Coal Hydrology Bibliography

United States Bureau of Land Management

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COAL HYDROLOGY BIBLIOGRAPHY

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U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
U.S. Geological Survey

Bureau of Land Management
Denver Service Center
Lakewood, Colorado
September 1983
INTRODUCTION

In 1975 the U.S. Bureau of Land Management and U.S. Geological Survey began cooperative coal-hydrology investigations designed to further knowledge about hydrologic processes and improve Federal coal-leasing decisions affecting water resources. Fiscal Year 1984 marks the 10th year of the program. During those 10 years a large quantity of data have been collected, analyzed, and interpreted. A substantial number of publications resulted from this work.

A decision was made by the two agencies in 1982 to compile a bibliography on coal hydrology. This document is meant to serve as a useful reference for land managers, planners, scientists, and regulatory officials involved with coal leasing and water-resources management.

In compiling this bibliography, Geological Survey publication lists, existing Geological Survey bibliographies, and the Water Resources Scientific Information Center (WRSIC) data base were searched for pertinent Geological Survey publications that contained information relevant to the hydrology of a coal area. The WRSIC abstracts were used unedited as received from the WRSIC data base. Also included are reports of the Energy Mineral Rehabilitation Inventory and Analysis (EMRIA) program, coal leasing environmental impact statements and environmental analysis reports, and Bureau of Land Management land-use planning documents containing information about coal hydrology. Only those documents authored by either the Geological Survey or the Bureau of Land Management are included in this bibliography.

Bibliography entries are organized alphabetically by state. A general list of titles, which did not fit into a specific state section, also is included following the state listings. The bibliography covers all the major Federal coal production regions (fig. 1). A list of common abbreviations used in the references is shown in table 1.

To help meet the need for hydrologic information created by the Surface Mining and Reclamation Act of 1977 (Public Law 95-87), the Geological Survey is in the process of preparing a series of reports that broadly characterize the hydrology of coal areas nationwide. These reports, termed Coal Area Hydrology Reports, are being prepared for the coal areas shown in figures 2a and 2b. The current (1983) status of these reports is shown in table 2.

Publications listed in this document are available from the publishing agency, either the Bureau of Land Management or the Geological Survey.

Bureau of Land Management publications should be requested from the following source:

Division of Resource Systems, D-470
Denver Service Center
Bureau of Land Management
Denver Federal Center, Bldg. 50
Denver, CO 80225
Figure 1.—Federal coal-supply regions in the United States.
Table 1.—Common abbreviations and acronyms used in abstracts.

<table>
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<tr>
<th>Abbreviation</th>
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Figure 2a.—U. S. Geological Survey coal areas in the Eastern Interior and Eastern Coal Provinces.
Figure 2b.—U. S. Geological Survey coal areas in the Rocky Mountain and Western Interior Coal Provinces.
Table 2.—Status of U.S. Geological Survey coal area hydrology reports.

<table>
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*Coal areas, shown in figures 2a and 2b, are delineated on the basis of hydrologic-basin boundaries within the major coal-production regions.
Alabama Compilation of Ground Water Quality Data in Alabama
Journal Announcement: SWA6801
All available data on the quality of ground water in Alabama, up to the date of this report, are tabulated to provide information for appraising water supplies in the state and to determine whether water use is impaired. Water-quality information was obtained by various agencies and individuals in Alabama for many years, but much of the information was not published previously. The chemical and physical character of waters, the significance of these properties, and the source of various constituents are discussed. Water-quality requirements for domestic, industrial, irrigation, and recreational uses also are described in detail. A total of 3,692 chemical analyses are tabulated in the report by counties. Radioelement data for 14 sites in the state are compiled in a separate table.

Iron ores, fuels, and fluxes of the Birmingham district, Alabama
With Charles D. The origin of the ores, by E. C. Eckel. Burchard, E. F., and Butts, Charles. 1910 U.S. Geological Survey Bulletin 400, 204 p. Section on fuels and fluxes (p. 170-188) by Butts describes the stratigraphy and physical properties of the principal coal beds of the Warrior Coal Field. It also contains descriptions of geologic sections for the various coal beds. Coking coal analyses and information on mining methods and coal washing are also included.

Warrior coal basin in the Brookwood quadrangle, Alabama

The Warrior coal basin in the Birmingham quadrangle, Alabama

Description of the Birmingham quadrangle, Alabama

Description of the Bessemer and Vannider quadrangles, Alabama

WATER AVAILABILITY AND GEOLOGY IN MARION COUNTY, ALABAMA
Water Availability in Bibb County, Alabama

Causey, L. V., Wahl, K. D., Jefferson, P. J., Harris, W. F., Jr.


Ala. Geol. Survey Map 144, 1978. 16 P., 3 Fig., 2 Plates, 3 Tab.

Journal Announcement: SWRA 1215

The largest sources of water in Bibb County in central Alabama are limestone, dolomite, and sand aquifers, and Cahaba and Little Cahaba Rivers. Potential sources of 0.5 Mgal/d (mil. gallons per day) or more per well are limestone and dolomite aquifers in topographic lows in the northern part of the county; limestone and dolomite aquifers in topographic lows and along faults in the central part; sand and sandstone aquifers in the southern part; and coal. The total average low-flow of all streams in the county is about 1,260 Mgal/d, of which 590 Mgal/d originates within the county. The Cahaba River at Centreville has an average flow of 1,000 Mgal/d and a 7-day low (median annual 7-day low flow) of about 130 Mgal/d. The Little Cahaba River near Utefield has an average flow of 150 Mgal/d and a 7-day low of about 37 Mgal/d. Wells in northern and central parts of the county are rarely drilled deeper than 300 feet. Wells in the southern part of the county generally range in depth from 150 feet in the Cahaba River valley to 800 feet in upland areas. Water from sandstone and sand aquifers is generally soft to moderately hard and generally contains iron in excess of 0.3 mg/l (milligrams per liter). Water from limestone and dolomite aquifers is generally moderately hard to hard and has an iron content less than 5 mg/l. Water in streams is generally soft to moderately hard and has a dissolved-solids content of less than 150 mg/l. The average use of water in Bibb County in 1969 was about 1,400 Mgal/d, which is less than 1 percent of the quantity available. (woodard-USGS)

Correlation of the Parkwood Formation and the Lower Members of the Pottsville Formation in Alabama

Culbertson, W. C., 1963

U.S. Geol. Survey Prof. Paper 450-E, pp. 47-50

Describes the correlation of lower members of the Pottsville Formation and redelineates the top boundary and extent of the Parkwood Formation. Illustrates columnar sections and their locations.

Geology and coal resources of the coal-bearing rocks of Alabama

Culbertson, W. C., 1964


Estimates coal reserves in Alabama and describes the stratigraphy of the coal-bearing rocks. Includes maps showing the location of coal beds in the warriors, Cahaba and Coosa coal fields.

Geology and Water Availability of Cullman County, Alabama

Faust, R. J., Jefferson, P. J.


Ala. Geol. Survey Map 145, 1980. 30 P., 4 Fig., 3 Plates, 3 Tabs. 13 Refs.

Journal Announcement: SWRA 1405

The Pottsville Formation of Pennsylvanian age underlies most of Cullman County in northern Alabama. It consists mostly of interbedded sandstones and shales that dip southward about 40 feet per mile. The bangor limestone of Mississippian age underlies the Pottsville and is crossed in a few valleys along the northern boundary of the county. The principal source of ground water in the county is the Pottsville formation. Sandstones of the Pottsville formation underlaying low topographic areas will yield as much as 200 gal/min (gallons per minute) to individual wells 200 feet deep or less. Cypress Creek, a stream on the county line, is the principal stream in the county. The average use of water in Cullman County in 1965 was about 1,500 Mgal/d (mil. gallons per day), which is about 5 gal/min. The average yield of streams in the county is about 150 Mgal/d (mil. gallons per day). The county is drained by tributaries of the Tennessee River. Water from coal aquifers is generally suitable chemical quality for most uses. Water from sand and sandstone aquifers is generally soft to moderately hard...
Mulberry Fork is the only stream in and adjoining Cullman County that have median annual 7-day low flows that exceed 2 mgd. Chemical analyses of water in the county indicate the water is suitable for most uses, but iron concentrations in ground water exceed 0.3 mg/L (milligrams per liter) in many places. Water use in Cullman County was estimated to average 5.6 mgd in 1967. (USGS)

Hydrologic Assessments, Eastern Coal Province Area 24, Alabama
Journal Announcement: SWRA1424
The Eastern Coal Province is divided into 24 separate hydrologic reporting areas. The division is based on hydrologic factors, location, size, and mining activity. Hydrologic units (drainage basins) or parts of units are combined to form each area. Area 23 is located at the southern end of the Eastern Coal Province, in the Mobile River basin, includes the Warrior, Cahaba, and edges of the Plateau coal fields in Alabama, and covers an area of 6,716 square miles. It is underlain by the Coker and Pottsville Formations and the pre-Pennsylvanian rocks. The Pottsville Formation contains coal beds and is overlain by the Coker Formation in the western and southern parts of the area. The pre-Pennsylvanian rocks crop out in two northeast-southwest trending belts or ridges along and near the eastern boundary where folding and faulting is common. The outcrop of rocks along the western ridge forms the divide between the Warrior and the Cahaba coal fields. Hydrologic problems relating to surface mining are: (1) erosion and sedimentation, (2) decline in ground-water levels, and (3) degradation of water quality. Average annual sediment yields can increase by four magnitudes in surface runoff areas from 20 tons per square mile per year near affected by mining to 300,000 tons per square mile per year from mined areas. Sediment yields increase drastically when vegetation is removed from the highly erosive soils and from uncontrolled surface mining operations. Decline in ground-water levels can occur in and near surface mining areas when excavation extends below the static water level in the aquifer. (USGS)

Hydrology of Area 24, Eastern Coal Province, Alabama
Harkins, J. R., 1981
Discusses the hydrology of "Area 24", which includes a small part of the Plateau coal field. Sections describe and illustrate water quality, geology, soils, lands use, and data sources. Prepared to provide general information to the coal industry and Federal and State regulatory agencies.

Hydrology of Area 24, eastern Coal Province, Alabama and Georgia
Harkins, J. R. and others, 1981b
Discusses the hydrology of "Area 24", which includes all of the Coosa coal field and the eastern Part of the Plateau coal field. Sections describe and illustrate water quality and quantity, geology, soils, land use, and data sources. Prepared to provide general information to the coal industry and Federal and State regulatory agencies.

Surface-Water Availability, Etowah County, Alabama
Harkins, J. R., Geological Survey Tuscaloosa, AL.
Alabama Geological Survey Map 108, 1972, 6 Figs, 1 Map, 1 Tab.
Journal Announcement: SWRA0716
Basic information on the surface-water resources of Etowah County, Alabama is presented in a map so that a quick visual appraisal of water availability can be made. The streams of Etowah County potentially will provide moderate to large supplies of water for municipal, industrial, and other uses. Two streams, Coosa River and Big Will Creek, are capable of yielding 10 MGD without storage, with storage streams draining areas in excess of 10 sq mi. The Coosa River has a runoff of 5,480 MGD where it enters the county and 6,200 MGD where it leaves the county. Water in the county, in general, is relatively low in total dissolved solids, of good chemical quality, and is suitable for most uses. (KNAP-USSG)

Surface-Water Availability, St. Clair County, Alabama
Harkins, J. R., Geological Survey University, AL.
Water Resources Div.
Alabama Geological Survey Map 148, 1980, 10 p, 4 Figs, 1 Tab.
Journal Announcement: SWRA1405
The Coosa River, the largest source of water in St. Clair County, has an average flow of 602 mgd (million gallons per day) where it enters the county and 8,500 mgd where it leaves the county. It is divided into the upper and lower sections, the Coosa River, which extends along the eastern boundary of the county, have average storage capacities of 132,500 and 359,600 acre feet, respectively. Big Canoe Creek, which flows through the northern part of the county, is the largest stream in the county other
then the Coosa River. It has an average flow of 210 Mgal/day at its confluence with the Neely Henry Reservoir. Water in streams in St. Clair County is of good chemical quality and is suitable for most uses. Water in Big Canoe Creek is generally soft to moderately hard. Water in the Coosa River is generally soft. (USGS)

Surface-Water Availability, Franklin County, Alabama

Surface-water resources are described for Franklin County, in northwestern Alabama, in a manner that provides for a quick visual appraisal of surface-water availability. The County has moderate relief and is drained primarily by Cedar and Bear Creeks. Streamflow varies considerably from one season to another. Highest monthly flows are 6 to 10 times greater than average monthly flows. Lowest monthly flows are only one-fourth to one-sixth of average flows. The average annual rainfall of 50 inches provides about 700 mgd of average runoff. The addition of 200 mgd via tributaries to Bear Creek results in a total average streamflow of 900 mgd which is about 300 times greater than actual water use in the county. Runoff from the county area is about 1.1 mgd per square mile. The water in streams generally is of a quality suitable for most uses. Cedar Creek, however, contains hard water (145 mg per liter) during periods of low flow. The temperature of water flowing in streams approximates the mean monthly air temperature and generally ranges from 3 deg C in January to 28 deg C during the summer. Temperatures of water from springs remain almost constant (15 to 17 deg C) throughout the year. (UW0AKB-USGS)

Description of the Stevenson quadrangle, Alabama-Georgia-Tennessee
Hayes, C. W., 1895

Description of the Gadsden quadrangle, Alabama
Hayes, C. W., 1896

The southern Appalachian coal field
Hayes, C. W., 1902

Hydrology of Area 20, Eastern Coal Province, Tennessee, Georgia, and Alabama (Duplicated see Tennessee), Hollyday, E. F., and others, 1982

ACID MINE DRAINAGE IN CANE CREEK BASIN, NEAR OAKMAN, WALKER COUNTY, ALABAMA
HYDE, L. W.
GEOLOGICAL SURVEY OF ALABAMA UNIVERSITY.
GEOLOGICAL SURVEY OF ALABAMA, CIRCULAR 64, 1970, 19 P., 7 FIG., 1 TAB. 3 REF., Journal Announcement: SWRA182.

ACID DRAINAGE RESULTS FROM THE PASSAGE OF WATER OVER AND THROUGH STRATA OR SPOLI PILES THAT ARE HIGH IN SULFIDE MINERALS. THE OXIDATION OF SULFIDE MINERALS IN THE PRESENCE OF WATER FORMS SULFURIC ACID AND RELEASES ITS PRODUCTS TO NEARBY STREAMS. THE IRON SULFIDE MINERALS ARE GENERALLY ASSOCIATED WITH THE HARDER ABOVE AND BELOW THE COAL SEAM, CANEHYDE THROUGHOUT ITS LENGTH OF 14 MILES, CHANGED FROM A NEUTRAL STREAM TO A VERY ACIDIC STREAM, TO A LESS ACIDIC STREAM, AND THEN BACK TO A NEUTRAL STREAM (PH HANES 3.0 TO 3.5). CLOSE CORRELATION BETWEEN LOW STREAM STAGE AND HIGH PH OF THE WATER WAS FOUND. ACIDIC WATER SHORTENS THE LIFE OF ORDINARY METALS AND CONCRETE USED IN CONSTRUCTION. THE WATER IS NOT SUITABLE FOR MUNICIPAL OR INDUSTRIAL USE WITHOUT EXTENSIVE TREATMENT, AND IS UNSATISFACTORY FOR RECREATIONAL USE. TESTS WERE MADE TO DETERMINE THE RESISTANCE OF MATERIALS USED FOR ROAD CULVERTS TO ACIDIC WATERS. CONTROL OF ACID DRAINAGE IS COMPLEX AND OFTEN ECONOMICALLY IMPRACTICAL. NO SINGLE METHOD HAS BEEN ENTIRELY RELIABLE BUT SEVERAL MEASURES ARE PRESENTED.

Coal deposits on Sand and Lookout Mountains, Dade and Walker Counties, Georgia
Johnson, R. H., 1959
U.S. Geological Survey, Preliminary Map

A Summary of Selected Publications, Project Activities and Data Sources Related to Hydrology in the Warrior and Plateau Coal Fields of Alabama
Kidd, Robert E., and Hill, Thomas J.
U.S. Geological Survey Open-File Report 82-913

The report is a reference source on hydrologic information related to coal-mining activities in the Warrior and Plateau coal fields of Alabama. It contains an bibliography of more than 200 references and selected annotations. Also included is information on maps, automated-data bases, water-monitoring programs, and data-source agencies and organizations.

Water Availability of Jefferson County, Alabama

The average annual precipitation in Jefferson County, Alabama, is 2000 mm.
is about 53 inches or about 2,820 mgd (million gallons per day). About 1,130 mgd runs off directly into streams, and the remaining 1,920 mgd replenishes soil moistens to underground reservoirs. Potential sources of ground water are limestone, dolomite, sandstone, and chert aquifers. Wells developed in these aquifers may produce as much as 0.5 mgd per well. In some areas, wells developed in limestone, dolomite, and chert aquifers may produce more than 0.5 mgd per well. Water from the limestone and dolomite aquifers generally is moderately hard and contains iron in excess of 0.3 mg/liter and has a median value of 150 mg/liter dissolved solids. Water from the sandstone aquifer generally is soft to moderately hard, contains iron in excess of 0.3 mg/liter, and has a median value of 210 mg/liter dissolved solids. Potential sources of surface water in Jefferson County are the black Warrior and Cahaba Rivers, Locust Fork, and Valley Village. Fifemile, Shores, and Turkey Creeks. Average flows at the mouth of these streams are 1,130 mgd per day, where the stream leaves the county are 4,470, 250, 1,230, 360, 100, 120, 100x, and 90 mgd. (Woodard-USGS)

Surface-water availability, Tuscaloosa County, Alabama

Knight, A. L.; Davis, M. E.,


Alabama Geological Survey Map 139, 1980. 12 p. 3 Figs. 1 Tab. 13 Ref.

Journal Announcement: SWA1405

The average annual runoff, about 1,270 Mgal/d (million gallons per day), originating in Tuscaloosa County, Ala., is equivalent to 20 inches or 0.95 Mgal/d per square mile. The black Warrior and Slipsy Rivers, the largest streams in the county, have average flows of 525 Mgal/d and 580 Mgal/d, respectively, where they leave the county, and median annual 7-day low flows in excess of 150 Mgal/d and 55 Mgal/d respectively. North Fork, Big Sandy Creek, and Hurricane Creek have average flows in excess of 100 Mgal/d and median annual 7-day low flows in excess of 2 Mgal/d. Surface water generally contains less than 100 mg/l (milligrams per liter) dissolved solids, less than 10 mg/l chloride, and is soft to moderately hard. Streams having the highest hardness and the higher dissolved-solids content are in eastern Tuscaloosa County. (USGS)

Water and Related Problems in Coal-Mine Areas of Alabama

Knight, A. L.; Newton, J. G.,


Available from the National Technical Information Service, Springfield, Microfiche, Water-Resources Investigations 76-130, April 1977, 51 Dr. 22 Figs. 1 Tab. 36 Refs.

Journal Announcement: SWA1103

Water-resource problems or potential problems in Alabama resulting from surface and subsurface coal mining include erosion and sedimentation, flooding, diversion of drainage, decline in water level, land subsidence, and the degradation of water quality. The degradation of water quality is the most serious and widespread coal-mine related problem in Alabama. The chemical quality of water in numerous streams draining coal-mine areas has been altered drastically. The pH of water draining from mine areas commonly ranges from 2.1 to 5.0, generally has high sulfate and dissolved solids concentrations, is hard to very hard, and may contain objectionable amounts of iron. The detrimental quality of water in some streams may persist for decades after mining has ceased. Without proper safeguards, additional mining may cause significant deterioration in the quality of water in major streams where the more mineralized mine waters are now diluted. (Woodard-USGS)

Elements of the Water Resources Situation in Alabama

Knowles, D. B.; Barksdale, M. C.,


Journal Announcement: SWA1620

The water-resources situation in Alabama has many facets ranging from water supply to waste disposal, from floods to droughts, and from navigation to recreation. Within this wide range of topics two common elements have been selected for consideration--factors intimately related to the hydrologic cycle and significant areas wherein the knowledge and data are inadequate. A discussion of the hydrologic cycle provides a background of understanding. This is followed by a discussion of the types of data and studies that are required for a better understanding of water-related problems with recommendations for needed supplemental or additional studies. Most water-resources problems relate in one way or another to the availability of water. Problems of water supply cover much of the water-resources field and are not restricted to the availability of water for domestic, industrial, or agricultural purposes. Under this concept, water for operation of navigational locks, control of floods, and disposal of a bauxite or foam support of fisheries all become water-supply problems. It is in this broader sense that water-supply problems and the knowledge and data needed for their solution are discussed. (See also WJ3-12315) (Woodard-USGS)


Water resources data for Alabama were presented in generalized areal form for the entire state. Maps delineating counties, population distribution, physiographic provinces, and river basins were presented. Other maps indicated the variability of
Drift on by the construction of the Tennessee-Tombigbee Waterway were presented. The study area includes all of Sumter County, Greene County, and Coffee. Data presented in those reports on groundwater are available and should encourage economic development. Sand and gravel are available for construction; abundant chalk and clay are available for use as lightweight aggregate. Energy sources in this area have not been fully developed, a coal-fired stream plant provides electricity to surrounding areas and a narrow band of lignite that has not been developed occurs in Sumter County. This area has the potential to become more productive; therefore, information was provided on the area's positive characteristics and its limiting factors were enumerated so that development will be accomplished in an orderly and efficient manner.

Environmental Geology as an aid to urban and industrial growth in Northwest Alabama

Moser, Paul H.
Alabama State Geological Survey, Tuscaloosa,

Journal Announcement: SWRA0317

With population increases in this country, urban and industrial expansion is anticipated as being quite dramatic. The role of environmental geology in contributing to the necessary planning is discussed with attention directed toward indicated problems in northwest Alabama. The results of the investigations are envisioned as furnishing planners with a comprehensive, detailed, practical analysis which can be used as an orderly urban and industrial growth. Lauderdale, Colbert, and Franklin Counties were the site of the first environmental investigations. A brief outline of which is Included. Information concerns hydrology, associated resources, engineering, and geology. Quantities of potential surface and groundwater are mentioned, and discussion is given to the quality (expressed in terms of chemical and physical characteristics) of the water. The use of such data in planning, in the muscle shoals area, is briefly described in terms of population concentration. Three roughly drawn areas are seen from a geologic and hydrologic viewpoint, and detailed geologic maps are indicated as being available and extremely valuable in planning. In the muscle shoals area, it is concluded, 8% per cent of the slopes are gentle enough to prevent no difficulties for any type of planning. Finally, the importance of engineering capacity is discussed. The bearing capacity of the soil is mentioned because it determines types and sizes of footings necessary. For various kinds of construction, in this regard is consideration of flood plains, drainages, soil classifications, mapping of sink holes, and soil thickness.
Acid mine drainage in the Appalachian Region. J. J. Schneider, W. J. and others. Water Resources in the Appalachian Region, Pennsylvania to Alabama. 1965


Gives brief discussion of acid mine drainage. Map shows coal fields and two categories of streams: Those containing free mineral acid and acid-producing salts, and those influenced by mine drainage but seldom containing free acid or acid-producing salts.

WATER AVAILABILITY OF KARENGO COUNTY, ALABAMA

NEWTON, J. G.; MCCAIN J. F.; KNIGHT, A. L.

GEOLOGICAL SURVEY TUSCALOOSA, ALA.

ALABAMA GEOLOGICAL SURVEY MAP 98, 1971, 17 P., 3 FIG., 1 MAP.

Journal Announcement: SWRA910

LARGE SUPPLIES OF WATER ARE AVAILABLE FOR USE IN KARENGO COUNTY, ALABAMA, OF THE AVERAGE ANNUAL RAINFALL OF ABOUT 52. 990,000 ACRE FEET PER YEAR OR AN AVERAGE OF ABOUT 0.8 MGD PER FORMATION IN THE NORTHERN PART OF THE COUNTY AND THE TUSCALOOSA SAND AND NAPANALLA FORMATION IN THE SOUTHERN PART. THE EUTAN WILL YIELD 1 MGD PER WELL AND THE TUSCALOOSA AND NAPANALLA 0.1 TO 0.5 MGD PER WELL. IN NORTHERN AND SOUTH-CENTRAL PARTS OF THE COUNTY, WATER IN AQUIFERS IS HIGHLY MINERALIZED, HAVING A CHLORIDE CONTENT THAT EXCEEDS 1,000 MG/L. THE PRINCIPAL STREAMS IN THE NORTHERN PART OF THE COUNTY, THE AVERAGE 6-270 MGD; IN THE SOUTHERN PART 5-800 MGD AND THE BLACK WARRIOR WAND GENERALIY HAS A DISSOLVED SOLIDS CONTENT OF LESS THAN 125 MG/L. (WOODARD-USGS)

Water Availability and Geology of Walker County, Alabama

O'NEAL, D. M.; WAHL, K. D.; JEFFERSON, P. D.

Geological Survey Tuscaloosa, Ala.

Alabama Geological Survey University Map 120, 1972, 21 P., 3 FIG., 2 PLATES, 5 TABS. 12 REF.

