statement of research needs.

2. Four commonly used methods to estimate sediment yield in the western U.S. were tested against observed sediment yield data from 10 experimental watersheds on Walnut Gulch near Tombstone, Arizona. The empirical methods generally overestimated measured sediment yields. However, the precipitation during the period of record was less than normal. This illustrated the importance of the less frequent, larger storms on annual sediment yield.

3. A monograph chapter entitled "Theory and Principles of Soil Erosion by Water and Generalized Control Strategies" was prepared for the ASA Monograph entitled "Dryland Agriculture". The manuscript includes development of fundamental erosion equations with emphasis on semiarid regions.

4. Parametric relationships for shear stress distributions in open channel flow have been developed. Equations have been developed to predict hydraulic geometry and erosion rates in small developing channels as functions of discharge, shear stress distribution, and soil properties. Data are being collected, in cooperation with the U.S. Geological Survey, for field evaluation of the equations for eroding channels.

5. Precise measurements were obtained on several very small watersheds to determine direct and indirect contributions to watershed sediment yield from developing gully systems. Comparison of sequential measurements indicated considerable sluffing of gully banks or sidewalls but only small changes in cross-sectional area. Preliminary observations suggest that significant amounts of sediment are being stored in the channel systems. Continued observations are required to determine the rate at which these sediments are being stored and transported in the channel system.

For additional information contact K. G. Renard, Research Leader, Southwest Rangeland Watershed Research Center, USDA-SEA-AR, Western Region, 442 E. 7th Street, Tucson, Arizona 85705.

SCIENCE AND EDUCATION ADMINISTRATION

COLORADO

Research Activities of the Agricultural/Surface-Mined Hydrology Group, Fort Collins, Colorado include the following:

1. A portable rainfall simulator apparatus was used to compare the effectiveness of different mulching techniques in controlling erosion from reclaimed strip mined surfaces. Hydrologic data from single rainfall simulator runs on straw mulch, standing grain mulch and fallow plots were used to calibrate a water and sediment routing model. The calibrated model was then used to compare sediment yield from the three treatments for one hour storms with rainfall intensities ranging from 1.5 to 5.0 in/hr. The straw mulch with a ground cover of 95 percent was most effective in reducing erosion and sediment yield for the entire range of rainfall intensities. The low ground cover density (5 percent) of the standing grain mulch surface probably accounted for its poor erosion control performance which was only slightly superior to the fallow treatment.

2. Much erosion from surface mined areas in this region results from runoff due to spring snowmelt. Twelve natural runoff plots composed of three replications of four different erosion control treatments were constructed and instrumented during 1980. Instrumentation is designed to automatically record plot runoff rates and sample suspended sediment. Data from these plots have not yet been analyzed.

For additional information contact David A. Woolhiser, Research Leader, USDA-SEA-AR, Western Region, Federal Building, 301 South Howes, P.O. Box E, Fort Collins, CO 80522.

SCIENCE AND EDUCATION ADMINISTRATION

GEORGIA

Research activities at the Southeast Watershed Research Laboratory in Tifton, Georgia include the following:

1. An average annual erosion rate of 8.0 tons/acre was estimated for the cropped portion of a 6.5 mi^2 Coastal Plain agricultural watershed, based on the USLE, observed cropping and land use practices, computed EI, and an experimentally determined soil erosivity factor. This watershed, which has heavily vegetated, low gradient alluvial floodplains typical of the Coastal Plain, had sediment yields of only 5% (on an annual basis) of the estimated gross soil movement from cropped areas within the watershed. Sediment delivery ratios varied primarily with season, with maximums occurring in the Dec.-Feb. quarter, and minimums occurring in the June-Aug. quarter. Multiple regression equations were developed for predicting seasonal SDR values based on season, runoff amount, and rainfall-runoff season interactions. Coefficients of determination were in excess of 0.9.

2. Seven small cropped study areas (1 to 4 acres each) have been instrumented to measure surface runoff and sediment movement from field areas under varying tillage (conventional and minimum) and residue management practices. Event samples have been installed for measuring sediment loads in surface runoff from the fields in an evaluation of alternate cultural and residue management practices on sediment production from agricultural areas.

For additional information contact Loris E. Asmussen, Director, Southeast Watershed Research Laboratory, USDA-SEA-AR, P. O. Box 946, Tifton, GA 31793.

SCIENCE AND EDUCATION ADMINISTRATION

GEORGIA

Research activities at the Southern Piedmont Conservation Research Center, Watkinsville, Georgia include the following:

1. A methodology has been developed for monitoring the temporal changes in stream bottom configuration due to the erosional effects of single and multiple storm events over one season. Using close-range, vertical photogrammetry, 35mm photography, and computer methods of data reduction and mapping, it was found that the heights of unknown points within the stream bottom could be calculated to within ±3.4mm. Further work is being done to further automate the laboratory phase of the method so that it may be used in other research projects where accurate records of change over time are required and where conventional measurement techniques are difficult.

2. Crop yield and runoff data (including sediment, N and P fractions) from watershed P-1 were summarized and related to three types of tillage practices. The three tillage systems included conventional, continuous fluted coulter, and inrow chiseling of summer annuals in residues of winter-spring annuals. These data were presented at an International Symposium, "Nutrient Cycling in Agricultural Ecosystems," University of Georgia, September 21-24, 1980. In addition, an unusual comparison of conventional (double disked) and inrow chiseled (18 cm deep x 3.8 cm wide) tilled soybeans in wheat stubble was made on adjacent P-3 and P-4 watersheds with a 7.32 cm high energy storm (EI = 254 mt-m/ha/cm) on August 15, 1980. A 3.71 cm storm (EI = 49 mt-m/ha) occurred on the previous day, August 14, 1980, following a prolonged drought without any runoff. Runoff from the second storm was 0.004 (<0.1%) and 1.490 cm (20%) for inrow chisel and conventional tilled systems, respectively. Sediment yields were 0.06 and 144.00 hg/ha, respectively. Multiple crop-conservation tillage systems are promising practices for reclaiming soil productivity and controlling soil erosion in the Southern Piedmont.

3. Slate Belt soils of the Southern Piedmont contain slaty fragments in their surface; these fragments are mostly flat, range from 5 to 40% by weight, and are up to 4 cm in diameter. Their effect on erosion and runoff was evaluated with a rainulator. Soils studied were Goldston very slaty silt loam, Badin slaty silt loam, Georgeville silty clay loam, and a Georgeville loam. Erosion and runoff were measured from a 120-minute storm of 6.35 cm/hour. Percent soil surface coverage by slaty fragments, which was determined at the end of each storm with photographs, ranged from 2.5 to 97%. Soil loss was directly related to coverage of the surface by slaty fragments. There was a good relationship between soil loss ratio and percent coverage by slaty fragments. The relationship was identical to that given in Figure 6, 0% canopy curve, USDA Handbook 537 (12), for plant residue mulch effects on soil loss ratio. It was concluded that the mulching effect of surface slaty fragments on soil loss can be accounted for in the Universal Soil Loss Equation by the use of an adjusted C. factor. The work has been reported in a paper entitled, "The Effect of Surface Slaty Fragments on Soil Erosion by Water," by J. E. Box, Jr. in the January-February 1981 issue of the Soil Science Society of America Journal.