Journal Announcement: SWRA2815

The largest quantities of groundwater in Walker County, Alabama, are obtained from sandstone beds in the Pottsville formation, which generally yield less than 50 gallons per minute to very soft and suitable for most uses except locally where the iron and bicarbonate concentrations may be objectionable or where the water is excessively hard. The coker formation is tapped by only a few wells in the county, and the alluvium in the Black Warrior basin of the Black Warrior River provides a limited amount of water to only a few wells. The water is generally reported to be soft and satisfactory for domestic use. Parks of two large reservoirs are in Walker County--Leeds Smith Lake, with a total storage of 1,670,700 acre-feet, and Bankhead Reservoir, with a total storage of 94,100 acre-feet. Blackwater Creek near Manchester has an average flow of 196 mgd. The chemical quality of water in streams in Walker County is relatively uniform and the water should be suitable for most uses. Water use in Walker County was estimated to be 8 mgd in 1966. Groundwater sources are estimated to supply about 15 percent of the water used in the county. (Knapp-USGS)

Flood Frequency of Small Streams in Alabama

ULLI, A.; BINGHAM, R. H.

Geological Survey, University, AL. Water Resources Div.

Journal Announcement: SWRA2209

Equations have been developed for estimating future floods for 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals on natural streams in Alabama with drainage areas of 1 to 15 square miles. One equation for each recurrence interval applies statewide. The equations were developed by multiple regression analysis of flood magnitudes obtained from both observed peak discharges and synthetic discharge data generated with a calibrated rainfall-runoff model, and physical basin characteristics. The regression analysis indicated that drainage area and main channel slope are the most significant basin characteristics affecting flood frequency and magnitude. Those characteristics of each basin can generally be determined from topographic maps. (Woodard-USGS)

Effect of Surface Coal Mining on the Hydrology of Crooked and Turkey Creek Basins, Jefferson County, Alabama

PLUE, E. J.; NEWTON, J. G.


Geological Survey Water Resources Investigations 79-91, 1979, 39 P., 18 FIG., 5 TABS. 21 REF.

Journal Announcement: SWRA1320

Streamflow and water quality were monitored from October 1975 through May 1977 to determine the impact of surface coal mining on the hydrology of Crooked and Turkey Creek basins in Jefferson County, Alabama. The basins are in the northeast part of the Warrior coal field, Coal is and has been mined from the Blue Creek, Mary Lee, and Newcastle coal beds in the Mary Lee group. Results show water-quality degradation, increased sediment yields, and increased low flow in most tributaries draining mined areas. The impact of mine drainage and sediment yield from mined subbasins on water in the main stem...
of Turkey Creek was small due to the alkalinity of the water in the creek and to dilution ratios that ranged from 1:30 to 1:300. Mine drainage has affected the quality of water in Crooked Creek. The dissolved solids concentration in water downstream from the mined area was as much as twice greater than that in water in unmined parts of the basin. The sediment yield to Crooked Creek was lower in the mined area than in the unmined segment of the stream. The lower yield is due, in part, to the trapping of sediment in sediment ponds in the mines and in a swamp downstream from the mines. (USGS)

Hydrology of Selected Basins in the Warrior Coal Field, Alabama—A Progress Report
Puentes, C. J.; Newton, J. G.; Hill, T. J.

Hydrology of potential mining areas in the Warrior Coal Field, Alabama
Puentes, Celsa and Newton, J. G., 1981

Assessment of hydrologic conditions in potential coal-lease tracts in the Warrior coal field, Alabama
Puentes, Celsa, Newton, J. G., and Bingham, H. H., 1981

The hydrology of four potential coal-lease tracts in the Pottsville Formation are assessed. Local and regional data are used to describe streamflow characteristics, surface-water quality, and ground-water availability and quality. Climatic, physiographic, and hydrologic data were analyzed by regression analysis to derive estimates of specific conductance and other constituents such as hardness, dissolved solids, and sulfate loads. Impacts that will result from future mining are defined, and methods are used to estimate these impacts on surface water quality are described.

Hydrology of Area 6, Eastern Coal Province, Pennsylvania, Ohio, and West Virginia. (Duplicated see Ohio, Tennessee, and West Virginia)

Roth, D. K.; Engelke, M. J., Jr., and Others, 1981

Water Availability, Shelby County, Alabama

Journal Announcement: SWRA1405
The largest sources of ground water in Shelby County, Ala., are limestone and dolomite aquifers which are potential sources of about 0.5 Mgal/d (million gallons per day) per well. The most favorable well sites are in valleys or low topographic areas and their lower reaches in the county are each capable of providing water at the rate of 10 Mgal/d or more without storage. The county has an average annual precipitation of 54 inches of...
which about 20 inches runs off in streams. The 20 inches of runoff is equivalent to 800 Mgal/d or 1.0 Mgal/s per square mile. Ground water is of suitable chemical quality for most uses, but water from some sources may be objectionable for certain uses because of hardness or iron content. Surface water is of suitable chemical quality for most uses, but water use in the county in 1969 was estimated to be 5.6 Mgal/d, which is insignificant when compared to the total available supply. (USSG)

Methodology for Hydrologic Evaluation of a potential surface mine

Show, L. M., and Others, 1982
Lobolly branch basin Tuscaloosa County, Alabama, 93 P, W D 82-50

WATER RESOURCES AND GEOLOGY OF WINSTON COUNTY, ALABAMA
Wahl, K. D.; Harris, W. J.; Jefferson, P. O.
GEOLGICAL SURVEY, UNIVERSITY, ALA.
ALABAMA GEOLOGICAL SURVEY HULTETIN 97, 1971. 51 P, 10 FIG, 6 PLATE, 7 TAB 25 REF.
Journal Announcement: SWRA0519

WATER RESOURCES DATA FOR WINSTON COUNTY, ALABAMA, SHOW QUANTITY AND QUALITY OF SURFACE AND GROUNDWATERS AS RELATED TO THE GEOLOGY AND WATER USE. THE BANGOR LIMESTONE AND THE POTTSVILLE FORMATION ARE THE TWO MAJOR SOURCES OF GROUNDWATER. THE BANGOR LIMESTONE CONSISTS OF ABOUT 400 TO 550 FEET OF LIMESTONE AND SHALE, WATER-BEARING OPENINGS OCCUR PRIMARILY IN THE UPPER 25 TO 50 FEET, WHICH IS A POTENTIAL SOURCE OF 25 TO 50 GPM. WATER FROM THE BANGOR GENERALLY IS MODERATELY HARD TO HARD AND LOW IN IRON CONTENT. THE POTTSVILLE FORMATION CONSISTS OF 1,200 FEET OF SANDSTONE, SHALE, AND COAL, INDIVIDUAL WELLS PRODUCE FROM LESS THAN 5 TO ABOUT 750 GPM. THE WATER RANGES FROM SOFT TO HARD AND IS OF GOOD CHEMICAL QUALITY EXCEPT IN PLACES WHERE THE IRON CONTENT MAY BE OBJECTIONABLE. MOST OF THE STREAMS DRAINING WINSTON COUNTY ORIGINATE WITHIN THE COUNTY. THE AVERAGE FLOW INTO LEWIS SMITH LAKE IS APPROXIMATELY 670 MGD. SIPSEY FORK, THE LARGEST ARM, HAD A MAXIMUM RECORDED FLOW OF 46,400 CFS NEAR FALLS CITY. THE TOTAL USE OF WATER IN WINSTON COUNTY DURING A PEAK DEMAND PERIOD WAS ABOUT 1.2 MGD IN 1965. GROUNDWATER SOURCES SUPPLY ABOUT 75% OF THE WATER AND SURFACE WATER SOURCES ABOUT 25%. (WOODARD-UGS)

GEOLOGIC MAP OF WALKER COUNTY, ALABAMA
Wahl, K. D.; O 'ReaR, D. M.
GEOLOGICAL SURVEY, TUSCALOOSA, ALA.
ALABAMA GEOLOGICAL SURVEY, UNIVERSITY, MAP 123, 1972, 1 SHEET.
Journal Announcement: SWRA0815

THE GEOLOGY OF WALKER COUNTY, ALABAMA, IS SHOWN ON A MAP SCALLED ABOUT 2 MILES TO 1 INCH. THE ENTIRE COUNTY IS UNDERLAIN BY THE POTTSVILLE FORMATION OF PENNSYLVANIAN AGE. THERE IS A FEW OUTCROPS OF THE COKER FORMATION OF CRETACEOUS AGE IN THE

NORTHWEST PART OF THE COUNTY. STREAM VALLEYS HAVE TERRACE DEPOSITS AND ALLUVIUM. THE POTTSVILLE FORMATION, THE PRINCIPAL AQUIFER IN THE COUNTY, IS 1,000 TO 1,000 FEET THICK AND CONSISTS CHIEFLY OF SANDSTONE AND SHALE. THE POTTSVILLE ALSO CONTAINS BEDS OF COAL WHICH HAVE BEEN MINED THROUGHOUT THE COUNTY. (KNAPP-UGS)

Sediment load of streams in the region, J. Schneider, W. J., and Others, Water Resources of the Appalachian Region, Pennsylvania and Alabama Wark, J. W., 1965
Map showing average annual sediment yield in tons per square mile for north-central Alabama and other regions. Includes brief discussion of sediment load in streams.

MINERALS AND WATER, BUTLER COUNTY, ALABAMA
GEOLOGICAL SURVEY OF ALABAMA, UNIVERSITY, ALA.
GEOL SURV OF ALA INFONSER 36, 37 P, 1967, 5 TAB, 12 REF.
Journal Announcement: SWRA0904

THE WATER RESOURCES OF BUTLER COUNTY, ALABAMA, ARE DESCRIBED AS PART OF A REPORT ON THE GEOLOGY, MINERAL RESOURCES, AND WATER RESOURCES OF THE COUNTY. GROUNDWATER EVALUATION IS BASED ON RECORDS OF 158 WELLS AT 7 SPRINGS. THE PRINCIPAL AQUIFERS ARE SAND BEDS IN THE EUTAW, RIPLEY, AND NANNAPAL SFORMATIONS, AND LIMESTONE BEDS IN THE CLAYTON FORMATION, OF UPPER CRETACEOUS TO CENOZOIC AGE. A MAP AND CROSS SECTION INDICATE MAXIMUM DEPTHS NECESSARY FOR WELLS THAT WILL PRODUCE 0.5 MGD; DEPTHS NEEDED FOR DOMESTIC WELLS ARE ALSO MAPPED. WATER FROM THE RIPLEY FORMATION IS SOFT, AND WATER FROM THE OTHER AQUIFERS RANGES FROM SOFT TO HARD, WITH CHLORIDES, IRON, AND HARDNESS CONTENTS ARE SHOWN ON MAPS. AVERAGE RUNOFF IS 19 IN. OR 0.9 MGD PER SQ MI. MANY OF THE STREAMS IN THE WESTERN PART OF THE COUNTY ARE INTERMITTENT. IN THE NORTHWEST THE WATER IS MODERATELY HARD DURING FLOOD FLOW AND MODERATELY HARD DURING LOW FLOW. IN THE EAST THE WATER IS SOFT DURING FLOOD FLOW AND MODERATELY HARD DURING LOW FLOW. IN OTHER PARTS OF THE COUNTY SURFACE WATER IS SOFT. ALL STREAM WATER HAS LESS THAN 15 PPM CONTENT CHLORIDES. (KNAPP-UGS)

Water Resources Data for Alabama Published annually since 1975.
Water resources data for Alabama consist of records of stage, discharge, and water temperature and quality of streams and stage and contents of lakes and reservoirs; and water levels in wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alabama. (USGS)
This statement assesses impacts of leasing a maximum of 78.27 million tons of marketable Federal coal in 26 tracts in Fayette, Tuscaloosa and Walker Counties, northwest-central Alabama. The coal is in the nearly flat-lying Pennsylvanian Pottsville Formation in the broad, dissected Warrior Coal Field plateau in the Warrior Synclinal Basin. Most tracts are in 1- to 5-mile-square headwater areas of intermittent streams that have eroded steep-sided gorge-like valleys into the plateau, leaving nearly level bottoms between narrow flat ridgetops. Annual runoff is 18 to 24 inches from about 54 inches of annual precipitation. Most of the Federal coal would be mined underground or lowered water levels. Ground water impacts will occur in the vicinity of the mines and will have no significant impact on the regional groundwater system. Mineralization of surface drainage will increase progressively and peak approaching or even exceeding 1,000 milligrams per liter of dissolved solids in 10 to 12 years before beginning its slow return to baseline conditions. Impacts on base flow will be local and long-term and after the accompanying impact on water quality will be positive.
use according to the type of use is discussed, and estimates are given for the amounts used. Water-use categories include domestic, irrigation, livestock, seafood processing, oil and gas development, petrochemical processing, pulp mills, hydroelectric, coal processing, steam electric, mineral processing, sand and gravel mining, and fish-hatchery operations.

(Woodard-USGS)

Hydrologic Reconnaissance of Streams and Springs in Eastern Brooks Range, Alaska—July 1972

Childers, J. M.; Sloan, C. E.; Meckel, J. P.


Basic data report, 1972. 25 p. 20 figs 1 tab. 6 ref.

Journal Announcement: SWRA0622

Estimates of Bankfull Discharge and Maximum Evident Flood Peak Discharge for 68 Streams in Alaska, Based on Field Observations. Flood discharges for 2-year and 50-year average recurrence intervals were estimated for the same sites using regression equations that relate flood discharge to basin physical and climatic characteristics, discharge, temperature, and specific conductance of selected springs were measured during the reconnaissance and water samples were collected for chemical analysis. All but one of the springs discharged from limestone bedrock or associated colluvial and type and has low total dissolved solids. Discharge, at time of measurement, ranged from about 4 to 36 cfs and temperature ranged from about 3 to 90.

(Woodard-USGS)

Bibliography of Reports by Members of the U.S. Geological Survey on the Water Resources of Alaska, 1870 through 1976

Feulner, A. J.; Reed, K. M.


Journal Announcement: SWRA1109

This bibliography lists publications prepared by members of the U.S. Geological Survey and published either by the Survey or by other agencies and organizations between 1870 and the end of November 1976. The titles included are those whose primary topic is hydrology, water resources, or other aspects of water in Alaska. Related subjects, such as geology, included in many of these reports.

(Woodard-USGS)

Effects of Placer Mining on Hydrologic Systems in Alaska—Status of Knowledge

Madison, R. J.


susceptible to pollution by contaminants disposed of or spilled on the alluvial fan. Avalanches may block the creek and cause flooding by directing streamflow into new or abandoned channels. (USGS)

Results of Exploratory Drilling at Point Mackenzie, Alaska, 1981

Patrick L.


Journal Announcement: SWRA1500

The Matanuska-Susitna Borough anticipates industrial development near Point Mackenzie, Alaska. Because little hydrologic information is available for the area, the Borough contracted for the drilling of two test wells. It was found that: both wells penetrated unconsolidated stratified clay, silt, sand, and gravel; each well penetrated a shallow unconfined and deeper confined aquifers; the water levels in the wells rose and fall with the tide; the chemical analyses indicate that the water quality meets the Alaska Drinking Water Standards, except for slightly high levels of manganese and p.i. and the potential for saltwater intrusion should be evaluated as part of future studies. (USGS)

Data from a Hydrologic Reconnaissance of the Beluga, Peters Creek, and Healy Coal Areas, Alaska

Scully, D. R.; Krumhardt, A. P.; Kernodle, D. R.


Geological Survey Open-File Report 80-1206, 1980, 34 p. 1 Fig. 1 Tab.

Journal Announcement: SWRA1412

Data are tabulated from a hydrologic study of the Beluga, Peters Creek, and Healy coal areas in Alaska from July 1975 to June 1979. These include streamflow and water-quality data for all three areas, groundwater data for the Beluga and Healy coal areas, and information from springs in the Beluga coal area. Results of analyses of samples of the benthic invertebrate community in the Beluga area are also included. (USGS)

Hydrologic Reconnaissance of the Beluga, Peters Creek, and Healy Coal Areas, Alaska

Scully, D. R.; Krumhardt, A. P.; Kernodle, D. R.


Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108402. Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-56a, 1981, 71 p. 37 Fig. 17 Tab. 31 Ref.

Journal Announcement: SWRA1510

The Beluga, Peters Creek, and Healy coal areas in Alaska were studied during 1975-1978, with major emphasis on surface-water hydrology and water quality. In the Beluga coal area, mean annual discharge is estimated to range from 2.2 to 3.4 cubic feet per second per square mile of drainage area. The 7-day low flow with a 10-year recurrence interval is estimated to be 0.5 to 0.6 cubic feet per second per square mile. The surface waters are calcium bicarbonate type: have low concentrations of nutrients; and, at times, may contain dissolved iron and manganese in concentrations in excess of U.S. Environmental Protection Agency recommended limits. The pooled diversity index of the benthic invertebrate community ranges from 2.93 to 4.06. No ground-water wells have been drilled in the potential mining areas. Water quality of streams in the Peters Creek area is similar to that of the streams in the Beluga coal area. No attempt is made to define streamflow characteristics in the Peters Creek coal area due to poor correlations with nearby gaging stations. In the Healy coal area, streamflow characteristics are dissimilar between the two major basins studied. Lignite Creek is estimated to have less yield than Healy Creek. Studied tributaries of Healy and Lignite Creeks contain waters with a dissolved solids range of 111 to 636 milligrams per liter and have calcium and bicarbonate or magnesium and bicarbonate as principal ions. Iron and manganese concentrations are high at some times of the year. The concentrations of sodium and chloride increases significantly in the lower reaches of Lignite Creek. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Southeast Alaska

Still, P. J.


Journal Announcement: SWRA1405

This report, which is one of a series of reports for Alaska, lists stations in southeast Alaska at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of southeast Alaska and a table listing the types of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Southeast Alaska

Still, P. J.


Alaska lists stations in southwest Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of southwest Alaska and a table listing the types of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Southwest Alaska
Still, P. J.
Journal Announcement: SWRA1405

This report, which is one of a series of reports for Alaska, lists stations in southwest Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey, included are a hydrologic subregion map of southwest Alaska and a table listing the types of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, Yukon Basin, Alaska
Still, P. J.
Journal Announcement: SWRA1405

This report, which is one of a series of reports for Alaska, lists stations in Yukon Basin, Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey, included are a hydrologic subregion map of Yukon Basin, Alaska, and a table listing the types of data collected and periods of record. (USGS)

Index of Streamflow and Water-Quality Records to September 30, 1978, South-Central Alaska
Still, P. J.
Journal Announcement: SWRA1405

This report, which is one of a series of reports for Alaska, lists stations in south-central Alaska, at which streamflow and water quality data have been collected by the U.S. Geological Survey. Included are a hydrologic subregion map of south-central Alaska and a table listing the types of data collected and periods of record. (USGS)

Index of Surface Water Quality Records to September 30, 1973, Northwest and Arctic Slope, Alaska
Still, P. J.
Open-File report (basic data), 1976. 9 p, 1 fig, 2 tab.
Journal Announcement: SWRA1013

This report includes a map showing the locations of all surface water quality sites in Northwest and Arctic Slope, Alaska, a table listing the types of data collected, and the periods of record to September 30, 1973. (Woodard-USGS)

Index of Surface Water Quality Records to September 30, 1973, South-Central Alaska
Still, P. J.
Open-File report (basic data), 1976. 12 p, 1 fig, 1 tab.
Journal Announcement: SWRA1015

This report includes a map showing the locations of all surface water quality sites in south-central Alaska, a table listing the types of data collected, and the periods of record to September 30, 1973. (Woodard-USGS)

A REVIEW OF WATER RESOURCES OF THE UMIAT AREA, NORTHERN ALASKA
WILLIAMS, JOHN R.
GEOLICAL SURVEY, WASHINGTON, D.C.
GEOLICAL SURVEY CIRCULAR 636, 1970. 8 p, 2 fig, 2 tab, 11 ref.
Journal Announcement: SWRA0409
IN THE UMIAT AREA OF NORTHERN ALASKA, SURFACE-WATER
SUPPLIED FROM THE COLVILLE RIVER, SMALL TRIBUTARY CREEKS, AND LAKES ARE ABUNDANT IN SUMMER BUT LIMITED IN WINTER BY LOW OR ZERO FLOW IN STREAMS AND THICK ICE COVER ON LAKES. A FRESH GROUNDWATER OCCURS IN UNFROZEN ZONES IN ALLUVIUM AND IN THE UPPER PART OF BEDROCK BENEATH THE COLVILLE RIVER AND BENEATH LAKES THAT DO NOT FREEZE TO THE BOTTOM IN WINTER. BRACKISH OR SALINE GROUNDWATER OCCURS IN BEDROCK BENEATH AS MUCH AS 1,055 FEET OF PERMAFROST IN THE ARCTIC FOOTHILLS AND BENEATH 750 TO 800 FEET OF PERMAFROST BENEATH LOW TERRACES OF THE COLVILLE RIVER VALLEY. THE FOOTHILL AREA IS UNFAVORABLE FOR DEVELOPING SUPPLIES OF POTABLE GROUNDWATER BECAUSE OF THE GREAT DEPTH TO WATER, PREDOMINANCE OF BRACKISH OR SALINE WATER, AND LOW POTENTIAL YIELD OF THE BEDROCK. IN THE COLVILLE RIVER VALLEY, SHALLOW UNFROZEN ALLUVIUM BENEATH THE RIVER AND DEEP LAKES WILL YIELD ABUNDANT YEAR-ROUND SUPPLIES OF GROUNDWATER, BUT THE BEDROCK BELOW PERMAFROST YIELDS LESS THAN 10 GALLONS PER MINUTE OF SALINE OR BRACKISH WATER. (WOODARD-USGS)

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA

WILLIAMS, John R.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, US GOVERNMENT PRINTING OFFICE, WASHINGTON, DC, 20402 - PRICE $1.00.

GEOLOGICAL SURVEY PROFESSIONAL PAPER 696, 1970. 83 P., 25 FIG. 4 TAB. 270 REF.

Journal Announcement: SWA121

ALTHOUGH GROUNDWATER IN PERMAFROST REGIONS IN ALASKA OCCURS ACCORDING TO THE SAME GEOLOGIC AND HYDROLOGIC PRINCIPLES PREVAILING IN TEMPERATE REGIONS, SUBFREEZING TEMPERATURES RESULT IN PROFOUND MODIFICATION OF GROUNDWATER FLOW SYSTEMS. FROZEN GROUND IS AN IMPENETRABLE LAYER WHICH: (1) RESTRICTS RECHARGE, DISCHARGE, AND MOVEMENT OF GROUNDWATER; (2) ACTS AS A CONFINING LAYER, AND (3) LIMITS THE VOLUME OF UNCONSOLIDATED DEPOSITS AND BEDROCK IN WHICH LIQUID WATER MAY BE STORED. FROZEN GROUND IN MANY AREAS ELIMINATES SHALLOW AQUIFERS AND REQUIRES THAT WELLS BE DRILLED DEEPER THAN IN SIMILAR GEOLOGIC ENVIRONMENTS HAVING NO PERMAFROST. LOCAL VARIATIONS IN THE THICKNESS, AREAL EXTENT, AND TEMPERATURE OF PERMAFROST DEPEND ON VARIABLE THERMAL PROPERTIES OF EARTH MATERIALS AND ON LOCAL DIFFERENCES IN THE RATE OF HEAT FLOW FROM WITHIN THE EARTH. CLIMATE, TOPOGRAPHY, VEGETATION, GEOLOGY, AND HYDROLOGY. GROUNDWATER OCCURS ABOVE, BELOW, AND LOCALLY WITHIN PERMAFROST. IN THE CONTINUOUS-PERMAFROST ZONE, THE MOST ECONOMICALLY DEVELOPED SOURCES OF WATER ARE IN UNFROZEN ALLUVIUM BENEATH LARGE LAKES AND RIVERS. IN THE DISCONTINUOUS-PERMAFROST ZONE, GROUNDWATER IS PRODUCED LOCALLY FROM SHALLOW AQUIFERS ABOVE PERMAFROST OF OFFSHORE BARS AND SPOILS BECAUSE WATER WITHIN OR BELOW THE FROZEN BEACH DEPOSITS IS SALINE. (KNAPP-USGS)

Summary Appraisals of the Nation's Ground-Water
Water Resources Reconnaissance of the Ouachita Mountains, Arkansas

Albin, Donald R.


Water for domestic and nonirrigation farm use can be obtained from wells nearly everywhere in the Ouachita Mountains, and ground-water supplies as large as 50,000 gpd (gallons per day) often can be developed. In general, the best procedure for developing ground-water supplies in the mountains is to drill wells on the flanks of anticlines (in synclinal valleys) and off the noses of plunging anticlines. Ground water for industrial or municipal use in the area may require treatment for removal of iron and calcium magnesium hardness.

Streams are the best potential sources of water for municipal growth and economic development in the Ouachita Mountains. Although most streams in the mountains occasionally have very little or no flow, with adequate storage facilities they generally are the best sources of supply when water demands approach 50,000 gpd. The streams contain water of excellent quality that chemically is suitable for nearly all uses.

Geology and Ground-water Resources of Bradley, Calhoun, and Ouachita Counties, Arkansas

Albin, Donald R.

U.S. Geological Survey Water-Supply Paper 1779-G

Bradley, Calhoun, and Ouachita Counties comprise an area of approximately 2,000 square miles in south-central Arkansas. The area is in the Coastal Plain physiographic province and is characterized by heavily timbered flatlands and low hills.