For additional information contact Adrian W. Thomas, Research Leader, USDA-SEA-AR, Southern Piedmont Conservation Research Center, P. O. Box 555, Watkinsville, Ga. 30677.

SCIENCE AND EDUCATION ADMINISTRATION

IDAHO

Research at the Northwest Watershed Research Center, Boise, Idaho, includes the following:

1. Sediment yields in the 1979-80 water year ranged from 4 percent of the 13-year mean at the Macks Creek sampling station, mean elevation 4,600 feet, to 96 percent at the Reynolds Mountain station, mean elevation 6,700 feet. Peak streamflows, runoff volumes, and sediment yields were much below normal from areas below 5,000 feet elevation. The maximum suspended sediment concentration at the Reynolds Creek Outlet station was about 25,000 mg/l during peak streamflow May 6, 1980, from heavy rain.

2. New PS 69 pumping sediment samplers were very reliable compared with out-dated PS 67 samplers.

3. Streams within the Reynolds Creek Experimental Watershed show widely different monthly sediment yield distributions. About 67 percent of yearly sediment yield, 1967-80, was in May and 23 percent in April from the Reynolds Mountain Watershed, 6,700 feet elevation. In contrast 63 percent of yearly sediment yield was in January and 19 percent was in March from the Macks Creek Watershed, 4,800 feet mean elevation. Generally, sediment yields from areas above 5,500 feet elevation were predominantly from spring snowmelt and from areas below 5,500 feet elevation were from winter rain and snowmelt, often with frozen soil, or intense spring and summer rain.

4. A study of ungrazed vegetative canopy and ground cover at peak standing crop and at the end of the grazing season showed 5 percent greater ground cover and 5 percent greater shrub canopy at the end of the grazing season. Thus, potential erosion on these sagebrush rangelands is less during the spring season. However, data are lacking on decomposition rates of individual plant species.

5. A rillmeter has been procured to measure soil loss from steep barren slopes with visible erosion.

For additional information contact Clifton W. Johnson, Hydraulic Engineer, Suite 116, Patti Plaza, 1175 South Orchard, Boise, Idaho 83705.

SCIENCE AND EDUCATION ADMINISTRATION

INDIANA

Research activities of the USDA, SEA, AR Soil Erosion Research Unit in Lafayette, Indiana include the following:

1. In the mid 1950's, values for the effectiveness of graded terraces for control of soil loss from fields were developed from only limited data. The original, very general, undocumented values have continued to be used to the present although these values are known to be functions of several variables that were not originally considered. At the request of the USDA-Soil Conservation Service (SCS), data on the effectiveness of terraces for inducing deposition were reexamined using information from the Federal Erosion Experiment Stations of the 30's and 40's. The analysis showed that soil loss from graded terraces depends strongly on terrace grade, a relationship which should be included in the Universal Soil Loss Equation. Also, graded terraces were found to be only about one half to three fourths as effective for trapping sediment as previously thought. The data from the stations were also used to validate that the erosion component of CREAMS, a field scale model for Chemicals, Runoff and Erosion from Agricultural Management Systems, accurately evaluates the effectiveness of graded terraces and grass waterways for controlling soil loss from fields. The results of this research will be considered when SCS updates their terrace standards in the Spring of 1981.

2. Advances in the understanding of the mechanics of raindrop impact on soil surfaces have been hindered due to (1) the lack of a raindrop tower design in which a single drop falling at its terminal velocity can strike a known target area, and (2) the inability to measure the shear strength properties of the near surface layers. We have designed an inexpensive raindrop tower 8.9 m high so that a single drop will hit a 1.6-cm diameter target. The tower height was limited by the laboratory ceiling and not by the design. We have also found a method to determine the near-surface soil shear strength and have correlated soil splash for six midwestern soils with near-surface shear strength as measured by the Swedish fall-cone device. The fall-cone method is rapid, inexpensive, and is easily adapted for field measurements.

For additional information contact W.C. Moldenhauer, Research Leader, USDA-SEA-AR, North Central Region, Agronomy Dept., Life Science Building, Purdue University, West Lafayette, IN 47907.

SCIENCE AND EDUCATION ADMINISTRATION

IOWA

Research activities at the Watershed Research Unit in Columbia, Missouri include the following:

1. Soil erosion and sediment yield measurements and associated hydrologic investigations were continued on 4 field-size watersheds near Treynor, 2 fifteen-acre subwatersheds, and six fractional-acre areas. The erosion effectiveness of a till-plant system of continuous corn has been conclusively demonstrated; sediment yields from till-plant fields of 150 and 107 acres in western Iowa average less than 10 percent of soil movement from fields with minimal conservation practices such as field contouring. These results are based on 8 years of sediment yield measurement from a 107-acre till-plant field, concurrent measurements from two 80-acre conventionally-tilled fields, and a previous 8-year experience on these control watersheds.

2. Rainfall simulation tests were run during 1979 and 1980 on 8 plots (10 x 35 feet) from two major soils in western Iowa to examine rill-interrill erosion processes, particle aggregation during transport, enrichment of clay and absorbed nutrients in runoff, and soil erodibility indices.

3. Erosion rates from the outlet gullies of the four Treynor watersheds were measured over a period of 16 years. These included two 8-year intervals when four different conservation management systems were evaluated for their effect on gullying. Although gully erosion rates on the two control watersheds averaged 45 percent less for the last period, 1972-79, the data clearly shows a reduction in gully erosion rate for all four conservation management systems--grass, conventional level terraces, conservation tillage, and conservation tillage with double-space terraces and underground drains. Scarp migration since 1945 in a reach of Keg Creek, Pottawattamie County, has exceeded more than a mile since 1945. Based on representative cross-section measurements, the channel voiding rate was 92,000 tons per mile, or 0.5 ton/yr per ft. of channel.

For additional information contact R. F. Piest, Acting Research Leader, USDA-SEA-AR, North Central Region, Watershed Research Unit, 207 Business Loop 70 E, Columbia, MO 65201.