The geologic units at the surface in the counties are of Eocene, Pleistocene, and Recent age. Water for domestic and small-farm use can be obtained in and at short distances downdip from the outcrop areas of each of the formations. However, only the Sparta Sand, the Cockfield Formation, the terrace deposits, and the alluvium are major fresh-water aquifers.

The total ground-water use in the counties is approximately 6.1 mgd (million gallons per day). Of this total, about 5.0 mgd is withdrawn from the Sparta Sand, about 0.1 mgd is withdrawn from the Cockfield Formation, and about 1.0 mgd is withdrawn from the terrace deposits and alluvium. Most of the pumpage is concentrated in the vicinity of the major towns and cities. Each of the aquifers is capable of yielding larger quantities of water than presently are being withdrawn from them. However, in a small area near Camden the total pumpage from the Sparta Sand is almost the maximum sustained yield.

The ground water in Bradley, Calhoun, and Ouachita Counties primarily is of the sodium bicarbonate type. Water from the Sparta Sand and the Cockfield Formation is suitable for most municipal, industrial, agricultural, and domestic uses.

Well records, depth-to-water measurements and logs of selected
of generally yield most rock. Arkansas, on from in the river valley can the geographic Center of sites having ground—water recharge at the aquifer since the early 1900's has been mostly for rice irrigation. Total pumping for rice in 1978 was about 1,050,000 acre—feet, of which about 86 percent was pumped from the aquifer west of Crowleys Ridge. Water levels in wells west of the ridge in parts of Poinsett, Cross, and Craighead Counties in 1978 were 75 feet below land surface and declining about 2 feet per year. Digital—model analysis indicated that at the end of 1978 water was being removed from aquifer storage at the rate of $40,000 acre—feet per year, and streamflow, mostly from the Cache River and Bayou DeVieus was being captured at the rate of 430,000 acre—feet per year. Projecting the 1978 pumping rate of 1,460,000 acre—feet per year, the pumping rate would have to be reduced by about 110,000 acre—feet per year by 1990 to sustain sufficient aquifer saturation for water needs through the year 2000 in all parts of Poinsett, Craighead, and Cross Counties west of Crowleys Ridge. (USGS) Hydrology of the Bayou Bartholomew Alluvial Aquifer—Stream System, Arkansas
Broom, M. E., and Reed, J. E., 1973
The study area comprises about 3,200 square miles of the Mississippi Alluvial Plain in southeast Arkansas. About 90

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over the natural recharge rate by constructing wells that will induce recharge from the river. Median values of the principal constituents in water from the alluvium indicate that it is a calcium magnesium bicarbonate water. Local high concentrations of sulfate, chloride, or nitrate are probably the result of water moving from other formations into the alluvium. High concentrations of chloride in the water however, can be the result of influent seepage of river water. The quality of water in the alluvium generally is suitable for domestic and irrigation purposes. The hardness and high content of iron and nitrate however makes the water undesirable for some industrial uses.

Alluvial Aquifer of the Cache and St. Francis River Basins, Northeastern Arkansas
Journal Announcement: SWA1423
The alluvial aquifer underlies about 9,000 square miles of the study area. Well yields from the aquifer commonly are from 1,000 to 2,000 gallons per minute. Flow toward the main area of pumping stress is eastward from the Cache River and westward from the St. Francis River. The Memphis aquifer acts as a conduit through Crowleys Ridge for induced flow from the alluvial aquifer since the early 1900’s has been mostly for rice irrigation. Total pumping for rice in 1978 was about 1,050,000 acre—feet, of which about 86 percent was pumped from the aquifer west of Crowleys Ridge. Water levels in wells west of the ridge in parts of Poinsett, Cross, and Craighead Counties in 1978 were 75 feet below land surface and declining about 2 feet per year. Digital—model analysis indicated that at the end of 1978 water was being removed from aquifer storage at the rate of $40,000 acre—feet per year, and streamflow, mostly from the Cache River and Bayou DeVieus was being captured at the rate of 430,000 acre—feet per year. Projecting the 1978 pumping rate of 1,460,000 acre—feet per year, the pumping rate would have to be reduced by about 110,000 acre—feet per year by 1990 to sustain sufficient aquifer saturation for water needs through the year 2000 in all parts of Poinsett, Craighead, and Cross Counties west of Crowleys Ridge. (USGS)

Hydrology of the Bayou Bartholomew Alluvial Aquifer—Stream System, Arkansas
Broom, M. E., and Reed, J. E., 1973
The study area comprises about 3,200 square miles of the Mississippi Alluvial Plain in southeast Arkansas. About 90

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over the natural recharge rate by constructing wells that will induce recharge from the river.
percent of the area drains south to the Ouachita River in Louisiana.

The alluvial aquifer and the streams are hydraulically connected and are studied as an aquifer-stream system. Bayou Bartholomew is a principal stream of the system.

The aquifer is underlain by confining strata of the Jackson Group and Cockfield Formation. The mean annual surface-water yield of the area that drains to the Ouachita River basin is nearly 2 million acre-feet. Flood-control projects have significantly reduced flooding in the area. Basin boundaries and low-flow characteristics of streams have been altered as a result of the flood-control projects and streamflow diversion for irrigation.

The direction of ground-water flow generally is southward. Bayou Bartholomew functions mostly as a drain for ground-water flow from the west and as a recharge source to the aquifer east of the bayou. As a result of navigation pools, the Ouachita River is a steady-recharge source to the aquifer.

Discharge from the aquifer and streams increased from about 20,000 acre-feet in 1941 to 237,000 acre-feet in 1970. Estimates of flow derived from analog analysis but lacking field verifications indicate that recharge to the aquifer in 1970 was about 161,000 acre-feet. About 70 percent of the recharge was by capture from streams as a result of ground-water pumpage. Discharge from the aquifer was about 233,000 acre-feet. About 80 percent of the discharge was through wells.

Stream diversion in 1970 from capture and open channel, excluding capture from the Arkansas and Mississippi Rivers, was about 110,000 acre-feet. Return flow to streams from rice irrigation and fishponds was about 60,000 acre-feet.

The chemical quality of streamflows is excellent for irrigation. Water from the aquifer generally ranges from permissible to excellent for irrigation. The use of water from the aquifer in the flood-plain area exclusive of irrigation is severely limited unless it is treated to remove the iron and reduce the hardness.


Water-Quality Assessment of the L’Anguille River Basin, Arkansas Bryant, C. T.; Morris, E. E.; Terry, J. E., Geological Survey, Little Rock, AR. Water Resources Div., Available from: OSFS 8X 25425, Fed. Ctr., Denver, CO paper copy 521.75 microfiche $3.50, Geological Survey open-file report 79-1682, 1979, 20 p. 22 fig. 23 Tab. 45 Ref., Journal Announcement: SWRA1311 For several years, dissolved oxygen in the L’Anguille River basin has been reduced to concentrations of less than 5.0 milligrams per liter during the summer and fall. In addition, concentrations of pesticides have been reported consistently at one long-term station on the river and trace metals have been reported at two long-term monitoring sites. The U.S. Geological Survey conducted an intensive study of the L’Anguille River basin during the summer and fall of 1978 in cooperation with the Arkansas Department of Pollution Control and Ecology. An assessment of the general water quality was made; the causes of stream dissolved-oxygen reductions were determined; and the occurrence of pesticides and trace metals in the basin was documented. A steady-state, segmented, dissolved-oxygen model was calibrated and used to project simulated dissolved-oxygen profiles. (Kosco-USSG)


Ground-water levels in Arkansas. Spring 1983 Edds, Joe
GOOD QUALITY SALINE, STREAMS. QUALITY OF FLOW; COUNTY MAGNITUDE LITHOLOGY OF PLATE, 12 TAB, 82 REF., DAILY FLOWS, INFORMATION IS MADE IN OBSERVATION WELLS IN ARKANSAS IN THE SPRING OF 1983. IN ADDITION, THE REPORT CONTAINS WELL HYDROGRAPHS RELATING TO THE ALLUVIUM ALONG THE SPARTA SAND, THE MOST IMPORTANT AQUIFERS WITH RESPECT TO GROUND-WATER AVAILABILITY AND USE IN ARKANSAS.


WATER SUPPLY IN GRANT COUNTY; ITS STORAGE REQUIREMENTS FOR WATER IN GRANT COUNTY AND THE CARRIZO SAND AND THE CARRIZO, SAND AND CARRIZO RIVER IN THE LAKE CATHERINE AREA; AT LOW FLOW, HURRICANE CREEK WATER IS UNFIT FOR MOST USES. WELLS IN THE SPARTA SAND, THE PRINCIPAL AQUIFER, YIELD AS MUCH AS 650 GPM OF SOFT WATER IN GRANT COUNTY. THE CARRIZO SAND AND CARRIZO RIVER FORMATION ARE POTENTIALLY IMPORTANT AQUIFERS IN GRANT COUNTY AND SOUTHEASTERN HOT SPRING COUNTY. WELLS IN THE WILCOX GROUP YIELD AS MUCH AS 700 GPM OF FRESH WATER IN SOUTHEASTERN HOT SPRING COUNTY AND SOUTHEASTERN GRANT COUNTY; IN THE REST OF GRANT COUNTY ITS WATER IS BRACKISH, ALLUVIUM ALONG THE PRINCIPAL STREAMS AND IN CONSOLIDATED ROCKS OF THE OUAHITA MOUNTAINS YIELD SMALL QUANTITIES OF WATER VARIABLE IN QUALITY FROM PLACE TO PLACE, SOME OF THE ALLUVIAL WATER HAS HIGH NITRATE CONTENT AND MAY BE A HEALTH HAZARD, (LARGUSGS)


Ground water in the Springfield-Salem Plateaus of Southern Missouri and Northern Arkansas: (Duplicated see Missouri) HARRISON, C. J. GEOLOGISCAL SURVEY, ROLLA, MO. WATER RESOURCES DIV. AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA 22161 AS PUBL-205635; PRICE CODES: A04 IN PAPER COPY, A01 IN MICROFICHE. GEOLOGICAL SURVEY WATER RESOURCES INVESTIGATION 80-1013, DECEMBER, 1980, 66 P, 25 FIG, 6 TAB, 38 REF.

Journal Announcement: SWRA1420

WATER RESOURCES OF CLAY, GREENE, CRAIGHEAD, AND POINSETT COUNTIES, ARKANSAS HINES, M. S., PLEBACH, R. O., LAMONDS, A. G. GEOLOGICAL SURVEY, WASHINGTON, D.C. AVAILABLE FROM USGS, WASHINGTON, DC 20242 PRICE $1.50 PER SET.

GEOLOGICAL SURVEY HYDROLOGIC INVESTIGATIONS ATLAS HA-377, 1972, 2 SHEETS, 6 FIG, 11 MAP, 7 TAB, 27 REF.

Journal Announcement: SWRA1516

FOURTEEN ILLUSTRATIONS AND TABLES IN THIS 2-SHEET HYDROLOGIC ATLAS DESCRIBE THE WATER RESOURCES OF CLAY, GREENE, CRAIGHEAD, AND POINSETT COUNTIES, ARKANSAS. THE OCCURRENCE, QUANTITY, AVAILABILITY, AND QUALITY OF GROUND AND SURFACE WATER AND THE VARIABILITY IN THESE SUPPLIES ARE DESCRIBED. IN ADDITION, WATER PROBLEMS BURDENSOME TO THE AREA ARE DEFINED AND CORRECTIVE MEASURES SUGGESTED. AVERAGE ANNUAL STREAMFLOW VARY FROM 1.2 CFS PER SQ MI IN THE WESTERN PART OF THE FOUR COUNTIES TO 1.4 CFS PER SQ MI IN THE EASTERN PART. AVERAGE ANNUAL Precipitation IS ABOUT 48 INCHES. USE OF WATER FOR AGRICULTURE GREATLY EXCEEDS ALL OTHER USES COMBINED. IN 1965, 111.4 MGD WAS USED FOR RICE IRRIGATION, AND 71.5 MGD WAS USED FOR IRRIGATION OF OTHER CROPS, AN ADDITIONAL 16.9 MGD TO IRRIGATE COTTON, 4.7 MGD TO IRRIGATE OTHER CROPS, 1.5 MGD TO IRRIGATE CRUPE...
Arkansas
Arkansas

WAS USED BY INDUSTRY, MUNICIPALITIES, AND OTHERS. OF THESE AMOUNTS 180.1 MGD WAS GROUNDWATER AND 19.7 MGD WAS SURFACE WATER, OR A TOTAL OF 199.8 MGD. (WOODBARK-USGS)

GEOHYDROLOGY OF THE COASTAL PLAIN AQUIFERS OF ARKANSAS
HOSMAN, R. L.
GEOLOGICAL SURVEY, WASHINGTON, D. C.


WASTE WATER PRODUCTION AND CHARACTER AND EXTENT OF THE GULF COASTAL PLAIN SYSTEM OF AQUIFERS IN ARKANSAS ARE SUMMARIZED IN THE 1-SHEET HYDROLOGICAL ATLAS CONSISTING OF BLOCK DIAGRAMS SHOWING STRATIGRAPHY AND EXTENT OF AQUIFERS, WATER CHEMICAL QUALITY DIAGRAMS, AND TABLES. THE HYDROLOGICAL CHARACTERISTICS OF THE PRINCIPAL AQUIFERS ARE DESCRIBED IN A SUMMARY OF PUMPING TEST RESULTS IS GIVEN. THE ALTITUDE OF THE BASE OF FRESH WATER IS SHOWN BY A MAP. (KNAPP-USGS)

Jennings, Marshall E., and Bryant, Charles T.

Waste load allocation studies in Arkansas form a central part of the development and implementation of basin water-quality management plans required of Arkansas Department of Pollution Control and Ecology by the Environmental Protection Agency (EPA). This report describes the methodology to be used in Arkansas waste load allocation studies. Steady-state segmented dissolution-box analysis of river-surface-water quality is the recommended basis for waste load allocation studies. A dilution model, based on the mass-balance principle, is used for analysis of stream conservative mineral loads. Data collection and laboratory procedures to support such a modeling effort are discussed.

Discharge Data at Water-Quality Monitoring Stations in Arkansas—published annually since 1975.
Knott, R. K.

Available from the OFS, USGS Box 25427S, Fed. Ctr., Denver, CO 80222.

Discharge data were computed for a network of water-quality monitoring stations operated by the Arkansas Department of Pollution Control and Ecology. Some of the sites are located at U.S. Geological Survey of U.S. Army Corps of Engineers daily-discharge stations, but most sites are at points where discharges are not regularly measured. (USGS)

Arkansas
Arkansas

Time of Travel of Selected Arkansas Streams
Lamb, T. E., 1983
U.S. Geological Survey Open-File Report 82-4068

Travel times of water-soluble materials in a stream is important for stream modeling, pollution studies, and estimating arrival time of contaminants to points downstream from spills. Between 1971 and 1981 time-of-travel and dispersion measurements were made in 15 streams in Arkansas. Most of the streams studied were at or near base flow. Graphs are presented for predicting travel time of solutes in segments of the streams. The relationship of time of passage and peak unit concentration to travel time is presented for two of the streams. Examples of use and application of the data are given.

Water-Quality Investigation of the Vache Grasse Creek Watershed, Sebastian County, Arkansas
Lamb, T. E., 1978

The results of a 1-year study in the upper Vache Grasse Creek watershed are presented to document surface-water quality conditions before implementation of Soil Conservation Service programs. Analysis of samples collected at four sites showed that during periods of warm weather several of the parameters sampled produced unusually high or low values that indicated possible water-quality problems. Low dissolved-oxygen concentration, high nitrogen and organic carbon concentrations, and high coliform bacteria counts were found at sampling sites upstream of the Greenwood water-supply lake. Sampling in and downstream from the lake indicated that the quality of the water passing through the lake was improved significantly. However, sampling in the lake indicated that there is a large layer of water with low oxygen concentration and a buildup of phosphorus, iron, manganese, and some other metals in the bottom ooze.

Water-Quality Investigation of the Tyrone River Watershed, Arkansas
Lamb, T. E.


The results of a 1-year study of surface-water quality in the Tyrone River Watershed, Arkansas, are presented to document conditions before implementation of Soil Conservation Service Programs. The report includes a general description of the watershed's topography, geology, and aquifers, and the results of monthly measurements of discharge at five sites, and several physical and chemical parameters, plus quarterly analyses for several ions and semianual analyses of bottom material for various pesticides. The results indicate that the quality of the water in the streams and ditches samples is normal for an intensely farmed area such as this.
Logs and water-level measurements of selected test holes and wells in the alluvium of the Arkansas River valley between Little Rock and Fort Smith, Arkansas.

Mayo, J. R., and Emnett, L. F., June 1964


Logs and water-level measurements of selected test holes and wells in the alluvium of the Arkansas River valley between Little Rock and Fort Smith, Arkansas.

Mayo, J. R., and Emnett, L. F., June 1964


Chemical analyses of the water from selected wells in the Arkansas River Valley from the mouth to Fort Smith, Arkansas.

Mayo, J. R., Yanchosek, J. J., and Jeffery, H. G., June 1964


Logs of Test Holes and Wells in the Red River Valley in Lafayette, Little River, and Miller Counties, Arkansas.


GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI.

Payne, J. N.


The thickness of the CARRIZO AND MERIDIAN SANDS VARIES FROM 0 IN AREAS OF NODIPPING TO A MAXIMUM OF 700-750 FEET IN DEWITT AND KARNES COUNTIES, TEX. AQUIFER TESTS INDICATE THAT THE COEFFICIENT OF PERMEABILITY INCREASES WITH INCREASE IN SAND-UNIT THICKNESS, BUT THE RANGE IN VALUES IN THE CARRIZO AND MERIDIAN SANDS IS NOT AS GREAT AS THE RANGE IN VALUES FOUND IN OTHER CLAIBORNE AQUIFER FORMATIONS. THE AREAS OF HIGHEST TRANSMISSIVITIY OF THE FORMATIONS ARE IN WEST-CENTRAL MISSISSIPPI AND IN SOUTHERN TEXAS, IN MISSISSIPPI AND TEXAS THE DOMINANT ANION IS BICARBONATE IN WATER FROM THE CARRIZO AND MERIDIAN SANDS FROM DEPTHS OF 1-700 TO MORE THAN 2-500 FEET, IN ARKANSAS AND LOUISIANA, CHLORIDE IS THE DOMINANT ANION BELOW DEPTHS OF 300-1-OU FEET. (WOODARD-USGS)

WATER RESOURCES OF HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS

Ludwig, A. H.

Geological Survey, Washington, D.C.

WATER-SUPPLY PAPER 1968.

The five-county area in southwest Arkansas that consists of Hempstead, Lafayette, Little River, Miller, and Nevada counties possesses abundant water resources. Nearly all water supplies are obtained from groundwater. Surface water is used primarily for municipal supply at Texarkana and for industrial supply at a paper mill near Ashdown. The aquifers of Cretaceous age are the principal sources of fresh water in northern Hempstead and Nevada counties, where wells yield as much as 300 gpm of good quality water from depths as great as 1,200 feet. Aquifers of Tertiary age are good sources of water in Miller and Lafayette counties and in southeastern Nevada County. Terrace deposits of weathered rock are good sources of water in Little River and Lafayette Counties. The Red River is the largest source of surface water in the project area. It drains about 45,000 square miles upstream from the area and has an average flow of 12,180 cfs. The principal reservoirs in the area are Millwood reservoir on Little River (capacity, 1,858,000 acre-feet) and Lake Eurling on Boudaou Creek (capacity, 49,000 acre-feet). More than 5,500 lakes and farm ponds of 5 acres or less have a combined storage capacity of more than 14,000 acre-feet. Water in the Red River is high in chloride and dissolved solids and consequently is chemically unsuitable for most uses unless treated. (WOODARD-USGS)
HYDROLOGIC SIGNIFICANCE OF LITHOFAcies OF THE Cane River Formation or equivalents of Arkansas, Louisiana, Mississippi, and Texas.

PAYNE, J. N.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM GPO, WASHINGTON, D.C. 20402 — PRICE $10.90.
GEOLOGICAL SURVEY PROFESSIONAL PAPER 569-C, 1972, 17 P., 4 FIG., 16 PLATE (BOUND SEPARATELY), 1 TAB, 61 REF.
Journal Announcement: SWRAU679


Reconnaissance of Stormwater-Runoff Water Quality of the Big Piney Creek Segment of the Cedar-Piney Creeks Watershed, Yell County, Arkansas.

Petersen, James E.
U.S. Geological Survey Open-File Report 82-761
A reconnaissance of the Big Piney Creek watershed was conducted between June 1981 and January 1982 to assess the water-quality of selected streams in the watershed. Streamflow was measured for one water sample was collected three times at each of the sites during the study. All samples were collected during periods of stormwater runoff. The water was soft (7 to 20 milligrams per liter calcium carbonate) and dissolved-solids concentrations ranged from 36 to 74 milligrams per liter. Suspended-sediment concentrations ranged from 7 to 144 milligram per liter. The 5-day biochemical oxygen demands, total-nitrogen concentrations and total-phosphorus concentrations ranged from 1.5 to 6.8 milligrams per liter, 0.54 to 5.8 milligrams per liter, and 0.03 to 0.56 milligram per liter, respectively. Fecal-coliform bacteria were present in large enough concentrations at two of the sites (340 to 490 colonies per 100 milliliters and 1,200 to 6,800 colonies per 100 milliliters) to indicate that the U.S. Environmental Protection Agency criterion for bathing waters and the Arkansas water-quality standard may be exceeded at times. Total—iron concentrations greater than 1,000 milligrams per liter (the U.S. Environmental Protection Agency criterion for protection of freshwater aquatic life) were detected at least once at all sites.

WATER RESOURCES OF CLARK, CLEVELAND, AND DALLAS COUNTIES, ARKANSAS.

Plebich, Raymond O.; Hines, Marion S.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM SUPERINTENDENT OF DOC, US GOVERNMENT PRINTING OFFICE, WASH, D.C. 20402. GEO SURV WATER-SUPPLY PAP 1879-A, P 1, FIG. 1 PLATE, 8 REF.
Journal Announcement: SWRAU223

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS.

Plebich, Raymond O.; Hines, Marion S.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM SUPERINTENDENT OF DOC, US GOVERNMENT PRINTING OFFICE, WASH, D.C. 20402. GEO SURV WATER-SUPPLY PAP 1839-A, P 1, FIG. 1 PLATE, 5 TAB, 27 REF.
Journal Announcement: SWRAU223

PULASKI AND SALINE COUNTIES CONSTITUTE AN AREA OF 1,506 SQUARE MILES IN SOUTH-CENTRAL ARKANSAS. THE AREA IS DRAINED BY THE OUACHITA RIVER, AND LITTLE MISSOURI RIVER AND THEIR TRIBUTARIES. THE AMOUNT OF WATER AVAILABLE FOR USE CAN BE INCREASED BY THE CONSTRUCTION OF RESERVOIRS. SECOND PER SQUARE MILE, OR A TOTAL OF ABOUT 3,000 CFS, GENERALLY, THE WATER QUALITY IS GOOD; BUT WATER FROM SOME OF THE STREAMS, PARTICULARLY FROM THE SMALLER TRIBUTARIES, MAY REQUIRE TREATMENT FOR EXCESSIVE IRON CONTENT AND HIGH COLOR. THE CONSOLIDATED ROCKS IN THE INTERIOR HIGHLANDS GENERALLY YIELD LESS THAN 10 GPM TO WELLS, PRECLUDING THE DEVELOPMENT OF LARGE MUNICIPAL OR INDUSTRIAL GROUNDWATER SUPPLIES IN THAT AREA. THE FORMATIONS OF TERTIARY AGE ARE THIN AND HIGHLY CONSOLIDATED, BEYOND THE POSSIBILITIES FOR GROUNDWATER, PARTICULARLY IN DALLAS AND CLEVELAND COUNTIES. THE SPAR ASAND IS THE BEST AQUIFER IN THE PROJECT AREA, PARTICULARLY EAST OF CENTRAL DALLAS COUNTY. WELL YIELDS OF 700 GALLONS PER MINUTE OR MORE ARE POSSIBLE. THE DEPOSITS OF QUATERNARY AGE ARE THIN AND GENERALLY SUITABLE ONLY FOR DOMESTIC SUPPLIES. TOTAL WATER USE IN THE PROJECT AREA IN 1965 WAS ABOUT 0.6 MILLION GALLONS PER DAY SINCE SURFACE-WATER SOURCES. THE TOTAL WATER USE IN THE AREA IN 1967 WAS INSIGNIFICANT COMPARED WITH THE TOTAL WATER AVAILABLE. (KNAPP-USGS)
ALUN FORK, MIDDLE FORK, AND NORTH FORK OF THE SALINE RIVER OFFER EXCELLENT IMPOUNDMENT STORAGE. MANY OF THE SMALLER STREAMS ARE SUITABLE FOR DEVELOPMENT OF SMALL SUPPLIES. IN CONTRAST, IN THE COASTAL PLAIN IT IS EASIER TO DEVELOP GROUNDWATER THAN SURFACE WATER IN RELATIVELY LARGE QUANTITIES. TWO AQUIFERS, UNITS 3 AND 9, YIELD AS MUCH AS 350 AND 2,000 GPM OF WATER, RESPECTIVELY. A THIRD AQUIFER, UNIT 7, IS AS YET RELATIVELY UNDEVELOPED IN THE PROJECT AREA, BUT YIELDS 860 GPM TO A WELL SOUTH OF THE PROJECT AREA. THESE AQUIFERS FIELD WATER THAT, WITH TREATMENT, IS SUITABLE FOR MOST USES. (KNAU-UGS)

Digital Model of the Bayou Bartholomew Alluvial Aquifer-Stream System
Reed, J. E., and Broom, M. E., 1979

A digital model of the aquifer-stream system was calibrated for the purpose of predicting hydrologic responses to stresses of water development. The simulated time span for model calibration was from 1955 to 1972. During which time the system was stressed largely by ground- and surface-water diversions for rice irrigation. The model was calibrated by comparing ground-water-level and streamflow data with model-derived ground-water levels and streamflow. In the calibrated model, the ratio of model-derived to observed streamflows for 17 subbasins averaged 1.1; the ratios among the subbasins ranged from 0.8 to 1.6. The average deviation of the differences between model-derived and observed ground-water levels at 47 nodes was 0.25 the average among the nodes ranged from 21 to 104. The average standard deviation of the differences between the model-derived and observed ground-water levels was 3.5; the average among the nodes ranged from 2 to 5. The model will provide projections of changes in the potentiometric surface resulting from (1) changes in the rate or distribution of ground-water pumpage or (2) changes in the stage of streams and reservoirs. The model will provide only approximate projections of the streamflow.

Waste-load allocation studies for Arkansas streams, Ouachita River basin, Saline River, Segment 2C

Waste-load allocation studies for Arkansas streams, Ouachita River basin, Bayou Bartholomew, Segment 2B
Reed, J. E., Terry, J. E., Lambert, B. F., and Morris, E. E., 1975

Waste-load allocation studies for Arkansas streams, Ouachita River, Segment 2D
Reed, J. E., Terry, J. E., Stephens, J. W., and Bryant, C. T., 1975

Low-flow characteristics of streams in the Mississippi embayment in northern Arkansas and in Missouri
Speer, P., R., Hines, M. S., Jansyn, R., and others, 1966
U.S. Geological Survey Professional Paper 448-F

A STUDY OF THE CHEMICAL QUALITY OF STREAMFLOW IN ARKANSAS STEELE, T. J.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
GEOLOGICAL SURVEY OPEN-FILE REPORT, OCTOBER 1971, 93 P, 8 FIG, 26 TAB, 9 REF

Journal Announcement: SWRA-610

HISTORICAL RECORDS OF STREAMFLOW CHEMICAL QUALITY OF 16 ARKANSAS WATER QUALITY STATIONS, REPRESENTING MORE THAN 102 STATION-YEARS OF DATA AND OVER 6200 COMPOSITED SAMPLES, ARE ANALYZED GRAPHICALLY AND STATISTICALLY. A SEQUENTIAL PROCEDURE IS DESCRIBED FOR ANALYZING DATA. A SUMMARY FOR EACH SAMPLING STATION INCLUDES BASIC STATISTICS FOR THE PERIOD OF RECORD, PLOTS OF SELECTED DATA PAIRS, AND REGRESSION RELATIONSHIPS DERIVED FROM THE HISTORICAL WATER-QUALITY DATA AVAILABLE FOR THAT LOCATION. A TECHNIQUE IS SHOWN FOR SIMULATING CONCENTRATIONS AND LOADS OF MAJOR INORGANIC SOLUTES USING SUPPLEMENTAL RECORDS OF SPECIFIC CONDUCTANCE, STREAM DISCHARGE, AND APPLICABLE CONCENTRATION-CONDUCTANCE REGRESSION EQUATIONS. PRELIMINARY SIMULATION STUDIES REVEALED THAT MONTHLY MEAN VALUES COULD BE ESTIMATED TO WITHIN 15-25% OF ACTUAL DETERMINATIONS FOR AN INDEPENDENT PERIOD OF RECORD OR SET OF DATA. ANNUAL MEAN CONCENTRATIONS AND LOADS FOR DOMINANT IONS ESTIMATED FROM THE REGRESSION RELATIONSHIPS Seldom exceeded 15% IN ERROR RELATIVE TO COMPARABLE VALUES COMPUTED FROM ACTUAL DATA. OTHER PROCEDURES IN DATA ANALYSIS INCLUDE EXAMPLES FROM TRANSFERRING INFORMATION ON STREAMFLOW CHEMICAL QUALITY BOTH IN TIME AND SPACE AND FOR ASSESSING LONG-TERM TRENDS IN STREAMFLOW SALINITY. (WOODARD-USGS)

WELL RECORDS, DEPTH-TO-WATER MEASUREMENTS, CHEMICAL ANALYSES OF GROUND WATER, DRILLERS LOGS, AND ELECTRIC-LOG INFORMATION IN HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS STEPHENS, J. W.
GEOLOGICAL SURVEY, LITTLE ROCK, ARK.
GEOLOGICAL SURVEY REPORT, 1970, 197 P, 6 FIG, 25 TAB.

Journal Announcement: SWRA-612

THIS REPORT IS A COMPILATION OF HYDROGEOLOGIC DATA COLLECTED DURING A WATER-RESOURCES INVESTIGATION OF HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS. THE DATA HAVE BEEN PREPARED FOR USE IN PLANNING WATER-RESOURCES DEVELOPMENT IN THE AREA. MOST OF DATA WERE COLLECTED BETWEEN

Arkansas
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Arkansas

Arkansas
Jackson, C. R., H., 1975
River basin, Boeuf
water
19~~rry,
associated dewatering on water resources.
continue through at least
defined. In addition, data-collection
defined. A thorouyh data file and literature search was
established
so that
will
water. To assess the magnitude of the
excavating
water, but the
water
south-central Arkansas is an importan
time
36
impacts
LOCATIONs; LITHOLOGIC LObS OF
MEASUkEMENT OF WATEl LEVELS
WELLS
JANUAHY
Arkansas Arkansas
U.S.
Waste-load allocation studi es for Arkansas streams,
Quantities of
white
mininy,
Processing, and conversion processes
will
quantitative
data at
be well
in northeast Arkans.s
be
maintained 259

WATER
STATIONS ON
THE
WATER
WATER
and test holes, water-level measurements of 295 wells, logs of 32
tests, and chemical analyses of water samples from 85
wells. (Woodard-USGS)

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1969; PART
7. LOWER MISSISSIPPI RIVER BASIN GEOLOGICAL SURVEY, RESTON, VA.
AVAILABLE FROM SUPT. OF DOCUMENTS, GPO, WASH., D.C. 20402.
PRICE $3.85. WATER-SUPPLY PAPER 2146, 1974, 540 p, 1 FIG, 40
REF.,

JOURNAL Announcement: SWRA9099
DURING THE WATER YEAR ENDING SEPTEMBER 30, 1969, THE
GEOLoGICAL SURVEY MAINTAINED 259 STATIONS ON 156 STREAMS IN THE
LOWER MISSISSIPPI RIVER BASIN FOR THE STUDY OF CHEMICAL AND
PHYSICAL CHARACTERISTICS OF SURFACE WATER. SAMPLES Were
COLLECTED DAILY AND MONTHLY AT 235 OF THESE LOCATIONS FOR
CHEMICAL-QUALITY STUDIES. SAMPLES ALSO WERE COLLECTED LESS
FREQUENTLY AT MANY OTHER POINTS. WATER TEMPERATURES WERE
MEASURED CONTINUOUSLY AT 28 AND DAILY AT 79 STATIONS. DAILY
WATER TEMPERATURES WERE MEASURED AT MOST OF THE STATIONS AT
THE TIME SAMPLES WERE COLLECTED FOR CHEMICAL QUALITY OR SEDIMENT
CONTENT. SO FAR AS PRACTICABLE, THE WATER TEMPERATURES WERE
TAKEN AT ABOUT THE SAME TIME EACH DAY. QUANTITIES OF
SUSPENDED SEDIMENT ARE REPORTED FOR 19 STATIONS, SEDIMENT SAMPLES
WERE COLLECTED ONCE OR MORE TIMES DAILY AT MOST STATIONS,
DEPENDING ON THE RATE OF FLOW AND CHANGES IN STAGE OF THE STREAM,
PARTICLE-SIZE DISTRIBUTIONS OF SEDIMENTS WERE DETERMINED AT 19
STATIONS. THE STREAM DISCHARGE REPORTED FOR A COMPOSITE
SAMPLE IS USUALLY THE AVERAGE OF DAILY MEAN DISCHARGES FOR
THE COMPOSITE PERIOD. THE DISCHARGES REPORTED IN THE TABLES
OF SINGLE ANALYSES ARE EITHER DAILY MEAN DISCHARGES OR DISCHARGES
OBTAINED AT THE TIME SAMPLES WERE COLLECTED AND COMPUTED FROM A
STAGE-DISCHARGE RElATION OR FROM A DISCHARGE MEASUREMENT.
(Woodard-USGS)
QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PART 7, LOWER MISSISSIPPI RIVER BASIN. GEOLOGICAL SURVEY, RESTON, VA. AVAILABLE FROM SUPT OF DOCUMENTS, GPO, WASHINGTON, DC 20402. PRICE $5.25. WATER-SUPPLY PAPER 2156, 1975, 636 P, 1 FIG, 41 REF.


WATER RESOURCES DATA FOR ARKANSAS, PUBLISHED ANNUALLY SINCE 1975.

GEOLOGICAL SURVEY, LITTLE ROCK, AR, WATER RESOURCES DIV.

AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA 22161.

WATER RESOURCES DATA FOR ARKANSAS CONSIST OF RECORDS OF STAGE, DISCHARGE, AND WATER QUALITY OF STREAMS; STAGE CONTENTS; AND WATER QUALITY OF LAKES AND RESERVOIRS. ADDITIONAL WATER DATA WERE COLLECTED AT VARIOUS SITES NOT PART OF THE SYSTEMATIC DATA-COLLECTION PROGRAM AND ARE PUBLISHED AS MISCELLANEOUS MEASUREMENTS. THESE DATA REPRESENT PART OF THE NATIONAL WATER DATA SYSTEM OPERATED BY THE U.S. GEOLOGICAL SURVEY AND COOPERATING STATE AND FEDERAL AGENCIES IN ARKANSAS.

ARIZONA

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE EAGLE HILL QUADRANGLE, JACKSON AND LARIMER COUNTIES, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980A.


COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF GOULD N\'F QUADRANGLE, JACKSON COUNTY, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980B.


COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF JOHNNY MOORE MOUNTAIN QUADRANGLE, JACKSON COUNTY, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980C.


COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF MACFARLANE RESERVOIR QUADRANGLE, JACKSON COUNTY, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980D.


COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF COWDREY QUADRANGLE, JACKSON COUNTY, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980E.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 79-196, 21 P, 7 OVERSIZE SHEETS, SCALE 1:24,000.

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF COALMONT QUADRANGLE, JACKSON COUNTY, COLORADO. AAA ENGINEERING AND DRAFTING, INC., 1980F.


RECONNAISSANCE EVALUATION OF WATER RESOURCES FOR HYDRAULIC COAL MINING, GRAND HOGBACK COAL FIELD, GARFIELD AND RIO BLANCO COUNTIES, COLORADO. ALLEY, W. M.; DRITTEN, L. J.; BOYD, E. L., GEOLOGICAL SURVEY, LAKWOOD, CO, WATER RESOURCES DIV.

AVAILABLE FROM THE USGS, OFFICE BOX 25425, DENVER, CO 80225. PAPER COPY $0.00, MICROFICHE $3.50.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 78-885, NOVEMBER 1978, 37 P, 9 FIG, 8 TAB, 20 REF.
Journal Announcement: SWA1212
Surface-water and ground-water data were compiled for the parts of the Colorado River and the White River basins in and adjacent to the Grand hogback coal field. The data were evaluated to assess the quantity and quality of water resources available in the area for use in hydraulic coal mining, based on discharge records, surface-water supplies of most streams should be adequate to meet the demands for hydraulic mining of 1 million tons of coal per year with a recycled water system. However, on some of the smaller streams in the area, some storage of water may be required for use during low-flow periods, for downstream reaches. Other potential sources of water include Rifle Gap Reservoir, Harvey Gap Reservoir, and ground water from valley fill deposits along major streams and river. Surface water and ground water should be of adequate quality for use in hydraulic mining, with the possible exceptions of suspended-sediment concentrations that periodically may be as much as 18,800 milligrams per liter in streams like Rist Canyon, and Creek drainage, and dissolved-solids concentrations greater than 20,000 milligrams per liter in some aquifers. Data are insufficient to assess the potential impact of hydraulic coal mining on downstream water quality. (Woodard-USGS)

Available surface-water and ground-water data were compiled for the parts of the Gunnison River basin in and adjacent to the Crested Butte coal field. The data were evaluated to assess the quantity and quality of water resources in the area for use in hydraulic coal mining. Based on discharge records, surface-water supplies of most streams should be adequate to meet the demands for hydraulic mining of 1 million tons of coal per year with a recycled water system. However, on some of the smaller streams in the area, some storage of water may be required for use during low-flow periods, for downstream reaches. Other potential sources of water for hydraulic coal mining include ground water from valley fill deposits along major streams and from the Dakota and Entrada Sandstones. The surface and ground water in the study area should be of adequate quality for use in hydraulic coal mining, with the possible exception of Coal Creek which has excessive concentrations of iron, manganese, and zinc. Data are insufficient to assess the potential impact of hydraulic coal mining on downstream water quality. (Woodard-USGS)

Average annual suspended- and total-sediment loads in streamflow were determined by the flow-duration sediment-transport-curve method at 18 sites in the Yampa River basin, Colorado and Wyoming. These computations indicate that about 2,000 million tons of sediment are carried by the Yampa River at Deerlodge Park during an average year. Significant areal differences in the sediment yield from various parts of the basin were determined. The Snake River subbasin contributes about 60 percent of the total basin sediment yield, although it represents less than 35 percent of the area and supplies less than 3 percent of the streamflow. In contrast, the upland (eastern) one-third of the basin contributes only about 14 percent of the sediment yield but 76 percent of the streamflow. Projected economic development of the basin, especially surface mining of coal, will impact the physical environment. Depending upon the amount and location of land disturbed, an estimated 10,000 to 30,000 tons per year of additional annual suspended-sediment load will be contributed to the main stem Yampa River. (Woodard-USGS)

MAP SHOWING AVAILABILITY OF HYDROLOGIC DATA PUBLISHED AS OF 1975. 1 SHEET, 1 MAP, 26 REF. Journal Announcement: SWA902
This MAP SHOWS BY SYMBOLS AND COLOR THE HYDROLOGIC DATA PUBLISHED AS OF JANUARY 1974 FOR THE COLORADO SPRINGS-CASTLE ROCK COL. AREA BY THE U.S. ENVIRONMENTAL DATA SERVICE AND BY THE U.S. GEOLOGICAL SURVEY AND COOPERATING AGENCIES. ALL SOURCES OF THE DATA ARE GIVEN IN THE REFERENCES AND ARE REFERRED TO IN THE DISCUSSION. OF THE 44 CLIMATOLOGICAL STATIONS SHOWN THE LONGEST PRECIPITATION RECORDS ARE FOR FOUNTAIN, COLO., BEGINNING IN 1866. COLORADO SPRINGS' PRECIPITATION RECORD BEGAN IN 1871. SURFACE-WATER DATA INCLUDE CONTINUOUS RECORDS OF STAGE AND DISCHARGE OF STREAMS. LOCATION OF 16 SURFACE-WATER DATA SITES ARE SHOWN: INCLUDED ARE 7

Colorado
Colorado
CONTINUOUS-RECORD STREAM-STAGE AND DISCHARGE STATIONS, AND 4,706 MEASUREMENT GROUPS AT 38 OTHER STREAM DISCHARGE SITES, STREAMFLOW RECORDS WERE COLLECTED AS EARLY AS 1908. GROUNDWATER DATA SITES PLOTTED ON THE MAP REPRESENT 40 WELLS WHERE WATER LEVELS HAVE BEEN MEASURED PERIODICALLY FOR 4 OR MORE YEARS OR MONTHLY FOR AT LEAST 1 YEAR, AND 49 WELLS FROM WHICH WATER SAMPLES HAVE BEEN ANALYZED FOR DISSOLVED-CHEMICAL CONSTITUENTS. (WOODARD-USGS)

LAND-USE CLASSIFICATION MAP OF THE COLORADO SPRINGS--CASTLE ROCK AREA, FRONT RANGE URBAN CORRIDOR, COLORADO. BY L. J. DRISCOLL. GEOLOGICAL SURVEY, DENVER, COL. FOR SALE USGS, RESTON, VA., 22092, PRICE $1.75. MISCELLANEOUS INVESTIGATIONS SERIES MAP I-857-B, 1975, 1 SHEET, 1 MAP, 2 REF., JOURNAL ANNOUNCEMENT: SWA9294.

THE FRONT RANGE URBAN CORRIDOR OF COLORADO, FROM FORT COLLINS ON THE NORTH THROUGH FOUNTAIN ON THE SOUTH, IS AN AREA OF RAPID POPULATION GROWTH AND EXPANDING LAND DEVELOPMENT. THIS MAP PROVIDES FOR THE COLORADO SPRINGS--CASTLE ROCK AREA THE FIRST STEP TOWARD COMPATIBLE LAND USES IN THE FUTURE--A COMPREHENSIVE PICTURE OF THE DISTRIBUTION OF DIFFERENT LAND CLASSES AND AN IMPLICATION ABOUT THE PROPORTIONS OF VARIOUS USES. IF USED WITH MAPS SHOWING RESOURCES, SOIL TYPES, GEOLOGY, WATER AVAILABILITY, TOPOGRAPHY, DEMOGRAPHY, AND OTHER ATTRIBUTES, THIS LAND-CATEGORY MAP HELPS TO SET LIMITATIONS ON USE OF THE LAND. ONCE THE LIMITATIONS ARE KNOWN, ZONING CAN HELP ASSURE LAND USES THAT ARE COMPATIBLE WITH THE NATURAL ENVIRONMENT. EXAMPLE, THE ZONING OF FLOOD PLAINS FOR GREENBELT OR RECREATIONAL USE. (WOODARD-USGS)


GROUNDWATER RESOURCES ARE DESCRIBED FOR A 29,000-SQUARE-MILE AREA IN WESTERN COLORADO. THE AREA INCLUDES ALL OR PARTS OF 15 COUNTIES AND IS DRAINED BY THE COLORADO, GUNNISON, WHITE, YAMPA, AND GREEN RIVERS. DATA SUMMARIES INCLUDE THE AVAILABILITY OF GROUNDWATER, THE CHEMICAL QUALITY OF GROUNDWATER, EXTENT OF CURRENT GROUNDWATER USE, AND PROBLEMS THAT ARE ASSOCIATED WITH MANAGING AND USING GROUNDWATER.
Salt-load computations—Colorado River; Camed, Colorado; to Cisco, Utah; part 1 Data summary
Drennan, R. J.; Groziera, R. U.
Geological Survey, Denver, Colo.
Journal Announcement: SWRA0919

Basic data for the salt-load computations, Colorado River; Camed, Colorado; to Cisco, Utah; part 1, data summary
Drennan, R. J.; Groziera, R. U.
Geological Survey, Denver, Colo.
Journal Announcement: SWRA0919

Salt-load computations for inflow and outflow stations in the Grand Valley area of Colorado have been computed using five methods. The salt-load increase of the Colorado River from the Grand Valley has been computed for the Colorado-Utah State line Station and the Colorado River near Cisco, Utah. Most of the salt loads given are about 30 percent of the average for all methods used; but differences of 70 percent do occur. Records presented in the basic-data report are regression curves of discharge versus specific conductance and of specific conductance versus calcium, magnesium, hardness, bicarbonate, chloride, dissolved solids, and sulfate; duration tables of daily discharge and D.S.F. daily specific conductance for the period of record; and the daily specific-conductance data.

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Colorado FOR THE PERIOD OF RECORD FOR ALL STATIONS IN THE STUDY AREA
(SEE ALSO W76-10143) (WOODARD-USGS)

Reconnaissance Evaluation of Surface-Water Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado
Birron, L. J.
Journal Announcement: SWRA1307

Salt data were collected from streams in a six-county area in northwest Colorado to determine if the streams were polluted and, if so, to determine the sources of the pollution. Eighty-three stream sites were selected for sampling in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties. A summary of data collected prior to this study, results of current chemical and biological sampling, and needs for future water-quality monitoring are reported for each county. Data collected at selected sites included temperature, pH, specific conductance, dissolved oxygen, and stream discharge. Chemical data collected included nutrients, inorganics, organics, and trace elements. Biological data collected included counts and species composition of total and fecal-coliform bacteria, fecal-streptococcus bacteria, benthiic invertebrates, and phytoplankton. Most of the sites were sampled three times: in April-June 1976, August 1976, and January 1977. (WOODARD-USGS)

Availability and Chemical Characteristics of Ground Water in Central La Plata County, Colorado
Harden, R. C.; Giles, D. E.
Water-resources investigations 76-69 (Open-file report), May 1976, 3 sheets, 14 ref.
Journal Announcement: SWRA1107

The central part of La Plata County, Colorado, has undergone rapid population growth in recent years. This growth has resulted in an increased demand for information about additional domestic, industrial, and municipal water supplies. A knowledge of the occurrence of ground water will permit a more efficient allocation of the resource. Aquifers in central La Plata County include alluvium, Anima Formation of Cretaceous age, and undifferentiated formations. Well yields generally are low usually less than 25 gallons per minute. However, higher yields, 25 to 50 gallons per minute may be found in aquifers in the alluvium and the Anima Formation.
The quality of water from the aquifers is dependent on rock type. Most of the water is a calcium bicarbonate type. However, aquifers that are predominantly fine-grained or contain interbeds of shale may contain sodium bicarbonate type water. The dissolution of minerals in the coal beds, which are present in the Mesaverde Group and the Dakota Sandstone, can contribute high concentrations of iron, sulfate, and chloride to ground water. (Woodard-USGS)

Reconnaissance of Ground-Water Resources in a Part of the Yampa River Basin between Craig and Steamboat Springs, Moffat and Routt Counties, Colorado
Brogen, R. E.; Giles, T. F.
Water-Resources Investigations 77-4 (open-file report), May 1977. 1 sheet 2 tabs 7 ref.
Journal Announcement: SWA1103
Parts of the Yampa River basin near the towns of Steamboat Springs and Craig, Colo., have undergone rapid population growth in recent years. Fort Union, Lance, Williams Fork, and Iles Formations, and the Lewis and Mancos Shales. Well yields are generally less than 25 gpm (gallons per minute). In the alluvium of the Yampa River, well yields may be as much as 900 gpm. Where the sandstones of the Williams Fork and Iles Formations are fractured, well yields have been reported to be as much as 100 gpm. Well yields from the Lewis and Mancos Shales are less than 5 gpm. The quality of the ground water is variable and dependent on rock type. Most of the waters are calcium and sodium bicarbonate types. Calcium sulfate type waters are found where the aquifer has been in contact with gypsum, organic materials, or coals. Dissolved-solids concentrations of ground water range from as little as 82 to as much as 4,230 milligrams per liter. (Woodard-USGS)

Availability and Quality of Groundwater, Southern Ute Indian Reservation, southwestern Colorado
Journal Announcement: SWA1407
Poorly-aquifer aquifers and the potential development of subsurface mineral resources have increased the need for good quality groundwater on the Southern Ute Indian Reservation in southwestern Colorado. A study was conducted during 1974-76 to assess the groundwater resources of the Shale Mesaverde Group, Lewis Shale, Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Aninas and San Jose Formations, and terraces and flood-plain deposits. Well yields from sandstone and shale aquifers are water quality in aquifers depends in part on rock type. Water from sandstone, terrace, and

flooding plains aquifers is predominantly a calcium bicarbonate type, whereas water from shale aquifers is predominantly a sodium bicarbonate type. Water from rocks containing interbeds of coal or carbonaceous shales may be either a calcium or sodium sulfate type. Dissolved-solids concentrations of groundwater range from 115 to 7,130 water from terrace and flooding plains aquifers is the least mineralized. In many water samples collected from bedrock, terrace, and flooding plains aquifers, the concentrations of arsenic, chloride, dissolved solids, fluoride, iron, manganese, nitrate, selenium, and sulfate exceeded U.S. Public Health Service (1962) recommended limits for drinking water. Selenium in the ground water in excess of the recommended limit of 10 micrograms per liter for drinking water occurs throughout the reservation but principally in the central part. (USGS)

GEOLOGY OF THE PICEANCE CREEK STRUCTURAL BASIN BETWEEN THE WHITE AND COLORADO RIVERS, NORTHWESTERN COLORADO
COFFIN, D. L.; WELDER, T. A.; CLANZMAN, R. K.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
AVAILABLE FROM US GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242. PRICE $1.25 PER SET. GEOLOGICAL SURVEY HYDROLOGIC INVESTIGATIONS ATLAS HA-370. 2 SHEETS. 1971. TEXT, 13 FIG. 5 MAP. 2 TAB. 8 REF.
Journal Announcement: SWAUS08
This atlas describes the availability, occurrence and chemical properties of the water resources for part of the Piceance Creek structural basin in northwestern Colorado. The area is between the White and Colorado Rivers, and contains 600 square miles in parts of Rio Blanco, Garfield and Mesa counties. The Piceance Creek basin contains some of the richest oil shale deposits in North America. These deposits represent a huge potential source of petroleum and efforts are currently being made to develop the resource. Some of the problems associated with the mining and retorting of oil shale are removal of water from mines, supplying water for mining and retorting operations, supplying additional domestic water for an increase in population, effect of mining operations on present users of groundwater and surface water, and water-quality problems created by mining operations. Surface-water supplies in the basin are small and are completely developed. Pumping large quantities of groundwater from either the alluvium or from the leached zone of the Green River formation would have adverse effects on present surface supplies. (Woodard-USGS)

MAP SHOWING POTENTIAL SOURCES OF GRAVEL AND CRUSHED-ROCK AGGREGATE IN THE BOULDER-FORT COLLINS-GREELEY AREA, FRONT RANGE

Quality of Ground Water in Routt County, Northwestern Colorado

Covar, K. J.; Tobin, R. L.