SCIENCE AND EDUCATION ADMINISTRATION

MINNESOTA

1. Current research at the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, is on the local scour caused by a cantilevered spillway or culvert pipe discharging onto a bed of cohesionless sand. Variables partly investigated are bed material size (d_{50}=0.5, 1, 2, 4, and 8 mm), standard deviation of bed material size (1.2, 1.4, and 1.6), effect of pipe elevation relative to the tailwater elevation (-2, -1, 0, 1, 2, 4, and 8 pipe diameters), and effect of pipe slope. The temperature is maintained constant at 20° C. Dimensionless discharges $Q/\sqrt{gD^5}$ are 0.5, 1, 2, 3, 4, and 5. (Q is the discharge, g is the acceleration due to gravity, and D the pipe diameter.) The flow is interrupted and the scour hole is measured at 10, 31.6, 100, 316, 1000, 3162, and 10000 minutes after the beginning of each test.

2. Because the apparatus would otherwise have been idle for lack of a technician, one scour test was allowed to continue to see if it reached a limit. Sediment was still being carried from the scour hole after 14-1/4 months.

3. Current work is on data analyses of the 77 test series and nearly 525 scour holes. The analyses show that the scour hole contours, expressed as a percentage of the maximum depth of scour, can be reduced to a single set of elliptical contours for all 6 discharges, all 7 scour periods, all 5 sizes and 2 gradations of bed material, and all 7 pipe heights if suitable normalizing parameters are chosen. These analyses were limited to those data where the discharges were insufficient to cause "beaching," i.e., excessively widen the surface of the scour hole. The normalizing parameters have been described mathematically. The developed relationships are being checked against the original data to see how well the mathematical model represents the data.

4. An analytical method has been developed that predicts the asymptotic dimensions of the scour hole, that is the scour hole dimensions at infinite time. A paper describing this method was published in the American Society of Civil Engineers Hydraulics Division Journal Vol. 107, No. HY3, March 1981, pp. 327-337.

5. To obtain the maximum disturbed dimensions of the scour hole, 47 tests were made for non-beaching flows in which the bed material suspended in the plume of the jet was removed. These data have been only partially analyzed, but the scour holes are significantly larger than those holes in which the disturbed and suspended material was not removed.

For additional information contact Fred W. Blaisdell, Research Leader, SEA-AR, USDA, St. Anthony Falls Hydraulic Laboratory, Third Avenue SE at Mississippi River, Minneapolis, Minnesota 55414.

SCIENCE AND EDUCATION ADMINISTRATION

MINNESOTA

1. Current research at the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, is on the local scour caused by a cantilevered spillway or culvert pipe discharging onto a bed of cohesionless sand. Variables partly investigated are bed material size (d_{50}=0.5, 1, 2, 4, and 8 mm), standard deviation of bed material size (1.2, 1.4, and 1.6), effect of pipe elevation relative to the tailwater elevation (-2, -1, 0, 1, 2, 4, and 8 pipe diameters), and effect of pipe slope. The temperature is maintained constant at 20° C. Dimensionless discharges $Q/\sqrt{gD^5}$ are 0.5, 1, 2, 3, 4, and 5. (Q is the discharge, g is the acceleration due to gravity, and D the pipe diameter.) The flow is interrupted and the scour hole is measured at 10, 31.6, 100, 316, 1000, 3162, and 10000 minutes after the beginning of each test.

2. Because the apparatus would otherwise have been idle for lack of a technician, one scour test was allowed to continue to see if it reached a limit. Sediment was still being carried from the scour hole after 14-1/4 months.

3. Current work is on data analyses of the 77 test series and nearly 525 scour holes. The analyses show that the scour hole contours, expressed as a percentage of the maximum depth of scour, can be reduced to a single set of elliptical contours for all 6 discharges, all 7 scour periods, all 5 sizes and 2 gradations of bed material, and all 7 pipe heights if suitable normalizing parameters are chosen. These analyses were limited to those data where the discharges were insufficient to cause "beaching," i.e., excessively widen the surface of the scour hole. The normalizing parameters have been described mathematically. The developed relationships are being checked against the original data to see how well the mathematical model represents the data.

4. An analytical method has been developed that predicts the asymptotic dimensions of the scour hole, that is the scour hole dimensions at infinite time. A paper describing this method was published in the American Society of Civil Engineers Hydraulics Division Journal Vol. 107, No. HY3, March 1981, pp. 327-337.

5. To obtain the maximum disturbed dimensions of the scour hole, 47 tests were made for non-beaching flows in which the bed material suspended in the plume of the jet was removed. These data have been only partially analyzed, but the scour holes are significantly larger than those holes in which the disturbed and suspended material was not removed.

For additional information contact Fred W. Blaisdell, Research Leader, SEA-AR, USDA, St. Anthony Falls Hydraulic Laboratory, Third Avenue SE at Mississippi River, Minneapolis, Minnesota 55414.

SCIENCE AND EDUCATION ADMINISTRATION

MINNESOTA

The following research is being conducted at the North Central Soil Conservation Research Laboratory at Morris, Minnesota.

1. A trailer mounted rainfall simulator for infiltration and erosion research has been built and tested. Rainfall is applied continuously through a series of drop forming needles. The simulator allows for a wide range of intensities, from near zero to approximately 200 mm/h. In conjunction with the simulator, an automatic microrelief profilimeter is used to measure soil surface characteristics. This instrument automatically scans points on a 1 cm by 5 cm grid spacing to measure soil surface elevations with a vertical resolution of 1 mm over a 25 cm range. Also, associated with the laboratory is a recording density measuring apparatus (Dynatrol density cell) to continuously monitor sediment concentrations in runoff water.

2. The density of eroded aggregates plays an important role in transport relationships of the erosion process. Comprehensive erosion and chemical transport models, such as CREAMS, which take into consideration the physical characteristics of eroded particles, are quite sensitive to variations in particle or aggregate density. Eroded aggregates of various sizes, collected during runoff events from field plots, were separated into seven size ranges, from less than 63 m to greater than 2000 m. Each size group was passed through a density cell to determine the specific gravity of the aggregates. The density cell was calibrated using various particles with known densities. Values obtained for the density of eroded aggregates were 8 to 20 percent higher than had been previously estimated.

3. The specific processes responsible for the commonly observed reduction in erosion under a crop canopy are being investigated. Simulated raindrops in a 45-foot drop tower, and both time lapse and high speed photography are being used to study drop breakup and changes in velocity and energy after impacting with various types of vegetative canopies.

4. The fact that erosion after soybeans is increased when compared to other crops has been documented as far back as the mid 1930's. Although the reason for this is not known, we have made a series of exploratory tests to try to determine how soybeans effect soil erodibility. Soil physical properties and soil microbiological activity were compared between soil in which soybeans were grown and soil in which corn was grown. Results, for the most part, have been inconclusive, although soil aggregate stability tended to be slightly lower in the soil in which soybeans were grown. Because of the possible effect on aggregate stability, we attempted to determine if mixtures of plant residue extracts and soil water might have an increased wetting effect on soil which would tend to decrease the stability of soil aggregates, allowing them to break down more readily. To test this hypothesis the surface tension of solutions blended with various amounts of soybean and corn residue extracts was measured. Soybean residue was found to be more effective in lowering the surface tension of the solutions than was corn residue. The stability of soil aggregates is currently being measured in solutions containing different concentrations of plant residue extracts.