Geological Survey Water Resources Investigations Open-File Report 80-956a. 1981. 38 p. 8 Fig. 1 Plate. 6 Tab. 17 Ref.

Journal Announcement: SWRA1511

Chemical and bacteriological data were collected to describe the quality of water from selected geologic units in Routt County, Colo. Calcium bicarbonate was the dominant water-chemistry type; magnesium, sodium, and sulfate were detected as codominant ions. Specific conductance values ranged from 50 to 6,000 micromhos. Mean values of specific conductance were calculated for the dissolved solids in 29 sample sites. Results were generally greatest in waters from the older sedimentary rocks of the Lance Formation, Lewis Shale, Mesaverde Group, and Mancos Shale, and least in the ground waters from the alluvial deposits, Browns Park Formation, and the basement complex. Correlations of specific conductance with dissolved solids and specific conductance with hardness were found within specified concentration ranges. On the basis of water-quality analyses, water from the alluvial deposits, Browns Park Formation, and the basement complex generally is the most suitable for domestic use. Chemical constituents in water from wells or springs exceeded State and federal standards for public-water supplies or State criteria for agricultural uses were pH, arsenic, boron, chloride, fluoride, manganese, nitrite plus nitrate, or dissolved solids. Total coliform bacteria were detected in water from 29 sites and fecal-coliform bacteria were detected in water from 6 of the 29 sites. (USGS)

UTILIZATION OF MULL (FOREST HUMUS LAYER) IN GEOCHEMICAL EXPLORATION IN THE EMPIRE DISTRICT, CLEAR CREEK COUNTY, COLORADO
Effects of Effluents from a Coal-Fired, Electric-Generating Powerplant on Local Ground Water Near Hayden, Colorado  
Ellis, C. J.; Mann, P. R.; Lies, T. F.  
Journal Announcement: SWRA1512

Data were collected at the Hayden, Colo., powerplant for about a year during 1978-79 to monitor the effects of effluent and raw-water storage ponds on the local ground water, Sage Creek, and the Yampa River. The concentration of boron in wells downgradient from the effluent ponds indicated that the ponds were leaking, increasing the average boron concentrations in the ground water to a level in excess of the standards indicators of downgradient water quality. Had average concentrations of boron two times that of the Colorado Department of Health (1977) standard for agricultural use of water. Chemical analyses of water from wells and the discharge weir downgradient from the raw-water storage ponds indicated these ponds are leaking. The effect of this leakage is that the water in wells downgradient from these ponds has a lower specific conductance and a lower boron concentration than the water in wells downgradient from the effluent ponds. The concentration of trace elements in the water from the wells and the discharge weir generally declined during the study, probably because the ground water was recovering from the effects of a plume from the raw-water pond previously used for fly-ash disposal. The effluents from the Hayden powerplant lowered the specific conductance and the iron and manganese concentrations. High boron concentrations increased the concentration of boron.  

Preliminary report on the geology of the Coalmont district, Jackson County, Colorado  
Erdmann, C. E., 1961  

Reconnaissance of Groundwater in the Vicinity of Gunnison and Crested Butte, west-central Colorado  
Giles, T. A.  
Available from the OFS, USGS Box 25425, Fed. Ctr., Denver, Colo.
Colorado


Hydrologic data was collected in the Gunnison-Crested Butte area, Colo., to determine the availability and chemical quality of groundwater. Parts of the area have undergone rapid population growth in recent years due to an increase of winter sports activities. This rapid growth has resulted in a demand for additional domestic, recreational, and municipal water supplies. Maximum yields of 100 gallons per minute are available from wells completed in the alluvial aquifers while as much as 60 gallons per minute may be obtained from wells completed in the Dakota and Entrada Sandstones. Yields from other aquifers generally are less than 25 gallons per minute. Calcium magnesium bicarbonate water is the predominant water type in the study area. Dissolved solids concentrations ranged from 30 to 829 milligrams per liter and hardness ranged from 18 to 400 milligrams per liter. (USGS)

Hydrologic Data, Yampa River Basin and Parts of the White River Basin, Northwestern Colorado and South-Central Wyoming


Selected hydrologic data are presented from four energy-related projects conducted by the U.S. Geological Survey in the Yampa River basin and parts of the White River basin in northwestern Colorado and south-central Wyoming. Water-quality data during 1974 and 1975 and parts of 1976 for 129 ground-water sites and 119 surface-water sites are tabulated. For most samples, major cations, anions, and trace metals were analyzed. For the same time periods, field measurements of specific conductance, temperature, and pH were made on 252 springs and wells. These samplings sites, as well as the locations of 20 climatological stations, 18 snow-couirs sites, and 43 surface-water gaging stations, are shown on maps. Geologic units that contain coal deposits or supply much of the water used for stock and domestic purposes in the area also are shown on a map. (woodard-USGS)

The Carboniferous formations and founas of Colorado


Availability and Quality of Ground Water in the Lake George Area, Southeastern Park County, Colorado

Colorado


Water for domestic use in the Lake George area, Colo., is produced from four aquifers. Two of the aquifers, fractured-cristalline and volcanic rocks, have a water table ranging from 10 to 100 feet below land surface and well yields range from 0.08 to 6 gallons per minute. The consolidated sedimentary-rock and unconsolidated-alluvial aquifers have a water table ranging from near land surface to 60 feet below land surface and well yields range from 50 to 50 gallons per minute. The aquifers generally contain calcite bicarbonate water with concentrations of dissolved solids ranging from 101 to 636 milligrams per liter. In some areas, concentrations of iron as much as 180,000 micrograms per liter and concentrations of fluoride as much as 5.6 milligrams per liter affect suitability for domestic use. Chemical degradation of ground water has occurred in 18 of the 35 wells and in the 1 spring that were sampled. Bacterial contamination was found in water from six wells. (Woodard-USGS)


Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --


Data showing results of 38 groundwater and 25 surface-water samples analyzed for hexavalent chromium are presented. Most samples were taken within the Telluride, Colo., city limits during October 1978. Twenty-four of the 38 groundwater samples (63%) contained more than 50 micrograms per liter of hexavalent chromium. Excluding the mill tailings pond 6 of the 23 surface-water samples (26%) contained more than 50 micrograms per liter of hexavalent chromium. Hexavalent chromium concentrations in groundwaters ranged from 0 to 2700 micrograms per liter and in surface waters from 0 to 1600 micrograms per liter. (USGS)
Hydrologic data collected in 1975-77 as part of a comprehensive water-resources investigation of Boulder County, Colo., by the U.S. Geological Survey in cooperation with the Boulder County Health Department and the Colorado Geological Survey are presented in this report. The data in tabular and graphic form consist of water-quality analyses of selected constituents and geohydrologic-site, water-treatment, and sewage-treatment data for 609 wells and 48 springs; water-quality analyses for 1/2 of the wells and 9 of the springs; water-temperature analyses of streamflow from 3 sites; and specific conductance and water-temperature measurements of streamflow from 3 sites. State and local officials in Boulder County may find these data useful in planning for residential, commercial, and industrial development.

Hydrologic data from Upper Grange Hall Creek Basin, Northglenn, Adams County, Colorado

Hydrologic data collected during 1977-79 as part of a water-resources investigation of storm runoff in Upper Grange Hall Creek basin, Adams County, Colo., are presented in this report. Data presented in tabular form consist of: (1) estimated daily precipitation at one site (April through October, 1976 and 1979); (2) mean daily streamflow at two sites (December 1977 through September 1979); (3) instantaneous streamflow at two sites along Grange Hall Creek and corresponding cumulative rainfall at one to three sites for 17 storms (April 1, 1978, to August 26, 1979); (4) concentrations of selected major ions, fecal--coliform bacteria, suspended sediment, nutrients, and trace elements at five sites during dry-weather flow; at three sites during rainfall runoff; and (5) concentrations of pesticides and polychlorinated biphenyls at two sites during dry-weather flow and rainfall runoff. (USGS)

Water Resources of Boulder County, Colorado


Surface water is abundant in Boulder County, Colo., because large amounts of precipitation fall in the higher mountains and this precipitation feeds the streams directly or indirectly throughout the year. Ground water is an important source of water mostly for domestic, stock, or limited--acreage irrigation needs. The most frequently used aquifers are flood plains, terrace, Laramie--Fox Hills, Pierre--Nlobrama--Benton, and crystalline rock. Median well yields of 15 or more gallons per minute occur for the flood plain, terrace, and Laramie--Fox Hills aquifers, whereas the yield of the surface water is best at higher altitudes and decreases as the streams flow easterly to the plains and leave the county. The chemical quality of ground water is influenced by geohydrology and the activities of man such as mining, farming, and sewage disposal. Many sources of water examined failed to meet Colorado Department of Health water-quality standards for raw drinking-water use, for agricultural use, and for aquatic life. Chemical quality of the ground water, particularly dissolved solids, is better in water from the unconsolidated and crystalline--rock aquifers in the mountains and decreases in the aquifers on the plains. Factors involved in the decrease of quality are the geohydrology and the quality of associated surface water. Local contamination of ground water by subsurface wastewater disposal is a frequent problem. (USGS)

MAP SHOWING AVAILABILITY OF HYDROLOGIC DATA PUBLISHED BY THE U.S. ENVIRONMENTAL DATA SERVICE, AND BY THE U.S. GEOLOGICAL SURVEY AND COOPERATING AGENCIES, GREATER DENVER AREA FRONT RANGE URBAN CORRIDOR COLORADO HAMPTON E. R.

GEOLOGICAL SURVEY, DENVER, COLO. FOR SALE BY USGS, RESTON, VA 22092, $1.25, MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-856-C 1975, 1 SHEET, 1 MAP, 41 REF. Journal Announcement: SWRA924

Coal resources of Trinidad-Aquifer area, Las Animas and Huerfano Counties, Colorado. Harbour, R. L., and Dixon, G. H., 1959


Water-Resources Investigations of the U.S. Geological Survey in Colorado--Fiscal Year 1979
Water-resources data-collection activities for October 1, 1976, through September 30, 1979, are summarized for Colorado and bordering States. Forty-nine interpretive hydrologic investigations include: 8 statewide investigations, 5 regional investigations, 10 investigations in the Missouri River basin, 8 investigations in the Arkansas River basin, 3 investigations in the Rio Grande basin, 15 investigations in the Colorado River basin, and 2 multistate investigations. The summaries of the investigations consist of maps showing the location of the areas of investigation and a brief description of the investigation's purpose, objective, approach, progress, and plans. (Woddard-USGS)

Well Yields and Chemical Quality of Water From Water-Table Aquifers in the Colorado Springs--Castle Rock Area, Front Range Urban Corridor, Colorado


Industrial, irrigation, and public-supply wells completed in unconsolidated alluvial deposits and the Dawson aquifer, the principal water-table aquifers in the area, have measured and reported yields ranging from less than 100 to 1,000 gallons per minute. Most wells yielding more than 500 gallons per minute are located in the Colorado Springs area and are completed in unconsolidated alluvial deposits. The maximum reported yields from the Dawson aquifer are 500 gallons per minute. Most of the principal water-table aquifers yield water containing dissolved solids concentrations less than 500 milligrams per liter. Water containing more than 500 milligrams per liter of dissolved solids occurs principally in the Colorado Springs area. Water containing more than 500 milligrams per liter of dissolved solids generally is suitable for all uses associated with urban development. The potential uses for urban development decrease as dissolved solids concentrations in the water increase. (USGS)

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Hydrologic Data for Water-Table Aquifers in the Greater Denver Area, Front Range Urban Corridor, Colorado
Hillier, D. E., Schneider, P. A., Jr., Hutchinson, E. C.
As part of the U.S. Geological Survey's investigations of the hydrology and geology in the Front Range Urban Corridor of Colorado, hydrologic data for water-table aquifers in the greater Denver area were collected and compiled during 1976-77. These data, consisting of records for 325 wells and 11 springs and chemical analyses of water for 272 of the wells and all 11 springs, are presented in tabular form. The tables contain data that were collected during the investigations, data compiled from reports published by the Colorado Water Conservation Board and the U.S. Geological Survey, and unpublished data from the files of the U.S. Geological Survey. State and local officials in the greater Denver area may find these data useful in planning for residential, commercial, and industrial development.

Water-Resources Investigations of the U.S. Geological Survey in Colorado—Fiscal Year 1977

Hillier, D. E.; Weeks, J. W.


Journal Announcement: SWRA1105

Current water-resources data-collection activities in Colorado are summarized for the 1977 fiscal year. The locations of long-term data-collection stations are shown on a map of the State. Forty-three interpretive hydrologic investigations are summarized; 6 statewide investigations, 6 regional investigations, 11 investigations in the Missouri River basin, 5 investigations in the Arkansas River basin, 2 investigations in the Rio Grande basin, and 13 investigations in the Colorado River basin. The summaries of the investigations consist of a map showing the location of the area of the investigation and a brief description of the investigation's purpose, objective, approach, progress, and plans. (Woodard-USGS)

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado

Hirsch, R. M.; James, I. C.; Scheffer, J. E.


Journal Announcement: SWRA1217

Residuals management provides a basis for projecting the effects of economic development on the discharge of residuals to the environment and on the use of water. It is a useful technique of river-quality assessment for basins wherein substantial economic growth is either occurring or expected. Residuals management techniques were utilized to assess the effects of coal development and utilization in the Colorado part of the Yampa River basin. Pre-plant-level models were used to describe the material and energy balances and the operating costs of surface mining of coal, the Synthane process of coal gasification, coal-fired thermal-electric generation, power transportation of coal by coal-slurry pipeline, and transportation by unit train. As part of the model of electric power generation, four alternative methods of cooling-leanr are considered: on-plant cooling ponds, wet cooling towers, and dry cooling towers. Each of these models provides estimates of water withdrawal, water consumption, and residuals generated directly by the power generation process. The total growth of the regional economy under four coal-development scenarios is determined. The amount of coal assumed to be mined is constant across all of these, but each of them assumes a different use of the "new" coal gasification, coal-fired electric power generation, coal-slurry pipeline exports, or model to provide estimates of total (direct and indirect) water use and residuals generation in the regional economy under the four scenarios. (See also SW-036706, Humphreys-USGS)

Descriptors: River basins; Colorado; Long-term planning; Model studies; Regional analysis; Yampa River Basin; Water utilization; Coal; Costs; Economics; Industrial plants; Consumptive use; Management; Thermal power plants; Resources development; Coal gasification; Electric power generation

Results of Test Drilling for Groundwater in the Southeastern Uinta Basin, Utah and Colorado (Duplicated see Utah)

Holmes, W. F.


Journal Announcement: SWRA1419

Water Resources of the Northern Uinta Basin Area, Utah and Colorado with Special Emphasis on Ground-Water Supply

Hood, W. J., Fleiss, F. K.


Journal Announcement: SWRA1311

These studies were made in a 5 x 200

...
square-mile area of the Uinta Basin and Uinta Mountains. The principal sources of water are precipitation and trans-basin inflow through the Green and White Rivers, which for the period 1941–70 annually averaged 4.67 million acre-feet and 3.55 million acre-feet, respectively. Of the water from precipitation within the area, 190,000 acre-feet was exported and 44,000 acre-feet entered from the Green River. The ground-water system is in unconsolidated and consolidated rocks. Gross recharge is estimated to be 500,000 acre-feet of which 200,000 acre-feet returns to streams in the water in storage significantly. Fresh to slightly saline water in storage amounts to an estimated 28 million acre-feet. Approximately 160,000 acre-feet is consumed by evapotranspiration, 12,000 acre-feet is consumed by springs, 120,000 acre-feet is discharged to streams. During high flow all streams are fresh; during low flow, water at the mouths of some tributaries is slightly to moderately saline. Ground water ranges from fresh to briny; fresh to slightly saline water can be obtained from at least one aquifer in about two-thirds of the area. (Woodard-USGS)

Selected Hydrologic Data, Uinta Basin Area, Utah and Colorado
Hood, J. W.; Mundorf, J. C.; Price, D.
fig. 2 plates, 15 tabs, 19 ref.,
Journal Announcement: SWA1017

The Uinta Basin area in northeastern Utah and northwestern Colorado covers an area of slightly more than 10,000 sq mi. More than 95 percent of the basin is in Utah, thus most of the data in this report apply to Utah. Selected data is consolidated from available records of water wells, springs, petroleum-test wells, and streams. Included are well logs, laboratory analysis of water samples, water levels in observation wells, stream discharge, and water-quality records for all types of water sources. (Woodard-USGS)

Ground-Water Resources of the Alluvial Aquifers in Northeastern Larimer County, Colorado
Hurr, R. C.; Schneider, R. A.
Water-Resources Investigations 77–7 (open-file report), January 1977, 31 p, 5 fig, 6 plates, 7 tabs; 13 ref.,
Journal Announcement: SWA1102
Ground water is a source of municipal, domestic, stock, and irrigation supply for most of northeastern Larimer County. A study of the alluvial aquifers in the northeastern part of the county was conducted to determine volume of water in storage, rate and location of ground-water withdrawals, and chemical quality of the water with particular attention to dissolved solids, hardness, sulfate, and selenium.

There are 251 large-capacity wells in the study area. Well yields range from about 80 gpm (gallons per minute) to a little over 1,800 gpm. Total annual withdrawals 133,000 acre-feet--32,000 acre-feet in the alluvium of Buckeye terrace and 101,000 acre-feet in the valley-fill aquifer associated with Boxelder Creek. Ground-water withdrawals for irrigation are about 50,000 acre-feet annually. The municipal wells pumped 210 acre-feet in 1974. The factors affecting ground-water quality are the quality of applied irrigation water, the amount of water lost to evapotranspiration during irrigation, and, to a lesser degree, solution of soluble material in the alluvium and in the bedrock at the base of the alluvium. Ground water at dissolved solids, redox potential, and Eh are similar for surface water and ground water. Coliforms and other bacteria have been found in 50 percent of the water from alluvial aquifers. Concentrations of chloride, nitrate, nitrate plus nitrite, silica, ortho, inorganic, total, and sulfate, nitrate plus nitrite as nitrogen, selenium, and sulfate in drinking water exceeding recommended or mandatory standards for drinking water established by the Colorado Department of Health and U.S. Public Health Service. (Woodard-USGS)

Hydrologic Data for Water-Table Aquifers in the Colorado Springs–Castle Rock Area, Front Ranges Urban Corridor, Colorado
Hutchinson, E. C.; Brogden, R. E.
Open-file report 76–10, December 1976, 36 p, 2 fig, 2 plates, 2 tabs, 7 ref.,
Journal Announcement: SWA1021
Water-quality data from a study by the U.S. Geological Survey of the Southern Ute Indian Reservation in southwestern Colorado are presented in two tables. The data were collected during 1973–76 from 338 ground-water and surface-water samples. All samples were analyzed for major cations and anions, and selected cations and anions. Chemical data in the tables are keyed by numbers to maps showing the locations of sampling sites. Many of the samples contained arsenic, chloride, dissolved solids, fluoride, iron, magnesium, manganese, molybdenum, nitrate, nitrite-plus-nitrate as nitrogen, selenium, and sulfate in drinking water exceeding recommended or mandatory standards for drinking water established by the Colorado Department of Health and U.S. Public Health Service. (Woodard-USGS)

Hydrologic Data for Water-Table Aquifers in the Colorado Springs–Castle Rock Area, Front Ranges Urban Corridor, Colorado
Hutchinson, E. C.; Hillier, D. E.
Journal Announcement: SWA1215
As part of the U.S. Geological Survey's investigations of the hydrology and geology in the Front Range Urban Corridor of Colorado, hydrologic data for water-table aquifers in the Colorado Springs–Castle Rock area were collected and

76

77
compilation of data, consisting of records for 157 wells and 47 springs and chemical analyses of water for 135 of the wells and all 47 springs, are presented in tabular form. The tables contain data that were collected during the investigations, data compiled from reports published by the Colorado Water Conservation Board and unpublished data from the files of the U.S. Geological Survey. State and local officials in the Colorado Springs-Castle Rock area may find these data useful in planning for residential, commercial, and industrial development.


RECONNAISSANCE INVESTIGATION OF GROUND WATER IN THE RIO GRANDE DRAINAGE BASIN—WITH SPECIAL EMPHASIS ON SALINE GROUND-WATER RESOURCES

KELLY, T. E.

GEOLoGY SURVEY, RLESTON, VA.

FOR SALE BY USGS, 1200 S. KADIS ST, ARLINGTON, VA 22202 PRICE $1.50 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-510, 1974. 4
maximum, minimum, and mean concentrations, as well as other statistics are presented; for minor elements, only the maximum, minimum, and mean values are included. Least-squares equations (regressions) are also given relating specific conductance of the streams to the concentration of the major ions. The observed range of specific conductance was 85 to 1,150 microhms per centimeter for the eight sites. (USGS)

Coal resources of Colorado: tabulated by bed; Landis, E. R., and Cone, G., 1971

Coal resources of Colorado
Landis, E. R., 1959

CHEMICAL AND RADIOCHEMICAL ANALYSES OF WATER FROM STREAMS, RESERVOIRS, WELLS, AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO

JOURNAL ARTICLES FOR SWRA0918
Wells were inventoried and sampled, and a network of 21 surface-water sampling stations was established in the Rulison area, Colorado, to determine changes in tritium content and water chemistry attributable to the Rulison project. An experiment in stimulating natural gas production by a nuclear explosion, locations of the sampling sites, pre-explosion chemical analyses of surface waters and groundwaters, well records, cistern records, and spring records are tabulated. (KNAPP-USGS)

APPRAISAL OF THE WATER RESOURCES OF NORTHEASTERN EL PASO COUNTY, COLORADO
AN APPRAISAL OF THE WATER RESOURCES OF NORTHEASTERNEl PASO COUNTY, COLO., WAS MADE AS THE FIRST PART OF A 5-YEAR STUDY OF THE ENTIRE COUNTY. MEAN ANNUAL PRECIPITATION RANGES FROM 14 TO 50 IN., AND IS A FUNCTION OF ALTITUDE. THE AREA IS DRAINED BY FOUNTAIN CREEK AND ITS TRIBUTARIES WHICH HAVE BEEN DESCRIBED BY MEANS OF THE OBSERVED FLOW CHARACTERISTICS AT 27 STREAM-GAGING SITES AND THE ESTIMATED FLOW CHARACTERISTICS AT 16 SITES. A WATER BUDGET SHOWS THE AVERAGE ANNUAL WATER INVENTORY IS ABOUT 520,000 ACRE-FT, OF WHICH ABOUT 92 PERCENT IS EVAPOTRANSPIRED. AN INVENTORY OF LAKES AND RESERVOIRS INDICATES THE STORAGE CAPACITY OF ONE RESERVOIR, NORTHFIELD RESERVOIR NO. 5, IS OVER ONE-HALF OF THE AREA'S TOTAL SURFACE-WATER STORAGE CAPACITY. THE ANNUAL PRECIPITATION AT COLORADO SPRINGS, THE COUNTRY'S LARGEST MUNICIPALITY, RANGED BETWEEN 8 AND 25 IN. IN THE LAST 24 YEARS. COLORADO SPRINGS OBTAINS ABOUT 89 PERCENT OF ITS TOTAL DOMESTIC WATER SUPPLY FROM SURFACE-WATER SOURCES. THE WATER SUPPLY FOR COLORADO SPRINGS APPEARS ADEQUATE UNTIL 1990 DUE TO THE REUSE AND TRANSMOUNTAIN IMPORTATION OF WATER. WATERS FROM STREAMS DRAINING PIKES PEAK ARE OF GOOD QUALITY FOR DOMESTIC USE EXCEPT FOR CONCENTRATIONS OF FLUORIDE WHICH EXCEED LIMITS OF DRINKING-WATER STANDARDS. DOWNSTREAM FROM COLORADO SPRINGS THE WATER IN FOUNTAIN CREEK IS BADLY POLLUTED DUE TO SEWAGE. THE PRINCIPAL AQUIFERS ARE ALLUVIAL DEPOSITS AND THE DAWSON FORMATION. CALCULATED RECHARGE RATES RANGE FROM 0 TO 4 IN. PER YEAR. IN THE PRINCIPAL AREAS OF RECHARGE TO THE DAWSON, THE DISSOLVED-SOLIDS CONCENTRATION OF IN AREAS OF DISCHARGE. (WOODARD-USGS)

Water Resources of El Paso County, Colorado
The rate of population growth in El Paso County, Colo., has been one of the fastest in the United States. Continued rapid population growth has been accompanied by a similar growth in demand for industrial and municipal water. The largest municipality in the county, Colorado Springs, imports more than one-half of its water from sources outside the county. Estimated water budgets for four drainage basins indicate that precipitation and evapotranspiration account for 82 to 100 percent of the water entering and leaving each basin. The county is drained by tributaries of both the South Platte and Arkansas
Rivers—the Arkansas River basin draining about 95 percent of the county. The dissolved-solids concentration of water in the streams of the county is inversely related to streamflow. The addition of sewage effluent deteriorates the water quality of Fountain Creek. The principal alluvial aquifers are in Fountain Creek and Jimmy Camp Creek valleys, which contain an estimated 350,000 acre-feet of water in storage. In the upper Black Squirrel Creek basin, which contains an estimated 150,000 acre-feet of water in storage, the dissolved-solids concentration of groundwater is obtained primarily from the Mesaverde Group, several sandstones in the Mesaverde Group, and the Entrada Sandstone, Westwater Sandstone, and sandstones of the Tertiary age. Most of the water flows from topographically high outcrop areas toward the San Juan River and Rio Grande valley. Much of the water may move through confining layers to other aquifers or to the land surface rather than discharging directly to the streams. Transmissivities of the sandstones range from 50 to 100 square feet per day. Lowest dissolved-solids concentrations occur in outer outcrops of the sandstones and increase in the direction of groundwater flow. Concentrations range from less than 500 milligrams per liter to more than 30,000 milligrams per liter. (Kosco-USGS)

MAP SHOWING APPROXIMATE GROUNDWATER CONDITIONS IN THE PARKER QUADRANGLE, ARAPAHOE AND DOUGLAS COUNTIES, COLORADO. A PAIR OF COMPETING GROUNDWATER CONDITIONS IN THE COUNTRY IS OBTAINED PRINCIPALLY FROM THREE AQUIFER SYSTEMS: STREAM ALLUVIUM AND ALLUVIAL TERRACES, RELATIVELY SHALLOW BEDROCK, AND RELATIVELY DEEP BEDROCK UNITS. THE GREATEST AMOUNTS OF WATER AVAILABLE GROUNDWATER OCCUR IN THE SAND, THE GRAY SEDIMENTAL FILL OF CHERRY CREEK VALLEY AND UPLAND ALLUVIAL AND TERRACE DEPOSITS OF ITS MAJOR DISTRIBUTARIES. THE ALLUVIUM IS AS MUCH AS 150 FEET THICK IN CHERRY CREEK VALLEY. LARGE-CAPACITY WELLS PRODUCING FROM ALLUVIUM ALONG CHERRY CREEK YIELD FROM 900 TO 1,800 GPM AND AVERAGE ABOUT 1,200 GPM. MOST OF THESE WELLS ARE USED FOR MUNICIPAL WATER SUPPLIES. DISSOLVED SOLIDS IN WATER FROM THE ALLUVIUM RANGE FROM 200 TO 300 PPM. (WOODARD-USGS)


MAP SHOWING FLOOD-PRONE AREAS, GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO. MCCAIN, J. F. HITCHKISS, W. R. GEOLOGICAL SURVEY, DENVER, COLO. FOR SALE BY USGS, RESTON, VA 22092. PRICE $0.75. MISCELLANEOUS INVESTIGATIONS SERIES MAP 1-856-D, 1975. 1 SHEET, 1 MAP. 9 REF. JOURNAL ANNOUNCEMENT: SWAU013 THE RAPID GROWTH OF POPULATION IN THE FRONT RANGE URBAN CORRIDOR OF COLORADO IS CAUSING INTENSE COMPETITION FOR AVAILABLE LAND RESOURCES. ONE FORM OF COMPETITION POSING SERIOUS PROBLEMS IS INDISCIMINATE DEVELOPMENT OF FLOOD PLAINS ALONG CREEKS AND RIVERS. THIS MAP DEPICTS A HIGH-Scale VIEW OF FLOOD-PRONE AREAS ALONG PRINCIPAL STREAMS IN THE GREATER DENVER AREA.
COLORADO

COLORADO

AREA OF THE URBAN CORRIDOR. FLOOD-PRONE AREAS IDENTIFIED ARE SUBJECT TO INUNDATION BY THE 100-YEAR FLOOD—A FLOOD HAVING A 1 PERCENT CHANCE OF BEING EQUALIZED OR EXCEEDED IN ANY GIVEN YEAR. THE Magnitude AND Depth OF THIS reference flood were derived FOR streams IN the study area FROM Streamflow records and reports of the U.S. GEOLOGICAL SURVEY, reports of the U.S. ARMY CORPS OF Engineers, AND FROM reports prepared BY various consulting engineering firms for the urban drainage and flood control district. (WOODARD-USGS)

Exploratory drilling in the Coalfield, Jackson County, Colorado
Madden, D. H., 1977a

Exploratory drilling in the McCallie Coalfield
Madden, D. H., 1977b

THE EAGLE VALLEY EVAPORITES, NORTHWEST COLORADO—A REGIONAL SYNTHESIS
MALLORY, W. W.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
BULLETIN 1311-E, 1971, 37 P, 8 FIG, 3 TABLE, 1 TAB, 31 REF.
Journal Announcement: SWRA1423

THE EAGLE VALLEY EVAPORITES OF NORTHWEST COLORADO CONSIST PRINCIPALLY OF GYPSUM AND ANHYDRITE, BUT CONTAINS AN APPRECIABLE QUANTITY OF HALITE AND TRACES OF POTASH SALTS. THE ENCLOSED ROCKS ARE CONGLOMERATE, SANDSTONE, SILTSTONE, SHALE, AND LIMESTONE. THE AGE OF THE FORMATION IS MIDDLE PENNSYLVANIAN, LATE ATOKA, AND DES MOINES. THE THICKNESS OF THE EVAPORITE INTERVAL RANGES FROM 9,000 FEET IN the VICINITY OF EAGLE, COLORADO, TO ZERO AT THE NORTHEASTERN EDGE OF the EAGLE BASIN, 25 MILES AWAY. IN SOME AREAS FLOWS HAVE INCREASED ORIGINAL DEPOSITIONAL THICKNESS, BECAUSE OF ITS PLIABILITY, THE EVAPORITE IS DEFORMED MORE THAN OTHER ROCKS IN ITS VICINITY. IT SHOW THE EFFECTS OF LOAD METAMORPHISM, LAHARUPTING DIAPIRC UPWELLING, AND CONTORTION DUE TO FLOWAGE AND HYDRATION OF ANHYDRITE. THE EVAPORITE WAS DEPOSITED IN A LANDSLIDE TROUGH BETWEEN THE UNCOMPAGNADE AND FRONT RANGE UPLIFTS. MARINE CIRCULATION AND INTERCHANGE OF WATER WERE IMPEDED ON the OPEN NORTHWEST END BY A BROAD, SHALLOW SHELTER, WHILE EXCEPTIONALLY THICK EVAPORITE ROCKS WERE DEPOSITED AT OCCASIONAL TORNAL RAIN. MINERAL COMPOSITIONS OF POSSIBLE FUTURE COMMERCIAL VALUE, CONTAINED IN OR ASSOCIATED WITH THIS FORMATION, ARE GYPSUM, HALITE, SALTS OF POTASSIUM, OIL AND GAS. (WOODARD-USGS)

Coal of the Denver Basin, Colorado
Martin, G. C., 1915

COLORADO


THERMODYNAMIC CONSTRAINTS ON METAL SOLUBILITIES IN A STREAM AFFECTED BY MINE DRAINAGE: GOMANZA, COLORADO
MORAN, R. E.; MENTZ, D. A.
GEOLOGICAL SURVEY, DENVER, COLO.
IN: WATER RESOURCES PROBLEMS RELATED TO MINING; AMERICAN WATER RESOURCES ASSOCIATION PROCEEDINGS SERIES NO 18, P 54-64, JUNE 1974. 1 FIG, 1 TAB, 15 REF.
Journal Announcement: SWRA1590
DRAINAGE FROM ABANDONED METAL MINES AND TAILINGS PILES HAS RESULTED IN ACID, METAL-LIFERUS SURFACE WATER IN THE VICINITY OF GOMANZA, COLORADO. MUCH OF THE STREAMBED IS COATED WITH AMORPHOUS FeO(OH)3 THAT CONTAINS SIGNIFICANT CONCENTRATIONS OF OTHER METALS. USING THERMODYNAMIC TECHNIQUES, IT WAS FOUND THAT SEVERAL COMPOUNDS OTHER THAN FeO(OH)3 COULD BE PRECIPITATED. THESE COMPOUNDS INCLUDE Cu2(OH)2CO3, Cu3(OH)2(C03)2, Cu5(OH)4(CO3)2, Cu5(OH)4SO4, Cu4(OH)6SO4·2H2O, MnCO3, AND znSO4·0. SOLUBILITY PRODUCTS WERE NOT EXCEEDED FOR ANY OF THE CADEMIUM, LEAD, OR NICKEL COMPOUNDS CONSIDERED. (WOODARD-USGS)

Selected biological Characteristics of Streams in the Southeastern Uinta Basin, Utah and Colorado (duplicated see Utah).
WATER, R. W.; FULLER, R. H.
GEOLOGICAL SURVEY, SALT LAKE CITY, UT, WATER RESOURCES DIV.
GEOLOGICAL SURVEY Open-File Report 81-664 (WR), 1981, 26 P, 6 FIG, 4 TAB, 12 REF.
Journal Announcement: SWRA1512

HYDROLOGIC RECONNAISSANCE OF THE SOUTHERN UNTA BASIN, UTAH AND COLORADO. (Duplicated see Utah).
PRINCE, D. J.; MILLER, L. L.
GEOLOGICAL SURVEY, SALT LAKE CITY, UT.
UTAH DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY, TECHNICAL PUBLICATION NO 69, 1975, 66 P, 11 FIG, 3 TABLE, 15 TAB, 38 REF.
Journal Announcement: SWRA1821

The Trinidad coal field, Colorado
Richardsen, G. H., 1970

Hydrogeochernecy and Simulated Solute Transport, Piceance Basin, Northwestern Colorado
Robson, S. G.; Saulnier Jr., G. J.
Oil shale mining activities in Piceance basin in northwestern Colorado could adversely affect the ground- and surface-water quality in the basin. This study of the hydrology and geochemistry of the area used groundwater solute-transport-modeling techniques to investigate the possible impact of the mines on water quality. Maps of the extent and structure of the aquifer were prepared and show that a saturated thickness of 2,000 feet occurs in the northeast part of the basin. Ground-water recharge in the upland areas in the east, south, and west parts of the basin moves down into deeper zones in the aquifer and laterally to the discharge areas along Piceance and Yellow Creeks. The saline zone and the unsaturated zone provide the majority of the dissolved solids found in the ground water. Precipitation, ion-exchange, and oxidation-reduction reactions are also occurring in the aquifer.

Model simulations of groundwater movement in tracts C-a and C-b indicate that the altered direction of ground-water movement near the pumped mines will cause an improvement in ground-water quality near the mines and a degradation of water quality downstream from the tracts. Model simulations of mine leaching in tract C-a and C-b indicate that equal rates of mine leaching in the tracts will produce much different effects on water quality in the basin. Tract C-a, by virtue of its remote location from perennial streams, will primarily degrade the ground-water quality over a large area to the northeast of the tract. Tract C-b, by contrast, will primarily degrade the surface-water quality in Piceance Creek with only localized effects on the ground-water quality. (USGS)

Hydrogeology and Simulated Solute Transport, Piceance Basin, Northwestern Colorado


Journal Announcement: SWR1412

Oil-shale mining activities in Piceance basin in northwestern Colorado could adversely affect the ground- and surface-water quality in the basin. This study of the hydrology and geochemistry of the area used groundwater solute-transport-modeling techniques to investigate the possible impact of the mines on water quality. Maps of the extent and structure of the aquifer were prepared and show that a saturated thickness of 2,000 feet occurs in the northeast part of the basin. Ground-water recharge in the upland areas in the east, south, and west parts of the basin moves down into deeper zones in the aquifer and laterally to the discharge areas along Piceance and Yellow Creeks. The saline zone and the unsaturated zone provide the majority of the dissolved solids found in the ground water. Precipitation, ion-exchange, and oxidation-reduction reactions are also occurring in the aquifer.

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Groundwater in the Laramie-Fox Hills aquifer is a potential source of supplemental municipal water supplies for the communities of Erie, Lafayette, Louisville, and Superior in Colorado. The present water supplies for these communities are not always adequate to meet current demands. The U.S. Geological Survey made a water-supply assessment of the Laramie-Fox Hills aquifer for the U.S. Bureau of Reclamation, which is investigating and evaluating alternative sources of water for the communities. Recharge to the aquifer is mostly in the western and southwestern parts of the study area. Groundwater movement is generally from the southwest to the northeast with water discharge in the water-supply area primarily by pumping wells. Since 1961, this pumping has caused water-level declines of about 250 to 300 feet from Broomfield to east of Niagara, Colorado, generally. Water levels in other parts of the area have remained the same. The aggregate sand thickness determined from well logs ranges from 42 to 360 feet and the mean thickness is 229 feet. The volume of groundwater in storage in the study area is about 5 million acre-feet. Reported yields from 93 wells ranged yields tended to be larger in the areas where aggregate sand thickness is the greatest. The water is greatly enriched with sodium and calcium bicarbonate type as it moves through the aquifer away from the recharge areas. The maximum limit established by the U.S. Environmental Protection Agency for nitrate plus nitrite in public-water supplies was exceeded in water from three wells, the maximum limit for fluoride was exceeded in water from two wells, and the maximum limit for selenium was exceeded in water from three wells. (USGS)
Journal Announcement: SWRA1308

With increasing development of coal production, there is concern over increased water demand and anticipated environmental impacts associated with coal mining, particularly in the Rocky Mountain States which have small populations and limited water resources. These assessment studies focus on the Yampa River basin in northwestern Colorado and south-central Wyoming, and involve that part of the basin east of Dinosaur National Monument. Objectives include: (1) to evaluate the environmental and economic impacts of regional energy- and water-resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. The major energy resource in the basin consists of near-surface coal deposits; other resources—oil and gas, oil shale, uranium and geothermal springs—also occur in the basin. The regional-appraisal and modeling studies used in this assessment are: ambient stream quality, stream traveltime and re-aeration characteristics, waste-load assimilative capacity, sediment loadings in streams, reservoir-modeling analysis, groundwater solute transport, remote-sensing applications and air quality modeling. In this assessment concern was given to projected increased water uses and how they are to be met within existing use patterns and other institutional constraints. Continuing studies such as these will enable resource managers to anticipate potential problems concerning the impending coal-resource development in the Yampa River basin.

(1ervolino-NC)

An Overview of River-basin Assessment Techniques in an Energy-Impacted Region--Yampa River Basin, Colorado and Wyoming

Steele, T. O.

Geological Survey, Denver, CO.

Water Supply and Management, Vol 3, No 3, p 151-171, 1979. 10 Fig, 2 Tab, 29 Ref.

Journal Announcement: SWRA1305

Reported here are the results of completed basin assessment studies of the Yampa River Basin in northwestern Colorado and south-central Wyoming that had as their objectives (1) to evaluate the environmental and economic impact of regional energy and water resource development for existing and feasible alternative policies, and (2) to describe the assessment methodologies used so that they may be applied to other energy-rich regions of the western U.S. where water resources are limited. A set of 7 coal-resource development alternatives are specified in order to evaluate the effects of possible water demands and generated residuals on the region's water resources. The resultant analyses consider both the direct effects of coal mining, processing, conversion and transportation and the indirect effects of increased population
and related commercial and service needs, based upon extensive field collection of hydrologic data and the analysis of regional economic projections, a range of impacts of the projected development on the basin's water resources are evaluated using several data-analysis and physical modeling techniques. (Tickes-Arizona)

Coal-Resource Development Alternatives, Residuals Management, and Impacts on the Water Resources of the Yampa River Basin, Colorado and Wyoming


Paper presented at Symposium on Water Resources and Fossil Fuel Production held in Dusseldorf, Germany, September 7-8, 1976; International Water Resources Association, 1976, 14 p, 1 fig, 1 tab, 17 ref., Journal Announcement: SWRA1010

Development of coal resources in the Yampa River basin in the southern Rocky Mountains of the United States will have a variety of effects on available water resources. These involve both direct effects caused by coal extraction, processing, transport, and conversion techniques utilized or proposed for the region and also indirect effects associated with regional economic growth. Impacts from both types of effects involve water resources of the basin in terms of water withdrawals, consumptive use, and assimilative capacities of discharged residuals (that is, non-economic byproducts). A regional residual-management analysis involves assessing mass and energy balances of the primary economic activities, as well as an economic and technical evaluation of alternative strategies of treatment and modification of residuals discharged to the environment from various sources. Approaches and results to date of residuals-management and environmental-modeling techniques are described for evaluating water-resources impacts of coal-related development in the Yampa River basin, Colorado and Wyoming. (Woodard-USGS)

Assessment Techniques for Modeling Water Quality in a River Basin Affected by Coal-Resource Development


A regional water-resources assessment in the Yampa River basin, Colorado and Wyoming, used modeling techniques applied in five component studies to evaluate direct and indirect impacts of coal-resource development. Modeling of the waste-load assimilative capacity of the Yampa River indicated exceedence of a proposed standard for nonionized ammonia concentration using assumptions of anticipated population growth and treatment-plant effluents. Travel times for a 50-kilometer reach of the Yampa River ranged from 15.7 hours for seasonal high flow of 28 cubic meters per second to 120 hours for a low flow of 0.0 cubic meter per second; measured reaeration coefficients for selected seepages ranged from 6.04 to 33.4 per day. Modeling of alternative configurations of proposed reservoirs indicated a reduction of annual time-weighted dissolved-solids concentrations downstream by an estimated 34 percent. By 1990, an increase of between 9 and 27 thousand metric tons of water-derived, sediment derived from surface-mined areas is estimated to be transported annually in basin streams. Model simulations of a hypothetical 5,000 milligrams per liter conservative contaminant predicted its detection, and dispersion in one of the major coal-bearing aquifers during a 200-year period. The benefits of integrating physically based modeling components for assessing regional water-resources management alternatives are demonstrated. (Woodard-USGS)

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING-PHASE-I WORK PLAN


COAL RESOURCES OF THE WESTERN UNITED STATES ARE BEING DEVELOPED AT INCREASING RATES, RESULTING IN INCREASED CONSUMPTION OF WATER. THE EFFECTS OF MINING AND ASSOCIATED ACTIVITIES ON THE ENVIRONMENT, THE YAMPA RIVER BASIN IN NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING IS UNDERGOING ECONOMIC DEVELOPMENT OF ITS COAL, OIL AND GAS, AND URANIUM RESOURCES. THE YAMPA RIVER BASIN ASSESSMENT IS A 2.5-YEAR PROGRAM OF THE U.S. GEOLOGICAL SURVEY. IT IS DESIGNED PRIMARILY TO ASSESS THE AVAILABILITY AND QUALITY OF THE BASIN'S WATER RESOURCES. THE BASIN ASSESSMENT ALSO WILL EVALUATE POTENTIAL ENVIRONMENTAL AND SELECTED SOCIOECONOMIC IMPACTS OF ENERGY-RESOURCE DEVELOPMENT PLANS PROPOSED BY MINING AND POWER COMPANIES. THIS REPORT SERVES AS A PROJECT WORK PLAN FOR THE BASIN ASSESSMENT'S FIRST-PHASE WORK ACTIVITIES. (WOODARD-USGS)

The Yampa River Basin, Colorado and Wyoming—a Preview to Expanded Coal-Resource Development and its Impacts on Regional Water Resources


Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 815s, Price codes: A07 in paper copy, A07 in microfiche. Geological Survey water-resources

An environmental assessment of impacts of coal development on the water resources of the Yampa River Basin in Colorado and Wyoming is based primarily on a 2.5-year program of the U.S. Geological Survey. The program also includes studies to evaluate potential environmental and selected socioeconomic impacts of energy-resource development plans proposed by mining and power companies. This report serves as a project work plan for the basin assessment. It describes the program objectives and the various approaches of analysis and evaluation. Environmenal studies are outlined for analyzing both the direct effects of various proposals regarding coal mining, development, and conversion, and the secondary effects resulting from increased population and urban growth. The basin assessment is designed to provide federal, state and local decision-makers with the basic environmental information needed to be formulated and to evaluate policies for the basin. The techniques applied and conclusions reached in the Yampa River Basin Assessment should aid similar studies in other energy-rich basins in the Western United States.


A hydrologic reconnaissance of a 74-kilometer reach of the Yampa River in Dinosaur National Monument in Colorado was made during the low flow in mid-August 1976. Stream discharge, which was measured every 16 to 24 kilometers, ranged from 9.4 to 10.6 cubic meters per second. Variations in streamflow were explained, in part, by underflow loss to ground water, and evaporation. Specific conductance was measured about every 2 kilometers and indicated a downstream increase on the order of 11 to 12 percent for the reach. Except for mercury, bottom-sediment trace-element concentrations in the study reach were less than maximum concentrations determined during August-September 1976 for bottom sediments at unperturbed sites upstream in the Yampa River basin. At one of five sampling sites, the mercury concentration in bottom sediments exceeded the maximum measured upstream level.
The primary problems which might result from reuse of the mine drainage would be damage or destruction of crops if the drainage water were used for irrigation. Also, the chloride and sulfate concentrations in some samples were in excess of recommended standards for public water supplies. (Carroll [FRC])

Appraisal of Ground water in the Vicinity of the Leadville Drainage Tunnel, Lake County, Colorado

Turk, J. T.; Taylor, O. J.


Available from the OFS, Box 25425S, Fed. Ctr., Denver, Co. 80225.

$5.50 in paper copy, $3.50 in microfiche. (Colorado Geological Survey open-file report 79-1538, November 1979, 24 p. 10 Fig. 5 Table)

Journal Announcement: SWRA1324

Ground water in the Leadville mining district occurs in granite, quartzite, sandstone, limestone, porphyry, and unconsolidated material. These rocks form a simple aquifer system because the formations are hydraulically connected through contact, mine workings, faulting, and fracturing. The aquifer is recharged by precipitation and water moves toward California Gulch and probably toward Evans Gulch, in the drainage basin of the Arkansas River. The Leadville drainage tunnel was constructed from 1943 to 1945 and later extended during 1950 to 1952, in order to drain the mine workings.

Discharge from the tunnel lowered water levels 30 to 96 feet in mine shafts from 1944 to 1951. Installation of an additional plug in the tunnel has been proposed in order to reduce the discharge of water containing objectionable concentrations of trace metals into the East Fork Arkansas River.

Coal energy development in Moffat and Routt Counties of the Yampa River basin in Colorado—Projected primary and secondary economic impacts resulting from several coal energy futures

Udis, Bernard; Adams, T. H.; Hess, W. C., and Orr, D. V., 1977

The South Park Coal field, Colorado, J. P. Campbell, Marius R., geologist in charge; Contributions to economic geology 1908, Part II—Mineral Fuels
Washburne, Chester W., 1910

Digital Model of ground-water flow to simulate water flow in the aquifer system in the basins drained by Piceance and Yellow Creeks in northwestern Colorado is described in detail. The model is described by the finite-difference flow equations in the mathematical sense. It is a three-dimensional model and is used to simulate ground-water flow in a multiaquifer system by assuming horizontal flow in the aquifers and vertical flow through the confining layers separating the aquifers. The model uses the iterative alternating-direction implicit procedure to solve the finite-difference flow equations. The digital model is documented by a program listing and flow charts, data used in the model and sample output are presented to document the simulation of steady-state flow in the aquifer system. The variables used in the computer program and program options are discussed in detail. (Woodard-USGS)

HYDROLOGIC AND GEOPHYSICAL DATA FROM THE PIECEANCE BASIN, COLORADO

J. B. WELDER, A. A.
GEOLOGICAL SURVEY, DENVER, COLO.
COLORADO DEPT. OF NATURAL RESOURCES, DENVER, COLORADO WATER RESOURCES BASIC DATA RELEASE NO 35, 1974, 121 P, 21 FIG, 5 PLATE, 70 TAB.