5. A rainulator was used to apply known amounts of rainfall energy on a set of plots, each 13.3 ft by 35 ft, on which a history of controlled wheel traffic had been established. Standard runoff collection procedures were modified to separate erosion and runoff in the wheel track from that occurring in the non-tracked area. The wheel tracks, while comprising only 22 percent of the total plot area, produced 33 percent of the runoff and 50 percent of the soil loss originating in the plot. The soil surface sealed more rapidly and soil loss rates equilibrated in less time in the wheel tracks than in the non-tracked area. Detailed aggregate analyses of the matrix soil and sediment indicated that, while the wheel tracks contained larger aggregates, these aggregates were less water stable than those in the non-tracked area. Wheel traffic increased the bulk density and decreased the porosity of the surface soil to a depth of about 12 inches.

6. A set of plots has been established to determine the effects on soil erodibility characteristics and the residue erosion control effectiveness of three high sugar crops proposed as biomass energy sources, and to examine the environmental effects of applying by-products of the distillation process (stillage) to the soil. Crops to be tested are corn (as a check), sugar beets, sweet sorghum, and sweet stalk corn, each with two levels of residue management. Background soil loss, runoff, and nutrient loss data have been obtained for the different crops grown for alcohol production. Another set of plots has been treated with different amounts of stillage obtained from a nearby alcohol processing plant.

For additional information contact G. R. Benoit, USDA-SEA-AR, Morris, MN 56267

SCIENCE AND EDUCATION ADMINISTRATION

MISSISSIPPI

Research activities at the USDA Sedimentation Laboratory in Oxford, Mississippi include the following:

1. The seasonal disappearance and volatile loss of toxaphene and DDT from cotton was measured under field conditions of the lower Mississippi River Valley (EPA Experimental Use Permit No. 11312-EUP-6 issued 18 August 1976). Disappearance rates, including volatilization and degradation, were linearly related to the insecticide loads on the cotton plants. Insecticide flux densities (volatilization in g/ha-day) and the insecticide loads on the plants decreased exponentially during the 33-day test period in late August and September. About 90% of the insecticides intercepted by the plants disappeared during this period; 60% of the insecticide load on the plants was lost by volatilization. Daily volatile losses were about 4% of the insecticide load on the plants with 60 to 70% of the mean daily volatile loss occurring between 0600 and 1800 hours when air temperatures and windspeeds were greatest. This study provides additional evidence that post-application volatilization is a major pathway of insecticide transport.

2. Research in cooperation with the North Mississippi Branch Experiment Station on no-till and reduced-till systems for cotton, corn, and soybeans is continuing. Use of cultivation for weed control in no-till planted corn without excessive erosion was reported previously. The same reduced-till system is being evaluated for soybeans and cotton. Other conservation tillage systems being evaluated for erosion control effectiveness are alternating 14- and 26-inch rows, narrow 7-inch rows, and wide 40-inch rows, all for soybeans with minimum tillage. Yield evaluations of tillage for cotton showed 1399 lb/a for conventional-tillage, 1437 lb/a for no-till, and 1572 lb/a for reduced till; these are 3 year average yields of seed cotton.

3. Rainulator tests were conducted in 1980 on duplicate plots with gradually increasing levels of tillage. Surface residues prior to tillage ranged from about 5.4 to 8.1 tons/ha. The tillage treatments reflected the effects of different levels of residue incorporation. Treatments were: (1) disk and do-all cultivation, (2) disk, disk and do-all cultivation, (3) disk, chisel, disk and do-all cultivation, (4) chisel and do-all cultivation and (5) moldboard, plow, disk, and harrow. Data from these studies will be used to define tillage and residue subfactors of the USLE cropping and management subfactors. Other rainulator data from different slopes were used to reduce the USLE slope factor for use on slopes less than 3 percent.

4. Research in cooperation with the SCS on flatland watersheds is continuing. Data collection on a pair of watersheds cropped in cotton on the McWilliams farm have been completed. One of these watersheds, 38.5 acres, with a Sharkey silty clay soil has now been planted in soybeans. Data collected from this watershed will be used for a C-factor comparison with cotton which was previously grown on the same watershed. Two more pairs of small watersheds cropped in cotton are being used to study the effect

of different tillage systems and also natural vs. graded slopes on sediment yield. Average annual sediment yield from a typical Delta flatland watershed of 640 acres was less than 2 t/a. A 100-acre sub-watershed within the 640-acre watershed is being gaged to obtain data on runoff and sediment yield for comparison to develop a simple field sediment yield model based on the USLE and sediment delivery ratios.

5. Survival evaluation of 1976, 1977, 1978, and 1979 plantings of various species of woody vegetation along the toe of several thousand feet of eroding channel banks in Northern Mississippi has shown varying degrees of response. In many cases, the failure of plants to survive without the support of structural materials can be attributed to high velocities along banks and the outside of channel bends. Bank sloughing due to reduction of shearing resistance from saturation, bank slides due to freezing and thawing, and poor unproductive soils are problems experienced with establishing vegetation both with and without the support of structural materials. Generally, a much higher survival rate is experienced where plantings are made in conjunction with the structural materials. Native black willow appears to be superior to the hybrid varieties of willow in both survival and growth. River birch, alders, and water elm show some potential when planted under the right environment. Studies were made of the 1979 plantings of various species of vegetation in different combinations with structural materials on 2,900 feet of formed straight channel bank on Johnson Creek in Panola County near Oxford, MS. Although plant growth was retarded by drought in the 1980 growing season, the survival rate for all the vegetation was considered better than average for the prevailing conditions. A contract was awarded September 26, 1980 for construction of vegetative studies along 2,240 feet of bank along channel bends on Johnson and Goodwin Creeks in Panola Connty. Construction of the Johnson Creek Project was completed January 5, 1981. Completion of the Goodwin Creek Project is scheduled for April 21, 1981. Construction on both projects consists of bank forming with slopes varying from 1:2 to 1:5. Various species of vegetation will be planted on the outside bends in conjunction with different combinations of structural materials. Plantings on the inside bends will be made wihtout the use of structural materials.

6. A series of experiments in the 250-ft test channel defined the sediment transport rates and flow resistance factors for equilibrium flows up to 150 cfs. A preliminary analysis of the data gave higher sediment concentrations and larger friction factors than those predicted by published relationships. The dune heights, as reflected by the standard deviations of the bed surface, relative to the flow depth were similar to those observed in a small flume for the same bed material. The time periods of variations in the sediment concentration were long and apparently coupled to the migration of bed forms down the channel. These long periods require long data records to reliably define the average transport and flow factors for these large-scale flows. An additional test series is planned to extend the record lengths.