Journal Announcement: SWRA0006

POSSIBLE OIL-SHALE DEVELOPMENT AND THE NEED FOR INFORMATION ON THE WATER RESOURCES OF THE PIECEANCE BASIN, COLORADO. A Cooperative Project Between the Colorado Department of Natural Resources and the U.S. Geological Survey to provide the data needed to evaluate the effects of oil-shale development on the hydrology of the Piceance basin. Data are from 97 wells, 31 springs, and 57 continuing surface-water stations. Miscellaneous measurements of discharge and specific conductance in streams are also given. Included in this report are


JOURNAL ANNOUNCEMENT: SWRA0718

THE DISCHARGE OF WATER WAS MONITORED DURING DRILLING OF TWO HOLES (Rb-e-01 AND Rb-d-01) AT THE RIO BLANCO SITE IN WESTERN COLORADO. RECOVERY OF WATER LEVEL WAS MEASURED FOLLOWING PERIODS OF WATER WITHDRAWAL FROM HOLE Rb-d-01. TWO INTERVALS OF HOLE Rb-d-01 WERE TESTED. ZONE 1, FROM 245 TO 845 FEET BELOW LAND SURFACE, HAS A TRANSMISSIVITY OF ABOUT 4,600 GALLONS PER DAY PER FOOT AND A STATIC WATER LEVEL OF 59.9 FEET BELOW LAND SURFACE. ZONE 2, FROM 882 TO 1,651 FEET BELOW LAND SURFACE, HAS A TRANSMISSIVITY OF ABOUT 200 GALLONS PER DAY PER FOOT AND A STATIC WATER LEVEL OF 40 FEET BELOW LAND SURFACE. THERE IS POTENTIAL AT HOLE Rb-d-01 FOR FLOW OF WATER UPWARD FROM ZONE 2 TO ZONE 1; HOWEVER, DIFFERENCES IN QUALITY OF WATER IN THE TWO ZONES INDICATE THAT WATER PROBABLY DOES NOT CIRCULATE FREELY BETWEEN THE ZONES. (KNAPP-USGS)

HYDRAULIC TESTING ACCOMPANYING DRILLING OF FIVE EXPLORATORY HOLES, PIECEANCE CREEK BASIN, COLORADO

WEIR, J. E. J.; DINWIDDIE, G. A.
GEOLOGICAL SURVEY, LAKEWOOD, COLO.
AVAILABLE FROM NTIS, SPRINGFIELD, VA. 22151 AS USGS-3002-2, PRICE $5.45 PRINTED COPY; $1.45 MICROFICHE, CONTRACT REPORT USGS-3002-2; SEPTEMBER 1973, 55 P, 6 FIG, 1 TAB, 1 REF. USEAC CONTRACT AT(49-16)-3002.

JOURNAL ANNOUNCEMENT: SWRA0701

FIVE EXPLORATORY CORE HOLES WHICH PENETRATED ALLUVIUM AND THE GREEN RIVER FORMATION WERE DRILLED IN THE PIECEANCE CREEK BASIN, COLORADO, AND HYDROGEOLOGIC INFORMATION WAS OBTAINED DURING DRILLING. TRANSMISSIVITY OF THE ROCKS TESTED WAS LOW (LESS THAN 7,500 GALLONS PER DAY PER FOOT), FIELD CONDUCTANCE INDICATED THAT WATER DISCHARGED DURING DRILLING RANGED FROM ABOUT 500 TO ABOUT 79,000 MICROHMS PER CENTIMETER. GENERAL CONCLUSIONS, BASED ON COMPARISON AND EVALUATION OF AVAILABLE DATA, ARE THAT (1) THE ROCKS HAVING GREATEST PERMEABILITY PENETRATED BY THE FIVE TEST HOLES ARE ABOVE THE MAHOGANY
LEGEND ZONE IN THE UPPER PART OF THE PARACHUTE CREEK MEMBER OF THE GREEN RIVER FORMATION: (2) GROUNDWATER IN THE PENETRATED ROCKS BECOMES MORE MINERALIZED WITH DEPTH, NOTICEABLY AT AND BELOW THE MANOSLY ZONE; AND (3) THE TEST HOLES PROBABLY ARE IN AN AREA OF POTENTIAL GROUNDWATER DISCHARGE. (WOODARD-USGS)

APPRAISAL OF SHALLOW GROUND-WATER RESOURCES, PUEBLO ARMY DEPOT, COLORADO

WELDER, F. A.; HURR, R. T.

GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV.

GEOLOGICAL SURVEY OPEN-FILE REPORT 71006, DECEMBER 1971, 44 P., 10 FIG., 5 PLATE, 5 TAB. 7 REF.

Journal Announcement: SWA5117

THE WATER SUPPLY FOR THE PUEBLO ARMY DEPOT, 15 MILES EAST OF WELDER, IS OBTAINED FROM WELLS THAT TAP AN AQUIFER IN TERRACE ALLUVIUM. ADVERSELY AFFECTS THE DISCHARGE RATE OF INDIVIDUAL WELLS. FURTHERMORE, EXCESSIVE PUMPAGE HAS RESULTED IN PROGRESSIVE DETERIORATION OF WATER THE DEPOT AND WERE TESTED TO DETERMINE AQUIFER PROPERTIES AND PROBABLE YIELDS. THE HYDRAULIC CONDUCTIVITY DETERMINED FROM THESE TESTS RANGED FROM ABOUT 350 TO NEARLY 600 GALLONS PER DAY PER SQUARE FOOT. THE TRANSMISSIVITY FOR THE FULL THICKNESS OF THE AQUIFER IS IN THE RANGE OF 7.500 TO 12,000 GALLONS PER DAY PER FOOT. THE TWO NEW SUPPLY WELLS CAN BE PUMPED AT A COMBINED RATE OF ABOUT 140 GALLONS PER MINUTE. IF PUMPAGE IN THE EXISTING WELL FIELD IS REDUCED BY THE SAME AMOUNT, SOME RECOVERY OF WATER LEVELS IN THE FIELD WILL OCCUR AND THE TRENDS IN WATER QUALITY DECELERATION MAY SLOW OR EVEN REVERSE. (WOODARD-USGS)

Geohydrologic Data from Twenty-Four Test Holes Drilled in the Parachute Basin, Rio Bl A COLO. Colorado 1975-76

WELDER, F. A.; SAULNIER, G. J.

GEOLOGICAL SURVEY, LAKESIDE, COLO. WATER RESOURCES Div.


Journal Announcement: SWA1211

Twenty-four test holes were drilled in the Parachute basin, northwestern Colorado, to obtain geohydrologic data from the Uinta and Green River formations of Eocene age. Depths of test holes ranged from 640 to 2,800 feet. The maximum quantity of water discharged during the testing of each individual test holes ranged from 14 to 880 gallons per minute. The specific conductance of water discharged during drilling ranged from 100 to 50,000 microhms per centimeter at 25 degrees Celsius. Aquifer tests made during drilling indicate transmissivity at four sites ranged from 100 to 1,600 feet squared per day and the storage coefficient at two sites ranged from 0.0004 to 0.0016. Depths to the static water level range from 30 to 695 feet. water levels were measured in each test well, and potentiometric maps constructed from these measurements are comparable in configuration and altitude to those previously drawn from compiled data. Water samples taken during drilling indicate that, except for water from the Uinta Formation, the water in Piceance basin is generally not suited for domestic water supply due to the presence of excessive amounts of certain trace constituents, notably fluoride. The average concentration of dissolved solids based on data from the test holes was 909 milligrams per liter water level. (WOODARD-USGS)


Journal Announcement: SWA0971

EFFECT OF MINE DRAINAGE ON THE QUALITY OF STREAMS IN COLORADO, 1971-72

WENTZ, D. A.

GEOLOGICAL SURVEY, LAKEWOOD, COLO.

COLORADO WATER RESOURCES CIRCULAR NO 21, 1974, 117 P., 9 FIG., 3 PLATE, 12 TAB. 93 REF. APPEND.

Journal Announcement: SWA7017

MINE DRAINAGE IN COLORADO IS COMMONLY ACID W ATER CONTAINING HIGH CONCENTRATIONS OF IRON AND SULFATE. THE OXIDATION OF METAL SULFIDES UNDER ACID CONDITIONS RELEASES HIGH CONCENTRATIONS OF TRACE ELEMENTS TO THE WATER. FIELD OBSERVATIONS MEASUREMENTS OF TEMPERATURE, SPECIFIC CONDUCTANCE, PH, STREAM-BOTTOM CONDITIONS, AND AQUATIC BIOTA AT 905 STREAM SITES IN COLORADO DURING 1971-72 WERE USED AS A GUIDE IN COLLECTING 192 SAMPLES FOR ANALYSIS OF SULFATE AND DISSOLVED TRACE ELEMENTS. APPROXIMATELY 450 MILES OF STREAMS IN 25 DIFFERENT AREAS ARE ADVERSELY AFFECTED BY METAL-MINE DRAINAGE, OF THE TRACE ELEMENTS FOR WHICH THE U.S. PUBLIC HEALTH SERVICE HAS ESTABLISHED DRINKING WATER STANDARDS, CAUZUM EXCEEDS ITS LIMIT IN MORE THAN 12% OF THE SAMPLES, WHILE ARSENIC AND LEAD EXCEED THEIR LIMITS IN 1-3% OF THE SAMPLES. MERCURY AND SILVER STANDARDS ARE NOT EXCEEDED. LEAD, COPPER, AND ZINC APPEAR TO PRESENT THE GREATEST DANGER IN SO FAR AS TOXICITY TO RESIDENT AQUATIC LIFE IS CONCERNED. ACID PRODUCTION IS LESS OF A PROBLEM IN COLORADO STREAMS DRAINING METAL-MINING AREAS THAN IN STREAMS DRAINING THE COAL-MINING AREAS OF APPALACHI A. (KNAPP-USGS)

STREAM QUALITY IN RELATION TO MINE DRAINAGE IN COLORADO

WENTZ, D. A.

GEOLOGICAL SURVEY, DENVER, COLO.


Journal Announcement: SWA9008

MOST OF COLORADO'S METAL DEPOSITS ARE COMPOSED OF SULFIDE ORES.
OXIDATION OF ASSOCIATED PYRITE YIELDS ACIDIC WATER, WHICH IN TURN DISSOLVES OTHER METAL SULFIDES AND RELEASES TRACE ELEMENTS TO THE SURFACE DRAINAGE, WHERE THE PROCESS IS RELATIVELY UNIMPORTANT IN COAL DEPOSITS WITHIN THE STATE. TRACE ELEMENTS IN COLORADO STREAMS DO NOT OFTEN FOLLOW A NORMAL OR SIMPLE LOGNORMAL FREQUENCY DISTRIBUTION. CONCENTRATIONS OF CADMIUM, COUGAL, COPPER, IRON, LEAD, MANGANESE, MOLYBDENUM, NICKEL, VANADIUM, AND ZINC OCCUR IN GREATER CONCENTRATIONS IN STREAM DRAINING METAL-MINING AREAS THAN IN STREAMS DRAINING COAL-MINING OR CONTROL AREAS. BASED ON THIS STUDY, IT IS SUGGESTED THAT FIELD MEASUREMENTS OF SPECIFIC CONDUCTANCE AND PH CAN BE USED AS A TOOL IN THE SELECTION OF STREAMS AFFECTED BY METAL-MINING ACTIVITY. VISUAL OBSERVATIONS OF STREAM CONDITIONS CAN ALSO HELP. IN SITUATIONS WHERE VISUAL OBSERVATIONS ARE DIFFICULT (FOR EXAMPLE, GROUNDWATER STUDIES), MEASUREMENT OF ONE OR MORE INDICATOR CHEMICAL CONSTITUENTS MAY BE FEASIBLE. IN COLORADO, ZINC, AND POSSIBLY SULFATE, MIGHT BE USED IN THIS REGARD. (WOODARD-USGS)

Analysis of Stream Water Quality in the Yampa River Basin, Colorado and Wyoming

Wentz, D. A.; Steele, T. D.


Journal Announcement: SWRA1022

Coal production in the Yampa river basin of Colorado and Wyoming is expected to exceed 20 million tons annually by 1990. Increased coal production and related development could increase withdrawals of surface water, which currently (1976) supplies the bulk of water used in the basin. Analyses have been carried out to determine ambient surface-water quality in the basin prior to accelerated coal-resource development. Regional temperature patterns, sediment yields, and relations between specific conductance and concentrations of major inorganic chemical constituents have been determined from available historical data. Time-trend analyses of historical stream specific conductance and concentrations of total trace elements have been determined from available historical data. The historical data were complemented by a reconnaissance of 82 stream sites during low-flow conditions in August and September 1975. At three sites, concentrations of trace elements in water were in bottom sediments were higher than ambient levels determined for the basin. Iron and manganese concentrations exceeded current drinking water standards. In addition, high concentrations of nitrogen, phosphorous, and organic carbon were found at six sites. Diversity indices for benthic macroinvertebrates provide no concrete evidence for additional anomalous sites in the basin. (Woodard-USGS)

SUMMARY APPRAISALS OF THE NATION'S GROUNDWATER RESOURCES—RIO GRANDE REGION

Wentz, S. W.; Brookhurs, W. L.


Available from Superintendent of Documents, GPO, Washington, D.C.
PRIVATE COMPANIES. GROUNDWATER DATA WERE COLLECTED FROM 52 WELLS IN THE PICEANCE BASIN. OF THE 52 WELLS, 25 WELLS HAVE TRANSMISSIVITY DATA, 10 WELLS HAVE DISCHARGE DATA, 39 WELLS HAVE TEMPERATURE DATA, 8 WELLS HAVE VERTICAL FLOW DATA, 37 WELLS HAVE SPECIFIC CONDUCTANCE DATA, 17 WELLS HAVE COMMON ION DATA, AND 18 WELLS HAVE TRACE ELEMENT DATA. A POTENTIALISTIC MAP OF THE REPORT AREA IS GIVEN. THE MAP IS BASED ON THE ALTITUDE OF WATER LEVELS IN 51 OBSERVATION WELLS WHICH PENETRATE THE GREEN RIVER FORMATION. THE WATER-LEVEL MEASUREMENTS WERE MADE DURING THE SUMMER OF 1972. (Knap-P-USGS)

Hydrologic Studies of the U.S. Geological Survey Related to Coal Development in Colorado


Open-file report 75-5649, August 1974, 22 p. 5 fig., 1 tab., Journal Announcement: SWRA1006

This report summarizes the hydrologic studies related to coal development being conducted by the U.S. Geological Survey in the State of Colorado. The objective of the hydrologic data-acquisition program is to collect surface-water quality and quantity data and ground-water level records. These data are needed to define predevelopment conditions and to monitor the effects of construction and operation of coal mines and waste-disposal areas.

Data-acquisition activities related to coal development in Colorado include (1) the study and collection of related reports and (2) the conduct of hydrologic studies currently in progress. Each study summary consists of the project title, definition of the problem being studied, objective of the study, approach of the study, and when known, the schedule for completion of the study and proposed report products resulting from the study. (Woodard-USGS)

PUBLICATIONS OF WATER RESOURCES INVESTIGATIONS IN COLORADO AND SELECTED PUBLICATIONS PERTAINING TO COLORADO

GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV. GEOLOGICAL SURVEY, COLORADO DISTRICT REPORT, 1973, 33 p., Journal Announcement: SWRA620


COLORADO

GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV.


Foidel Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in Routt County, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 6-76

The 4.36-square-mile Foidel Creek study site includes much of the ephemeral and intermittent headwater drainage to Foidel Creek. Relief in less than 2 miles is 1080 feet. Annual precipitation is about 16 inches. Runoff occurs only in spring from snowmelt and spring rains. The Wedge coal in the Williams Fork Formation of the Mesaverde Group dips northwad, as does much of the surface, and contains 31 million tons of coal no deeper than 201.3 feet. Small quantities of water, less than 10 gallons per minute to wells, occur in this discontinuous sandstone layers above, within and below the coal. The water is not highly mineralized, containing only hundreds of milligrams per liter total dissolved solids. Surface mining spoil will increase dissolved solids content of ground water. Proper operational and restoration practices should minimize or eliminate erosion and addition of sediment downstream.

Lay Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in Moffat County, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 20-78

The 5.7 square-mile Lay Creek site consists mostly of "badlands" between gently sloping valley bottoms and steep slopes leading to 40-foot vertical escarpments of narrow dissected mesas. The site is drained by through-flowing Lay and Bond Creeks, both ephemeral. Annual runoff is probably less than 200 acre-feet. The coal is in the Fort Union Formation, which slopes gently northward from the Mud Springs anticline. Strippable coal resources in the Emerald and Blievena beds from 6.5 to more than 15 feet thick amount to 142 million tons. Small amounts of water occur in alluvium, good quality, and in the coals (dissolved solids, 900 to 1,400 milligrams per liter). Mining would remove 6 small stock reservoirs which could be replaced readily. No significant hydrologic impacts are foreseen.

Taylor Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Axial Basin Coal Field, northwestern Colorado
BLM, Denver, Colorado
EMRIA Report No. 3-75

The 2,000-plus acre Taylor Creek study site in Moffat County, northwestern Colorado is on the southern flank of the Axial Basin. Its rolling hills and sloping ridges are drained by minor ephemeral tributaries to the Yampa River, 8 to 10 miles north. The coals beneath the site are in the lower part of the Williams Fork Formation of the Upper Cretaceous Mesaverde Group. Coal seams within 200 feet of land surface range up to 12 feet thick and are separated by thin to thick layers of shale, siltstone and fine-grained sandstone layers. Thicker coal seams occur at greater depths. Water, perched on impermeable layers, is commonly found within 30 feet of the surface. Sustainable well yields probably would not exceed 5 gallons per minute. Small, manageable quantities of water may be encountered while surface mining. Proper operation and reclamation practices would reduce or eliminate increases in sediment to streams.

Moffat and Routt Counties, in Colorado. Federal action would result in annual coal production of 15.7 billion tons by 1980, and 24.8 billion tons by 1990. The coal would be mined both by underground and surface methods. Precipitation ranges from less than 8 inches to more than 24 inches annually. The area is drained almost entirely by the Yampa and White Rivers—major tributaries to the Green River flowing into the Colorado River in southwestern Utah. The northwest corner of the area is drained by intermittent Vermillion Creek into the Green River. Water yields range from less than one inch of runoff in desert areas to more than 20 inches from areas at higher elevations. Total dissolved solids range from 50 to 500 milligrams per liter in streams of the area. Major water use in the area is for irrigation, which together with saline ground water inflow are the major causes of salinity (263 tons per day). Mining would add 5,000 tons per year of dissolved load and less than 30,000 tons of sediment annually to the Colorado River System by the year 1990, resulting in an insignificant, less than 1 milligram per liter increase in dissolved solids below Hoover Dam. Ground water occurs throughout the area in limited quantity, ranging from less than a gallon per minute from shale areas, to several tens of gallons per minute in coarser sedimentary rock units, to 1,500 gallons per minute from the Mississippian-age Madison Limestone and alluvium of larger streams. Quality ranges from less than 20 to more than 5,000 milligrams per liter of dissolved solids. Impacts of mining on ground water would be localized to the loss of a few wells and springs.

This document addresses impacts of approval of mine plans in existing Federal leases, grants of associated rights-of-way, and possible future leasing, in
This record assesses the impacts of leasing 2,130 acres of Federal coal, three miles northwest of Paonia, Delta County, Colorado. The coal would be mined underground as an extension of existing Orchard Valley mine. The coal is the 26-foot thick "D" seam of the Mesa Verde Paonia Shale Member dipping 3 to 6 degrees northwestward on the southern flank of the Piceance Basin. Overburden ranges from zero at the outcrop to 2,000 feet three miles north.
GROUNDWATER GEOLOGY OF THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEMANEE AREA, ILLINOIS
BRUECKMANN, JOHN E., GERSHON, ROBERT E.
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA, ILLINOIS
GEOLOGICAL SURVEY REPORT OF INVESTIGATIONS 221, 1968, 56 P.

Journal Announcement: SWAO324
GROUNDWATER IN THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEMANEE AREA, ILLINOIS, IS OBTAINED FROM (1) SAND AND GRAVEL AQUIFERS WITHIN THE GLACIAL DRIFT; (2) SHALLOW BEDROCK AQUIFERS THAT ARE PRIMARILY DOLOMITE OF THE NIAGARAN SERIES (SILURIAN), THE KEOKUK-BURLINGTON LIMESTONE (MISSISSIPPIAN); AND (3) DEEP BEDROCK AQUIFERS, PRIMARILY THE ORDOVICIAN ANCELL GROUP (GLENWOOD-ST. PETER SANDSTONE) AND THE NIAGARAN SERIES IRONWOOD-GALESBURG SANDSTONE. MOST PRIVATE WATER SUPPLIES GENERALLY ARE OBTAINED FROM THE DEEP BEDROCK AQUIFERS. SAND AND GRAVEL AQUIFERS ARE SPARSELY DISTRIBUTED IN THE AREA. THE ESTIMATED TOTAL PUMPAGE OF GROUNDWATER ALONE IS 16,551,000 GALLONS PER DAY FOR THE AREA. THIS CONSTITUTES ABOUT 50% OF THE ESTIMATED TOTAL PUMPAGE OF BOTH SURFACE AND GROUNDWATER AND SERVES ABOUT 63% OF THE POPULATION. MUNICIPALITIES NOW USING GROUNDWATER CAN PROBABLY DEVELOP ADDITIONAL GROUNDWATER SOURCES TO MEET INCREASED DEMANDS IN THE FUTURE. (KNAPP-USGS)

Magnitude and Frequency of Floods in Illinois
Carns, J. M.

This report presents flood-peak data and methods of estimating the magnitude and frequency of floods for most streams in Illinois. Flood-frequency curves are given for gaged sites where 10 or more years of flood records have been collected. Flood characteristics from these curves were related, by multiple correlation and regression analyses, to drainage basin characteristics. Regional equations are presented which relate flood-peak discharges to recurrence intervals of 2, 5, 10, 25, 50, and 100 years using drainage area, main-channel slope, rainfall intensity, and a regional factor as independent variables. These equations can be used to estimate the magnitude and frequency of floods at most ungaged sites where flood discharges are not significantly affected by regulation or urbanization. Graphs are presented for estimating flood magnitudes on some streams where the regional equations are not applicable.

The report contains a compilation of peak stages and discharges at gaging stations having 5 or more years of record, where available. All floods above a selected base are included in the tabulations. Only the annual maximum floods are shown for other stations.

Frequency Analysis of Illinois Floods Using Observed and Synthetic Streamflow Records
Curtis, George W.

Equations, applicable Statewide, for estimating flood magnitudes having recurrence intervals ranging from 2 to 500 years for unregulated rural streams, with drainage areas ranging from 0.02 to 10,000 square miles (0.05 to 25,900 square kilometers), were derived by multiple regression analyses. A rainfall-runoff model was used in the synthesis of long-term annual peak data for each of 54 small watersheds (drainage areas less than 10.2 square-miles, 26.4 square-kilometers). Synthetic frequency curves generated from five long-term precipitation stations were combined into one synthetic curve and then this synthetic curve was combined with the observed station frequency curve to define the station frequency curve. Synthetic data from the 54 small streams, observed data at 33 small streams, and observed data at 154 large streams were used in the analyses. The most significant independent variables in the regression analysis for estimating flood peaks on Illinois streams were drainage area, slope, rainfall intensity, and an areal factor.

Technique for estimating magnitude and frequency of floods in Illinois
Curtis, G. W.

Time of Concentration and Storage Coefficient Values for Illinois Streams
Graff, Julia B., Garklavs, Georgey, and Oberg, Kevin A.

Values of time of concentration and storage coefficients, two unit hydrograph parameters, are presented for 194 and 120 basins in Illinois, respectively. Tabulated values consist of those computed by previous investigators as well as those computed for 96 basins as part of this investigation. These additional values were computed by calibration of the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The significance of differences in method used by each investigator to compute these unit hydrograph parameters was evaluated by statistical comparison of four sets of time of concentration values and three sets of storage coefficient values. Because no difference due to method was identified, it is concluded that all of the values in Table 1 in this report can be used in any application for which time of concentration and storage coefficient are required.

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams
Volumes of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume III includes the Illinois River basin and Mississippi River tributaries north of Illinois River basin. (Woodard=USGS)

Chemical Analyses of Surface Water in Illinois, 1958-74 Volume II

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume III includes the Illinois River basin and Mississippi River tributaries north of Illinois River basin. (Woodard=USGS)

Grason, D.J.; Healy, R.W.
Journal Announcement: SWRA1304

Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency. The results from water years 1975 to 1977 are presented in three volumes. The history of sampling and analytical methods used during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. Volume I includes the Des Plaines River basin and Lake Michigan. (Woodard=USGS)

Chemical Analyses of Surface Water in Illinois, 1975-77, Volume III, Ohio River Tributaries and Mississippi River Tributaries South of Illinois River Basin
Grason, D.J.; Healy, R.W.
Journal Announcement: SWRA1304

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Grason, D.J.; Healy, R.W.
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River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any streams draining at least 100 square miles.

River Mileages and Drainage Areas for Illinois Streams - Volume 2, Illinois River basin


River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any streams draining at least 100 square miles.

Chemical Analyses of Surface Water in Illinois, 1958-74 Volume I


Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency and its predecessor, the Stream Pollution Control Board of the Illinois Department of Public Health. The results for the period 1958 to 1974 are presented in tabular form and the history of sampling and analytical methods are summarized. Stream discharge data from records kept by the Illinois Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made.

Chemical Analyses of Surface Water in Illinois, 1958-74 Volume II


Samples of surface water were collected and analyzed by the Illinois Environmental Protection Agency and its predecessor, the Stream Pollution Control Board of the Illinois Department of Public Health. The results for the period 1958 to 1974 are presented in tabular form and the history of sampling and analytical methods are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made.

ILINOIS STATE GEOLOGICAL SURVEY, URBANA.

ENVIRON GEOl NOTE NO 26, ILL STATE GEOl SURV. MAR 1969, 42 P., 5 FIG, 8 TAB, 2 REF, GRANT NO. 5-001-01-00006-02.