7. A report was prepared presenting a symmetrical-range Fast Fourier Transform algorithm for computing the migration speeds and volumetric transport rates of migrating bed forms. This algorithm requires less computer time than an earlier correlation/transform method while giving comparable

results in terms of spectral accuracy.

8. The first phase of the development of a two-dimensional finite-element model for predicting local changes in stage and bed elevations in short alluvial channel reaches has been completed. The model has been used to predict bed scouring around spur dikes, and natural backfilling of small sediment traps. Results from this project have been published in papers presented at international symposiums. A final report has been prepared and submitted to the U. S. Army Corps of Egineers.

9. Experiments on alluvial bed channel flow resistance have been run in a computer-controlled flume equipped for continuous collection and analysis of data on water depths, head losses down the channel, bed configuration generation, etc. A great deal of data scatter was found in the results of these experiments. Nonetheless, an attempt was made to define time-mean alluvial channel resistance functions. Tentative functions could be defined for the subcritical and supercritical flow regimes. These functions related the resistance coefficient to the relative roughness of the alluvial channel bed, and this on the bed configuration height. Although the experimental facility was designed to be used in the study of unsteady flow channel resistance, the experiments successfully performed to date have been confined to constant discharge siutations. A few experiments with discharge increasing with time have been performed, but considerable difficulty has been encountered with sensor failure during these experiments, and the data collected to date has not been analysed and is regarded as deficient in most cases.

10. Row-sideslope erosion research continued on major soils to measure their sediment production rates. Interrill erodibilities and sediment characteristics of five more soils, including 3 major Iowa soils, were evaluated during field studies in 1980. Simulated rainstorms at 4 intensities were applied to row sideslopes of soils in a bare, tilled contition. The Iowa soils--Clarion loam, Tama silty clay loam, and Monona silt loam/silty clay loam--were among the 5 least erodible of the 18 intensively cropped soils that have been studied to date. Only the Mississippi blackland prairie soils--Brooksville silty clay and Leeper clay soils--were less erodible. The Iowa soils were only about half as erodible as Mississippi soils of comparable texture, and the size distribution of sediment eroded from the Iowa soils was much coarser than that from Mississippi soils of similar texture. The lesser erosibility and transportability of the Iowa soils may be attributed to their high organic matter contents and excellent structure.

11. Need for a rainfall simulator capable of applying a wide range of rain intensities to rills or crop rows of considerable length was recognized several years ago. During 1980, one unit was designed, constructed, and tested on a row length of about 10 meters. The overall performance was satisfactory, although numerous modifications, improvements, and additions are needed. Four units are planned, to be capable of applying simulated rainstorms at intensities of less than 10 to above 100 mm/hr to rows to rills up to about 40 meters in length.

12. Rain intensity is a key climatic characteristic that affects soil erosion and runoff. Rates of interrill erosion from row sideslopes have been measured for many soils and for a wide range of soil and cover conditions at rainfall intensities of about 10, 25, 67, and 105 mm/hr following initial rainstorms to standardize field-site moisture conditions. Analyses of the results at the different rain intensities showed that erosion (E) was related to intensity (I) as the power equation, $E = aI^b$ for a wide range of soils and cropping conditions. The exponent b decreased from slightly above 2.0 for soils of low clay content to about 1.6 for soils near 50% clay. For the low-clay soils (silts, silt-loams, loams, and sandy loams), this power equation with b = 2 ($E = cI^2$) fit the data well, and the coefficient c then expressed the relative interrill erodibility of the different soils.

13. Studies have been initiated to describe the channel morphometry of Goodwin Creek, Northern Mississippi. Aerial photographs and channel survey data were used to evaluate channel width, length, sinuosity and thalweg slope. Channel width and depth are highly variable at point locations. Similarly, average widths and depths per reach are variable for Goodwin Creek channel in toto. Field reconnaissance, however, had established 3 distinguishable segments of this creek. Average width-to-depth relations were consistent within each segment but were different between segments. These relations were, in turn, significantly related to sinuosity. Segment differentiation is attributed to the dominant influences of individual valley-fill deposits. Thalweg slope apparently is also influenced by the presence or absence of certain valley-fill deposits and by the occurrence of unusually large bendways (relative to upstream conditions).

14. Seven identifiable valley-fill units regularly crop out in channels of the northern Mississippi bluff line study area. Two additional units have been observed but are not widespread. The regularly occurring units, from oldest to youngest, are (a) consolidated sandstone, (b) bog-type deposits, (c) channel lag deposits, (d) massive silt, (e) channel fill, (f) meander-belt alluvium and (g) post-settlement alluvium. Each individual unit affects over-all stability of channel beds and/or banks. About 135 wood samples from individual units or from contacts between units have been dated by standard ^{14}C analysis. These age relations together with unit properties and distributions fit the record of late-Quaternary paleoclimatic conditions and variable base-level controls. Weathering profiles developed in the massive silt and meander-belt alluvium also fit the paleoclimatic record. The identification of paleoclimatic and base level controls of unit formation indicates that results from the study area may be applicable to a much larger area.

15. Richards equation was solved with a spectral series solution for rain infiltration under changing boundary conditions. Prior to surface ponding, a flux-type condition was employed which was followed by a concentration type condition. During this latter stage, a flux-matching boundary condition was used to describe the movement of the interface between the saturated and unsaturated zones. The solutions yield a general expression for ponding time, wetting front advance, and moisture profile. Infiltration rates beyong ponding include the effect of time-dependent ponding height and saturation depth.

16. Hydraulic similitude modeling of low-drop channel grade control structures is continuing. Tentative design criteria are being formulated from the model test results. The pertinent dimensions of the stilling basin geometry, and the size and location of the baffle pier or plate are all normalized with the critical depth to formulate dimensionless parameters. Results of the tests show conclusively that when the relative drop height, H/Yc (absolute drop height/critical depth) is equal to or less than 1 the structure operates as a low-drop (undular jump). When H/Yc > 1, the structure operates as a high-drop (direct hydraulic jump). Very little energy is dissipated in an undular hydraulic jump when the structure is functioning as a low-drop. Therefore, a baffle pier or plate located in the stilling basin was found to be an effective means of dissipating energy in low-drop structures.

17. Rainfall, runoff, and sediment data obtained during a 33-month study on two small Mississippi Delta watersheds, were processed and preliminary analyses completed. Annual runoff ranged from 75 cm, 43% of rainfall, during a wet year to 35 cm, 28% of rainfall, when rainfall was slightly below normal. Annual sediment yields were higher than anticipated on these flat, 0.2% slope, fields, ranging from 5 to 12 metric tons per hectare. Most of the sediment, about 83%, removed from the fields was clay particles less than 2 microns in size. Nearly all, 98% of the outflowing sediment was less than 16 microns and virtually no sand was removed from the plots.

18. A model representative of in-stream sediment traps, such as those used by the SCS, was constructed in one of the laboratory flumes. Tests were run with dye to determine the flow characteristics, flushing times, and flow detention times for various flow rates and flow depths in the model. Model tests of sediment depositional patterns and sediment trap efficiency await the development of a suitable sediment feeder for fine sediments.

19. Measurements, on a storm basis, of water and sediment inflow and outflow in a small sediment detention reservoir began in 1980. For selected storms additional measurements are being made of water temperature and sediment concentrations at various depths at two locations within the reservoir. The study is designed to provide information on the behavior of fine sediments in small impoundments. Sufficient data for detailed study have not yet been obtained.

20. Instruments were installed to measure and sample runoff from a 7-acre cultivated (soybeans) watershed in the Goodwin Creek drainage basin in North Mississippi. Data collection is scheduled to begin in 1981. Data from this and two previously instrumented small unit-source watersheds will provide data on runoff and sediment yield from single cover areas for development and refinement of hydrologic models.

21. Analysis of the 1976-1979 survey of the Bear Creek aquatic ecosystem revealed that plankton productivity was dependent on temperature, suspended sediments, and nutrients from agricultural runoff. Plankton species present were more dependent upon habitat. Benthic productivity was limited to hardy species which were able to cope with the deposition rates. Benthos species diversity was low, indicating heavily stressed

community structure. Fish studies showed areas with less sediment inflow to have better balance of species and catch, although all fish populations showed degradation.

22. In a cooperative study with the U. S. Army Corps of Engineers, Vicksburg District, collection of sediment and water quality data was continued in 1980 on Lake Chicot, Arkansas. Sediment and chemical loads entering and leaving the lake were monitored on a daily basis. Suspended sediment inflow from the 350 square mile watershed was 309×10^6, 235×10^6, and 1131×10^6 lbs for WY 1977, 78, and 79 with trapping efficiencies for those sediments 68, 56, and 62%. The data are being used in computing sediment and chemical budgets for the lake and are also helping verify mathematical models for predicting sedimentation processes in impoundments.

23. The effects of agricultural runoff products upon aquatic productivity in a large lacustrine system continued to be studied in the two sections of Lake Chicot, Arkansas. One section was subject to heavy sediment inflow while inflow into the other was small and intermittent. Suspended sediments had a dampening effect upon productivity at all levels. The isolated section with low sediment concentrations had higher rates of primary productivity, based on C-14 uptake and chlorophyll a from 1977-1980 showed that algal growth rates and productivity were limited by suspended sediments concentrations of over 30-40 ppm. These data are also being used in the verification of a mathematical model of primary productivity of agriculturally-affected reservoirs. Analysis showed that the older fishes were still concentrating some residual pesticides.

24. An ecological study of five impoundments on small watersheds in Panola County, Mississippi, was begun to determine how runoff from different agricultural habitats (row crop, gullies, pasture) affect farm pond productivity. Runoff sediment concentrations and nutrients were also measured. The project is continuing.

25. Instrumentation of the Goodwin Creek Watershed is progressing satisfactorily. Construction of supercritical flumes for streamflow/sediment sampling is complete. On nine of the fourteen structures instrumentation is complete; the remaining five are in different stages of completion. The instrumentation/electronics packages being installed include water level recorders for headwater and tailwater depths, a Chickasha pumped sediment sampler, a Dynatrol density cell, a recording raingage, thermistors to measure water, air temperature, and soil temperature. At several sites, ground level raingages are being installed in addition to the regular raingage. A central climatological site in the watershed measures solar radiation, relative humidity, barometric pressure, wind speed and direction, and pan evaporation. The data from most of these sites are transmitted back to a receiving computer at the laboratory by VHF radio telemetry. This gives access to the data on a nearly real time basis. Other data types being collected in the watershed include soil moisture, crop growth data such as canopy height and density, farm pond water levels and channel section profiles. The major

use of the data will be testing comprehensive water and sediment transport models developed and under review at the laboratory.

For additional information contact D. G. DeCoursey at the USDA Sedimentation Laboratory, P. O. Box 1157, Oxford, MS 38655.

SCIENCE AND EDUCATION ADMINISTRATION

MISSOURI

Research activities at the Watershed Research Unit in Columbia, Missouri include the following:

Trap efficiency research by the SEA Watershed Research Unit on two central Missouri reservoirs was continued through 1980. Studies were discontinued on Ashland Reservoir and the instrumentation moved to a new reservoir and its sediment basin. This research included the measurement of inflow and outflow on a storm basis. To improve the quality of water stored in small reservoirs, two of the reservoirs are equipped with a bottom-withdrawal spillway to see what effect it has on the water quality in and downstream. This spillway is expected to lower the trap efficiency because it eliminates the "dead" storage below the spillway intake which, in turn, reduces the detention time of storm runoff.

Because of the drought conditions in 1980, only a small amount of runoff occurred in early spring and none after June 1; thus, additional sedimentation data for the year was meager. However, progress was made in adapting the DEPOSITS model as a research tool. It is presently being used to evaluate Brune's C/I curve and to establish a procedure for predicting TE of a bottom-withdrawal reservoir.

For additional information contact R. F. Piest, Acting Research Leader, USDA-SEA-AR, North Central Region, Watershed Research Unit, 207 Business Loop 70 E, Columbia, MO 65201.

SCIENCE AND EDUCATION ADMINISTRATION

NEBRASKA

Research activities at the Watershed Research Unit in Columbia, Missouri include the following:

> Further progress was made in defining changes in the fluvial morphology of Dry Creek Basin, Frontier and Lincoln Counties, Nebraska. Headcutting, as previously reported, has been severe in the valley-bottom gullies of the drainage system. Large quantities of soil are passing through the system; since 1951 more than 30,000 tons were removed by a single advancing scarp. Upland gully erosion in this 20 square-mile drainage basin is also severe, and much arable upland has been voided in 29 years. Much of this material is deposited in the drainage system--depths to 11 feet, although downstream channels have widened considerably in the 29-year interval, and some local scour is still occurring.

For additional information contact R. F. Piest, Acting Research Leader, USDA-SEA-AR, North Central Region, Watershed Research Unit, 207 Business Loop 70 E, Columbia, MO 65201.

SCIENCE AND EDUCATION ADMINISTRATION

NEBRASKA

Research at Lincoln, Nebraska pertinent to research and erosion is conducted on two farms in Stanton County, 100 and 112 miles north of Lincoln. These studies are on Nora and Crofton soils, typical of the lands where undulating topography and slopes are such that terraces cannot be installed and farmed with reasonable effort. Small areas of these lands often contribute major sediment production within a watershed and are of serious concern in the Missouri Valley Loess and Table Land areas.

1. Sediment and water control basins (discontinuous terraces) have been constructed with riser inlets and underground pipe outlets. The basins impound runoff and discharges are controlled through the riser inlets. The basins have selected designs for 2-, 5-, and 10-year frequency storms downslope on each subwatershed drainway. The basins are on terrace spacing and permit parallel row-crop tillage. Runoff in excess of the detention storage and discharge capacity of the underground pipe is discharged as overland flow to the next basin. Each instrumented basin has a water stage recorder to provide a runoff hydrograph of the discharge through a calibrated riser and an orifice plate. Programmed samplers take discrete samples from the pipe discharges at selected time intervals during runoff. Construction of some basins were completed in 1978 and the balance in the spring of 1979. Some basins have received very little sediment, while a couple accumulated more than 600 mm from two rainfall events in 1980. The greatest amount of solids are transported in the initial stage of runoff but decrease after impondment starts and deposition occurs in the basin. Total soil losses are small compared to as much as 20 ton per acre inch of runoff from this field prior to installation of the basins. Farmability of the fields has been improved with savings of time and fuel. Only the backslope of each structure is lost to production which is offset by the elimination of waterways.

For additional information contact Lloyd Mielke, Soil Scientist, SEA-AR-USDA, 121 Keim Hall or LaVerne E. Stetson, Agricultural Engineer, SEA-AR-USDA, Dept. of Agricultural Engineering, University of Nebraska-Lincoln, Lincoln, Nebraska, 68583.

SCIENCE AND EDUCATION ADMINISTRATION

OKLAHOMA

Research activities at the Southern Plains Watershed and Water Quality Laboratory, Durant and Chickasha, Oklahoma, include:

1. Sediment deposition and benthic diatoms were studied in two SCS flood retarding reservoirs in the Little Washita River basin. The average daily sediment deposition was 175 g/m^2 in the more eutrophic pond and 32 g/m^2 in the less eutrophic pond. About 60% of the material deposited in the eutrophic pond was from one storm. Benthic diatoms were examined from artificial substrates placed in each pond. Some 115 taxa, of 28 genera, have been identified. Navicula, Nitzschia, Synedra, and Gomphonema were genera with the most species (seven or more).

2. In a cooperative study with the Wisconsin Department of Natural Resources, cesium-137 concentrations were determined in three sediment profiles from Strum Lake (Trempealeau Co.) and three sediment profiles from Fall Creek Pond (Eau Claire Co.). Sedimentation rates were 2.25 to 2.75 cm/yr in Strum Lake for the period 1954-63 and decreased to 1.0 to 1.9 cm/yr for the period 1964-80. Fall Creek Pond yielded similar differences though actual rates were lower. Present rates of 1.0 cm/yr or less indicate stable upland watershed conditions. Sediment profiles from South Dakota lakes are being collected by the South Dakota Department of Water and Natural Resources.

3. Fifteen sediment samples were collected from oxbow lakes in Bear Creek (Yazoo River Basin) and detailed particle size analyses were made. Four different methods were compared at three SEA-AR locations. The pipette method was used at Oxford, MS: the Sedigraph Analyzer at Chickasha, OK; the Electrozone Particle Data Analyzer at Oxford, MS, and the Microtrak Analyzer at Tucson, AZ. The data have been analyzed and a manuscript is in preparation.

4. Preliminary spectral signatures were obtained from surface water dominated with phytoplankton and compared with signatures from surface waters dominated by sediment. Six experimental ponds at Durant, OK, are being prepared for detailed studies of sediment and phytoplankton dominated systems.

5. In an impoundment where only light is limited, preliminary relationships have been developed. These predict (1) the light intensity as a function of depth, concentration of suspended sediment, and incident solar radiation, (2) the local rate of photosynthesis, and (3) the integral photosynthetic production in the mixed layer in terms of chlorophyll a. The existing lake and reservoir model (RESQUAL) has been improved with graphic routines and preliminary work has begun on modeling phosphorus kinetics.

6. Mutual flocculation of clay and algae was demonstrated in water samples from various impoundments. A filtrable, flocculating agent was found in pure algal cultures and when added to turbid water clarification of the water occurred.

7. Nutrient and sediment discharge measurements were continued through 1980 on 10 cropland, 13 grassland, and 2 mixed use watersheds in different land resources areas of Oklahoma and Texas. Sediment and nutrient losses were greater from the cropland watersheds than from the grassed watersheds. Maximum sediment loss (3327 kg/ha) occurred on cropland watersheds at Bushland; minimum losses (<10 kg/ha) were also at Bushland on grassed watersheds. Maximum total P loss (1.9 kg/ha) was from a blackland watershed at Riesel, TX, and maximum total kjeldahl N loss (6.2 kg/ha) was also from the Riesel cropped watersheds.

8. Instrumentation was completed to measure runoff and sediment discharge from 11 small watersheds within the Little Washita Watershed. Sediment sources represented are gullies, roadsides, wheatland, rangeland, pasture-land and idle land. From incomplete results it appears that gullies and roadsides were the main contributors of sediment during 1980, a year with rainfall 20-30% below average.

9. The percentage of clay particles (<2μ) averaged 1.3 - 1.8 times greater in suspended sediment in runoff than in the surface soils from two Ft. Reno watersheds.

10. The measured sediment yields from 7 cropland watersheds with slopes between 0.2 and 0.68% and slope lengths from 260 to 800 ft were used to determine a fitted length exponent in the USLE. An average exponent was determined for each watershed based on 8 to 9 years record. The average fitted exponents ranged from a -0.25 to a -1.39, in sharp contrast to the exponent value of 0.2 in Handbook 537. The negative exponent became larger as the slope length shortened. Lengths greater than 850 ft would be required to yield a positive valued exponent. LS values indicated high sediment yields for short slope lengths, decreasing values to 400-500 ft lengths, and then an increase with length.

11. The White Clay Lake Watershed, Shawno Co., WI, was resampled in cooperation with the Department of Agricultural Engineering, University of Wisconsin, Madison. Samples were taken on the same transects across fields sampled in 1974. We will determine cesium-137, particle-size distribution and other parameters to assess changes brought about by infield erosion and deposition. We continued cooperative studies with the Missouri SCS by dating (Cs-137 technique) sediments from Wildlife areas on the Grand River in northwest Missouri. Cooperative work was begun with Southern Illinois University and Commonwealth Edison Co. on dating sediment profiles from Pool 14, upper Mississippi River. Dating of sediments collected in the Schuylkill River basin was completed for the Water Resources Division, U.S. Geological Survey, Harrisburg, PA. These sediments were derived from the coal field areas of eastern Pennsylvania and were considerably different in physical character than most sediments.

For additional information contact J. Roger McHenry, Director, USDA, SEA, AR, Southern Region, P.O. Box 1430, Durant, OK 74701.

SCIENCE AND EDUCATION ADMINISTRATION

OREGON

Research activities at the Columbia Plateau Conservation Research Center in Pendleton, Oregon include the following:

1. A permanent erosion site located near the research center has been in operation for three years. The site has plots in a wheat-pea rotation in addition to permanent fallow plots. Findings after 3 years of operation are: 1) the bulk of yearly soil loss and runoff are the result of only 1 or 2 events per year; 2) the subsurface hydrology at this site is of major importance in runoff generation; 3) average soil loss from the wheat-pea rotation and continuous fallow plots has been significantly less than predicated by the USLE despite the fact that November-April precipitation has been 132, 99, and 106% of average for the 3 years of operation; 4) seeding or re-seeding winter wheat under high soil moisture conditions results in soil compaction, reduced infiltration rates and accelerated soil loss.

2. Runoff and soil erosion studies in farm fields require that borders for runoff and erosion plots be placed after all farm operations are finished and just before the winter rainy season. A border installation device, which uses vinyl impregnated canvas as the border material, was developed for easy portage into fields and use without any vehicular traffic in the field. The device is drawn toward the field boundary using a pickup-mounted winch. The border system performed as well as galvanized borders. Operational costs were less, portability was achieved and field disturbance was minimal.

3. A new program of soil erosion research in northeastern Oregon was initiated in 1980. Fully instrumented erosion monitoring plots were installed over a wide geographical area encompassing 5 counties in northeastern Oregon. (Data collection and maintenance of these widely scattered sites is achieved through a cooperative effort by SEA-AR; Snow Survey Section, SCS; and SCS District Conservationists). The data collected thus far show that 86% of the runoff and soil loss events involved frozen soils and 86% also involved snowmelt. Also, preliminary analysis of the data indicate that frozen soils, snowmelt and rain on snow in combination with high dewpoint temperatures were the key mechanisms involved in the soil loss events observed during 1980.

4. Terrace effects on water pollution from soil erosion and sediment have been investigated over the same 5 county area in northeastern Oregon. Significant findings after 3 years of investigation are: 1) measurements at terrace outlets showed 25 to 50 percent less material leaving the terrace than was eroded above the terrace; 2) specific combinations of tillage practice, residue management and terraces can reduce erosion by 50 to 75 percent (1000 pounds or more residue per acre, near contour drilling, and 300 feet or less terrace spacing).

For additional information contact John F. Zuzel or R. R. Allmaras, USDA-SEA-AR, P. O. Box 370, Pendleton, OR 97801.

SCIENCE AND EDUCATION ADMINISTRATION

PENNSYLVANIA

Research activities of the Northeast Watershed Research Center at University Park, Pennsylvania, include the following:

1. Spoil, topsoiled spoil, and natural soil were subjected to simulated rain. Largest erosion losses occurred on the natural soil, largest piping losses occurred on the spoil. Infiltration was a major flow pathway on spoil, runoff predominated on the soil and topsoiled spoil. Settling was more localized on the natural soil, while rock pavement development largest on the spoil, appeared to be a random phenomenon.

For additional information contact Andrew S. Rogowski, USDA, SEA, AR, Northeastern Region, 110 Research Building A, University Park, PA 16802.

SCIENCE AND EDUCATION ADMINISTRATION

TEXAS

Research activities at the Grassland, Soil and Water Water Research Laboratory, Temple, Texas, include the following:

1. The MUSLE was linked to a modification of the CREAMS daily rainfall hydrology model so that tests could be conducted on large complex basins. The modified CREAMS model called SWRRB (Simulator for Water Resources on Rural Basins) allows a greatly expanded spatial scale compared with CREAMS because basins can be subdivided according to land use, soil type, etc. Simple methods for routing water and sediment were deveoped for use in SWRRB. Flow and sediment yield for individual events are routed through streams, valleys, stock ponds, and reservoirs. A new degradation component based on sediment concentration, flow rate, particle size, and travel time was developed to provide for convenient interfacing of a previously developed sediment routing model with SWRRB. The new degradation component appears to give reasonable results with much less input than the stream power degradation component.

   The MUSLE was tested with data from 102 small basins located throughout the U.S. These basins provided a wide range in basin and climatic characteristics and management strategies. In tests using measured runoff data from 59 basins, MUSLE generally gave satisfactory results, but two possible deficiencies were discovered: (1) the LS factor may not be adequate for flat slope basins; and (2) there may be a tendency for MUSLE TO overpredict small storms and underpredict large ones-the runoff energy and P factors need attention.

   In tests with SWRRB simulated runoff the MUSLE results were also generally satisfactory. Since data was collected by reservoir survey for most of these 43 basins, only the accumulated sediment yield was available for testing. Runoff and sediment yield from sheet and rill erosion were simulated for the period of record using SWRRB. Gully sediment yield was estimated by SCS geologists.

For additional information contact J. R. Williams, Hydraulic Engineer, USDA-SEA-AR, Southern Region, P. O. Box 748, Temple, TX 76501.

SCIENCE AND EDUCATION ADMINISTRATION

WASHINGTON

The following research is being conducted by the Land Management and Water Conservation Research Unit at Pullman, Washington:

1. A portable, photographically recording rill meter is being used to measure soil loss from rills from selected field sites at the end of the erosion season. The purposes of the study are to determine (1) the effect of slope length and steepness on soil loss, and (2) the variation of soil loss across the climatic belts of eastern Washington and northern Idaho. The results from this study, initiated in 1973, will be used in developing a second generation adaptation to the Pacific Northwest of the Universal Soil Loss Equation.

2. Runoff plots have been installed on fields in eastern Washington 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) to determine the effect of crop treatments on (a) runoff, (b) soil loss, and (c) nitrogen, phosphorous, and selected herbicides in runoff water; (2) determine the effect of slope length on relative magnitudes of sheet and rill erosion; (3) determine the effect of certain conservation practices on runoff and erosion; and (4) determine potential for residue harvesting for biomass conversion processes. Instrumentation includes frost depth meters to determine the effect of crop treatment on frost depth and subsequent runoff and erosion following periods of frozen soil.

3. A crop management factor evaluation model has been developed for use in the adaptation of the Universal Soil Loss Equation to the Pacific Northwest. The model considers such factors as surface residue, tillage operations, vegetative cover, and soil moisture content prior to and during the winter erosion season.

4. A sediment transport and delivery rate study was conducted on a 27.1 square mile watershed. A PS-69 automatic pump sampler, located near a USGS gaging station, was used to collect suspended sediment samples. Several channel cross sections were measured before and after the erosion season to estimate the amount of channel aggradation or degradation and are used with upland erosion and valley deposition measurements and estimates to calculate delivery ratio. Data from the study are also being used to determine sampling frequency requirements for streams in agricultural watersheds of the Palouse. The study was concluded at the end of water year 1980.

For additional information, contact Donald K. McCool, USDA, SEA, AR, Agricultural Engineering Department, 219 Smith Engineering Building, Washington State University, Pullman, WA 99164.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981 — 341-614/221