Journal Announcement: SWRA0214

SANITARY LANDFILLS AT 4 SITES IN ILLINOIS WERE DRILLED AND SAMPLES OF WATER AND SOLID MATERIALS WERE ANALYZED TO DETERMINE THE HYDROGEOLOGIC CONDITIONS AND EFFECTS OF WASTE DISPOSAL IN GLACIATED TERRAIN. THE TABULATED DATA INCLUDE SITES OF PIEZOMETERS AND SAMPLES, DRILLERS LOGS, SIEVE ANALYSES OF EARTH MATERIALS, CLAY MINERAL ANALYSES, CHEMICAL ANALYSES OF LEACHATE AND GROUNDWATER, AND NEUTRON ACTIVATION ANALYSES. THE LANDFILL MAPS INCLUDE PIEZOMETER LOCATIONS, LOCATIONS OF CROSS SECTIONS, AND WATER TABLE CONTOURS. (KNAPP-USGS)

HYDROGEOLOGIC DATA FROM FOUR LANDFILLS IN NORTHEASTERN ILLINOIS

HUGHES, G. M.; LANDON, R. A.; FARVOLDEN, R. N., ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, U. S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. 20402 PRICE $1.50. REPORT SW-120, U.S. ENVIRONMENTAL PROTECTION AGENCY, 1971, 154 P, 28 FIG, 20 REF, 8 APPEND.

Journal Announcement: SWRA0510


Low-Flow Frequencies of Illinois Streams


This report contains low-flow data and regionalized low-flow frequency estimates for all areas in Illinois where at least five years of record (through 1956) have been collected.

In the first section minimum average flows for periods of 1, 7, 15, 30, 60, 120 and 183 days are tabulated for the benefit of those who are interested in the amount of flow available in the stream with minor or no storage. Data for 12, 24, and 60 months are also included in the tables for those concerned with the minimum expected inflow into large impounding reservoirs.

Six
separate regionalized frequency curves for each station have been fitted on the plotted data. These curves evaluate the minimum average flow expected in periods of 7, 15, 30, 60, 120, and 183 days, respectively.

In the second section a technique is derived to serve as a guide to fitting frequency curves to observed data from regionalized basins and for the purpose of extrapolating short-term records. This technique is based on relations empirically developed between low-flow and flow-duration parameters. The advantage of using this approach of regionalization and synthesis of frequency curves is that methods for the synthesis and regionalization of duration curves are available (Mitchell, 1957). "Flow Duration of Illinois Streams."

Drainging areas for Illinois Streams
Ogata, K. M.

Drainging areas were tabulated for all streams in Illinois which drain over 100 square miles at sites where streamflow data have been collected and at other selected locations. Areas were planimetered on U.S. Geological Survey topographic quadrangle maps and balanced to known areas taken from Smithsonian Geographical Tables of areas of quadrilaterals of the same surface (procedures and standards recommended by Subcommittee on Hydrology, Federal Inter-Agency River Basin Committee). Streams are tabulated in sequence; first, the Ohio River basin, followed by the St Lawrence River basin; and finally, the Mississippi River basin. Streams are listed in downstream order, starting at the headwaters; the rank of the stream system within each basin is indicated by indentation. At sites where data did not differentiate, previously assigned U.S. Geological Survey eight-digit numbers are used; these numbers which describe unique sites, increase in downstream order. All locations are identified by reference to a town, land-line location, topographic quadrangle, and county at the point where the drainage area was determined. An alphabetical index is provided.

Hydrologic effects of storing liquified sludge in strip-mined land
Patterson, G. L.

The water table near four sewage sludge storage basins in a strip-mined area of western Illinois has risen about 10 feet since the basins were constructed in 1971. Two-dimensional modeling of the water table indicated that the rise is caused by leakage from storage basin. The hydrologic-parameter values producing the best fit between computed and observed head values are 7 X 10 exp(-6) feet per second for the hydraulic conductivity of the mine spoil; 4 X 10 exp(-9) feet per second (1.51 inches per year) for the areal recharge rate, and 5.6 X 10 exp(-8) feet per second (21.1 inches per year) for recharge from basin 1. The model indicates that the volume of water leakage from basin 1 is 91,600 cubic yards per year.

On the principal components of the sewage sludge after the solids have been removed are alkalinity, nitrogen, phosphorus, and chloride. In ground water away from the storage basins, the principal cation was magnesium, whereas in that near the basins, the principal cation was sodium. Components in higher concentrations near the basins were sodium, alkalinity, and chloride. Sulfate was the principal anion in both areas. Because the sodium and chloride concentrations in the sludge were too low to cause the higher concentrations in the ground water, the strip-mine spoil used in constructing the basins was considered to be the major source of these constituents. This spoil had been moved from its original location and unweathered surfaces exposed, which allowed dissolution of carbonate and chloride and release of sodium through cation exchange.

Hydrologic Characteristics of Surface-Mined Land Reclaimed by Sludge Irrigation: Fulton County, Illinois
Patterson, G. L., Fuentes, R. F., and Toler, L. G.

Analyses of water samples collected at four stream-monitoring stations in an area surface mined for coal and being reclaimed by surface irrigation show the principal metals to be sodium, calcium, and magnesium and the principal non-metals to be chloride, sulfate, and bicarbonate. Comparisons of yearly mean chemical concentrations show no changing trends since the reclamation began. Relationships between stream stations upstream and downstream from the site, yearly suspended-sediment loads and discharge, are not similar. Reclamations from the site also are not notably different. Discharge hydrographs of two tributary streams draining the site show a delayed response to precipitation with other sites, compared with other sites, with the damping effect of several upstream strip-mine lakes. The shape of the water-table surface generally follows the irregular topography. Monthly water-level fluctuations in wells were dependent on the surface material penetrated (mined or unmined) and their proximity to surface discharge. The largest fluctuations were in unmined land away from discharge, whereas the smallest were in mined land near discharge. The water table is closer to the surface in unmined land than in mined land.

The chemical characteristics of ground water are typical of those in mined areas. Automatic water flow in high concentrations of sulfates, calcium, magnesium, chlorides, iron, zinc, and manganese. However, no changes in ground water quality attributable to reclamation were identified.
Conductivity (dissolved solids).

oxygen and fecal bacteria showed seasonal variations. Streptococcus bacter~

• • ng nese, alcohol, mercury, and concentrations of organic compounds result of coupled organic compounds.

Total Illinois Report.

Municipal sanitary treatment facilities showed three basic types of responses to climatic and hydrologic stresses. Stream temperatures and concentrations of dissolved oxygen, ammonia nitrogen, total phosphorus, biochemical oxygen demand, and fecal bacteria showed seasonal variations. Conductivity (dissolved solids), pH, chloride, and suspended solids concentrations varied more closely with stream discharges. Total organic carbon, total nitrogen, total phosphorus, biochemical oxygen demand, and fecal coliform and fecal streptococcal bacteria concentrations exhibited variations indicative of initial flushing action during storm runoff.

Selected analyses for herbicides, insecticides, and other complex organic compounds in solution and in bed material showed that these contaminants were coming from sources other than the municipal sanitary treatment plant effluent. Analyses for 10 common metals: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc showed changes in concentrations below the municipal sanitary plant outfall.

Report.

A proposed streamflow data program for Illinois Sieber, C. R., 1970

Some chemical characteristics of mine drainage in Illinois Toler, L. G., 1980

Some chemical characteristics of mine drainage in Illinois Toler, L. G., 1982
U.S. Geological Survey Water-Supply Paper 2078

Surface mining for coal in Illinois has affected runoff from the mined areas and altered water quality in the streams. Average annual sulfate loads in streams are 3000-4000 tons per square mile of mined land in the Illinois and Saline River basins in southern Illinois. Relatively high concentrations of dissolved aluminum, arsenic, cadmium, chromium, copper, iron, manganese, and zinc are commonly associated with concentrations of sulfate greater than about 2000 milligrams per liter.

Wiegert, D. E.
Illinois District reports.
These reports detail the activities of the U.S. Geological Survey, Water Resources Division in Illinois.
(Woodard-USGS)

Hydrology of Area 25, Eastern Region, Interior Coal Province, Illinois
Zuehlke, E. E.; Ryan, G. L.; Peart, D. B.; Fitzgerald, K. K.
Journal Announcement: SWA0151
The eastern region of the Interior Coal Province has been divided into 11 hydrologic study areas. Area 25, located in west-central Illinois, includes the Spoon River and small tributaries to the Illinois River. Pennsylvanian age rocks underlie most of the study area. Illinois coal, with the largest reserves of bituminous coal, is second only to Montana in total coal reserves. Loess soils cover most of the study area. Agriculture is the dominant land use. Surface water provides 97% of the water used, collected at over 31 sites. Analysis for specific conductance, pH, alkalinity, iron, manganese, sulfate and many trace elements and other water-quality constituents have been completed. These data are available from computer storage through the National Water Data Storage and Retrieval System (WATSTORE). (USGS)

Hydrology of area 35, Eastern Region, Interior Coal Province, Illinois and Kentucky

GEOLOGY FOR PLANNING IN ST. CLAIR COUNTY, ILLINOIS
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
ILLINOIS STATE GEOLOGICAL SURVEY CIRCULAR 445, 1971. A.
M. Jacob, Compiler. 35 p., 4 Fig., 8 Tab., 63 Ref.
Journal Announcement: SWA0619

WATER RESOURCES DATA FOR ILLINOIS, PUBLISHED ANNUALLY SINCE 1975 River Basin
Available from the National Technical Information Service, Springfield, VA 22161.
Water resources data for Illinois consist of records of stage, discharge, and water quality of streams, stage and contents of lakes and reservoirs, and water levels and water quality of ground-water wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measures and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)

WATER RESOURCES INVESTIGATIONS IN ILLINOIS, 1977
GEOLoGICAL SURVEY, WASHInGtoN, D.C.
GEOLoGICAL SURVEY REPORT OF INVESTIGATIONS FOLDER, 1 SHEET, 1977. 6 FIG., 1 MAP.
Journal Announcement: SWA0515
THE WATER RESOURCES STUDIES AND INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN ILLINOIS ARE SUMMARIZED. A SELECTED BIBLIOGRAPHY OF MATERIAL CONCERNING THE STATE IS INCLUDED. A LIST IS GIVEN OF STATE AND FEDERAL AGENCIES, COUNTIES, AND CITIES WHO COOPERATE IN DIFFERENT PARTS OF THE PROGRAM. THE HYDROLOGIC DATA NETWORK CONSISTS OF 173 PRIMARY SECONDARY, AND WATER MANAGEMENT STREAMFLOW STATIONS; 4 GROUNDWATER OBSERVATION WELLS; AND 7 WATER QUALITY OBSERVING SITES. SMALL STATE MAPS
SHOW AVERAGE ANNUAL PRECIPITATION, DISCHARGE OF PRINCIPAL RIVERS, AND AREAS OF FLOOD INUNDATION. A MAP, SCALE 50 MI TO THE IN., SHOWS BY SYMBOLS, NUMBERS, AND COLORED OUTLINE THE HYDROLOGIC DATA NETWORK AND INVESTIGATIONS IN ILLINOIS IN JUNE 1968. (WOODARD-USGS)
A water-quality assessment of the Anderson River watershed, Crawford, Dubois, Perry, and Spencer Counties, Indiana
Ayers, M. A., 1975

A water-quality assessment of the Middle Fork Anderson River watershed, Crawford and Perry Counties, Indiana
Ayers, M. A., 1978

A Water-Quality assessment of the Prairie Creek watershed, Vigo County, Indiana
Ayers, Mark A.

A water-quality assessment of the Prairie Creek watershed was made April 1 to 5, 1974. Stream waters were a calcium bicarbonate type with moderately low dissolved solids content except where affected by drainage from coal mines in the headwaters. Dissolved manganese values were above the desired level of 0.05 milligram per litre at all but two sites sampled. Stream waters contained less than 0.05 milligram per litre dissolved phosphorus, and dissolved nitrate concentrations ranged from 0.8 to 2.9 milligrams per litre. Fecal coliform bacteria concentrations ranged from 150 to 3,500 colonies per 100 millilitres. Fecal streptococci concentrations ranged from 450 to 2,300 colonies per 100 millilitres. The concentration of dieldrin in bed materials increased in a downstream direction in Prairie Creek from about 2 to 6 micrograms per kilogram. About 15 micrograms per kilogram PCB compounds were found in an upstream sampling site and 2.3 micrograms per kilogram DDT were found in another sampling site. The Prairie Creek benthic communities at two sites were 80 percent midge and black fly larvae, with diversity indices of 2.7 and 2.8.

Gazetteer of Coal-Mine Lakes in Southwestern Indiana
Bobo, L. L.
Geological Survey, Indianapolis, IN, Water Resources Div., report, June 1979, 107 p., 54 Fig., 2 Tab., 13 Ref., Journal Announcement SWA1303

This gazetteer is a catalog of lakes formed by surface coal mining in southwestern Indiana that are 0.5 acre or larger, and in nonactive mine areas. Approximately 1,000 of the lakes are listed by 7.5-minute quadrangle topographic map name, lake-identification number, latitude and longitude, and county. Other data given are shape of lake, maximum length, mean width, length and development of shoreline, surface area, orientation, presence of a stream inlet or outlet, and geologic data (geologic formation of area surrounding the lake and the mined coal-bed member). Field data (sampling date, pH, specific conductance, apparent color of lake, and general vegetation along the shoreline) were collected for 287 of the lakes. The apparent colors of the lakes observed were varying shades of aqua, blue, brown, lime green, red, and green. Eighty percent of the lakes sampled were green. (Woodard - USGS)

Ground and surface-water quality and hydrologic data from in and around an active surface coal-mine, Clay and Vigo Counties, Indiana
Few data exist from reclaimed surface coal mines to evaluate water quality and hydrology, particularly in areas where high acid-production potential material is selectively buried. Because so few data exist from these regions, a study was done to determine the degree of modern mining and reclamation on both ground and surface water in and around an active reclaimed surface coal mine, Clay and Vigo Counties, Indiana, from September 1977 through February 1980. Water quality and hydrologic data were collected from 41 wells and 24 stream sites. Land use in the study area was: agricultural and forested, affected and unaffected by mining operations, and reclaimed and unclaimed surface coal mining.

Field measurements included water temperature, specific conductance, pH, Eh, dissolved oxygen, ground-water elevations and streamflow. Water samples from wells and streams were analyzed for concentrations of major cations and anions, alkalinity, hardness, aluminum, iron, manganese, trace elements, organic carbon, phosphorus and dissolved-solids residue at 180 degrees Celsius. Additional analyses of stream samples done to determine (1) concentrations of elements absorbed onto streambed materials, (2) concentrations and particle size of suspended-sediment water, and (3) populations and Shannon diversity indices of phytoplankton in water.

Water-Quality and Other Hydrologic Data Collected in and Around a Surface Coal Mine, Clay and Vigo Counties, Indiana, 1977-80

Few data are available for evaluating water-quality and other hydrologic properties in and around surface coal mines, particularly in areas where material having a high acid-production potential is selectively buried. This report contains hydrologic data collected in coal-mine areas in Clay and Vigo Counties, Indiana, from September 1977 through February 1980. Methods of sampling and analysis used in collecting data are also described. The data include field and laboratory measurements of water at 41 wells and 24 stream sites. Variables measured in the field include water temperature, specific conductance, pH, Eh,
dissolved oxygen, ground-water levels, and streamflow; and in the laboratory, concentrations of major ions, alkalinity, hardness, trace elements (in this report, elements having concentrations of 1 milligram per liter or less), organic carbon, phosphorus, and dissolved solids. Other variables measured in the laboratory include ferrous iron concentration of water samples from selected wells, percent sulfur by weight and the potential acidity of core samples of to (3) improve water quality, concentrations of elements adsorbed on streambed materials, concentrations, and particle size of suspended sediment in water, and populations and Shannon diversity indices of phytoplankton in water. Dissolved solids concentrations and pH of ground water ranged from 173 to 5,130 milligrams per liter and from 6.1 to 8.9, respectively, and of surface water, from 120 to 4,100 milligrams per liter and from 6.1 to 8.8, respectively.

Evaluation of ground-water quality, coal mining region, southwestern Indiana. (Soon to be published). Bobb L. L., and Martin J. D.

Water-Quality Assessment of the Cypress Creek Watershed, Warrick County, Indiana Bobb L. L., Peters C. A.


Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221989, Price codes: A04 in paper copy.


The U.S. Soil Conservation Service needs chemical, biological, and hydrological data to prepare an environmental evaluation of the water quality in the Cypress Creek watershed, Warrick County, Ind., before plans can be made to improve water quality. (1) Minimize flow, (2) reduce sedimentation, and (3) provide adequate outlets for drainage in the watershed. The U.S. Geological Survey obtained these data for the Soil Conservation Service in a water-quality survey of the watershed from March to August 1979. Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The upper reaches of Cypress Creek receive acid-mine drainage from a coal-mine waste slurry during periods of intense rainfall. All the remaining tributaries, except Summer Pecka ditch, drain mined or reclaimed lands. The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. In contrast, the water type at background site 21 on Summer Pecka ditch is calcium sulfate. Specific conductance ranged from 670 to 4,730 micromhos per centimeter at 25 degrees Celsius and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries.

Concentrations of iron, manganese, and sulfate in water samples and chloridane, DDT, and PCB's in streambed samples exceeded water-quality standards set by the U.S. Environmental Protection Agency. (USGS)

HYDROGEOLOGY OF THE PRINCIPAL AQUIFERS IN SULLIVAN AND GREENE COUNTIES, INDIANA

Cable L. W., Robison T. M.

GEODETICAL SURVEY, INDIANAPOLIS, IND.

INDIANA DEPARTMENT OF NATURAL RESOURCES DIVISION OF WATER

BULLETIN NO 35, 1975, 26 P, 8 FIG, 3 PLATE, 28 REF., JOURNAL ANNOUNCEMENT: SWA1078

The rocks that underlie Sullivan and Greene counties, Indiana, may be placed in two general categories—consolidated and unconsolidated. Based on their water-bearing properties the consolidated rocks are subdivided into three major hydrologic units, aquifers in unit 1 are relatively thickbedded limestone and sandstone bodies. The average yield from wells in this unit is 10 gpm with yields of as much as 100 gpm reported. The aquifers of unit 2 are sandstone bodies which occur throughout the strata of this unit. The average yield of wells in this unit is 5 gpm, and maximum yields are about 20 gpm. Unit 3 is similar in most respects to unit 2; however, in this unit there are fewer water-bearing sandstone bodies and, as a consequence, numerous dry holes are drilled. Aquifers in the unconsolidated rocks of the area are coarse sand and gravel deposits located predominantly along the stream valleys. The valley bottoms are underlain by gravel and sand and have the highest water yields. (Woodard-SGS)

HYDROGEOLOGY OF THE PRINCIPAL AQUIFERS IN VIGO AND CLAY COUNTIES, INDIANA

Cable L. W., Watkins F. A., Jr., and Robison T. M., 1971

Indiana Division of water bulletin 34, 91 p.

Ground-Water Resources of Vanderburgh County, Indiana Cable L. W., Wolf R. J.


Sandstone units of Middle and Late Pennsylvanian age and sand
and gravel of Quaternary age are the source of fresh (1,000 parts per million of dissolved solids or less) ground water in Vanderburgh County, Indiana. Aquifers occur in older rocks, but their water is too highly mineralized to be useful for most purposes. Sand and gravel deposits of the Ohio River Valley are the best aquifers in Vanderburgh County. These deposits form a single hydrologic unit referred to as the Ohio River valley aquifer. This is the only aquifer in the county capable of accommodating high-yield wells. Properly constructed wells in this aquifer could easily yield 1,000 gallons per minute and more. Transmissibilities in the Ohio River valley aquifer range from 120,000 gallons per day per foot and less near the valley walls to more than 200,000 gallons per day per foot in the thickest parts of the aquifer. The water in the aquifer is predominately a very hard calcium bicarbonate type having a high iron content.

(Woodard-USGS)

Analysis of historical surface-water-quality data in the coal mining region of southwestern Indiana. (Soon to be published). Crawford, C. G.

A Water-Quality Assessment of the Feather Creek Watershed, Vermilion County, Indiana

Eikenberry, Stephen E.


Chemical quality of surface water within the Feather Creek watershed is generally good. However, fecal bacteria concentrations are high enough to reflect a potential problem, especially because of the water-contact recreation proposed for the Feather Creek river.

Chemical analyses of surface-water samples collected on October 9, 1974, and periodically from October 1, 1975, to September 28, 1976, show that the water was calcium bicarbonate type at all sites except one, where it was calcium sulfate. Range of dissolved-solids concentration was from 290 to 1,080 milligrams per liter.

Ranges of concentrations (in milligrams per liter) of some of the dissolved constituents in water were: nitrate (as nitrogen), from 0.01 to 6.92; phosphate (as phosphorus), from 0.01 to 0.14; and total organic carbon, from 2.5 to 16. Concentrations of fecal coliform bacteria and fecal streptococci bacteria ranged from 60 to 6,700 and 70 to 15,000 colonies per 100 milliliters, respectively.

Concentration of dieldrin in bed materials from two sites was 0.4 microgram per kilogram, but aldrin, chlordane, DDE, DDT, endrin, heptachlor, heptachlor epoxide, lindane, toxaphene, polychlorinated biphenyl (PCB), and polychlorinated naphtalene (PCN) compounds were not detected.

NAVICULA sp and SCENEDESMUS sp dominated the phytoplankton community at the site sampled and indicated an environment lacking in organic enrichment. CLADOPHORA sp dominated the periphyton community sampled. Benthic invertebrates sampled were mostly caddis flies (CHEMATOTPSYCHE sp) and midges (ORTHOCLADIUS sp) and had a diversity index of 2.3, which indicates some organic enrichment of the stream.

A Water-Quality Assessment of the Busseron Creek Watershed, Sullivan, Vigo, Greene, and Clay Counties, Indiana

Eikenberry, S. E.


Journal Announcement: SWRA1173

February 1978. 36 p., 7 fig., 6 tab., 21 ref.

A Water-Quality Assessment of the Busseron Creek Watershed, Sullivan, Vigo, Greene, and Clay Counties, Indiana

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February 1978. 36 p., 7 fig., 6 tab., 21 ref.
adjacent to the mine were monitored during a 5-year study (1975-79) in the 1,210-acre watershed of the tributary. Compared with the background values, pH and concentrations of all major dissolved ions and dissolved suspended and streamed metals generally increased in Spencer Creek tributary downstream from the mine. Median dissolved-sodium and sulfate concentrations increased as eighteenfold and fourteenfold, respectively, and median dissolved-manganese and suspended aluminum concentrations increased as much as sevenfold and more than twofold. Concentrations of suspended metals decreased more than 50% after installation of sediment ponds by the mine operator. During high streamflow, concentrations of major ions at background at all sites on Spencer Creek tributary decreased, but dissolved- and suspended-metal concentrations increased downstream from the mine. South Lake exhibited seasonal stratification and mixing characteristics of other lakes in a similar latitude. However, the bottom 3 feet of the water column demonstrated persistent chemical stratification. Phytoplankton populations of the lake varied seasonally, and the population density patterns resembled those in other lakes at latitudes similar to that of South Lake. (USGS)


Analysis of stormwater quality for different land uses in the coal-mining region of southwestern Indiana. (Soon to be published.) Renn, D. E.


Journal Announcement: SWRA111

Glacial sand and gravel deposits in and near the Wabash and Ohio River valleys of Posey County, Ind., are capable of yielding from 50 to more than 1,000 gallons per minute of water to individuals. In the tributary valleys, as much as 80 gallons per minute has been obtained from small isolated sand and gravel deposits. In the remainder of the county, wells in sandstones of Pennsylvanian age yield from 5 to 25 gallons per minute. Natural discharge from sand and gravel into the Wabash and Ohio Rivers is estimated to be 60 million gallons per day, far exceeding the 6 million gallons per day estimated usage of ground water in the county. The shallow ground water is normally of the calcium bicarbonate type and has a dissolved-solids concentration of less than 500 parts per million. In deep bedrock wells, the water is of the sodium bicarbonate type and has a dissolved-solids concentration of more than 500 parts per million. (Woodard-USGS)
Low-Flow Characteristics of Indiana Streams

Stewart James A.
U.S. Geological Survey Open-File Report 82-1007, 277 p., 8 illus., 1 table

Knowledge of low-flow characteristics of Indiana streams is essential to the planners and developers of water resources for municipal, industrial, and recreational uses in the State. Low-flow frequency characteristics and points on the duration curve are given for 208 continuous-record gaging stations having 10 or more years of record. In addition, a few low-flow-frequency characteristics were estimated for each of 258 partial-record stations. Methods used for estimating these characteristics are included in the report.

A preliminary biological assessment of streams in the coal-mining region of southwestern Indiana. (Soon to be published).

Wangsness, D. J.

Reconnaissance of stream Biota and Physical and Chemical Water Quality in areas of selected land use in the coal mining region, southwestern Indiana, 1979-80

Wangsness, David J. 1982

To help meet the goals of the Surface-Mining Control and Reclamation Act of 1977, the U.S. Geological Survey is assessing the physical, chemical, and biological characteristics of surface water within the coal-mining region of southwestern Indiana. This report discusses benthic-invertebrate and periphyticolgal communities in streams draining homogenous-agricultural, forested, active/reclaimed mine, reclaimed mine, and unclaimed-mine watersheds and relates the biological communities to the physical and chemical characteristics of the streams.

Alkalinity and pH were lower and the concentrations of dissolved solids, suspended solids, calcium, magnesium, sodium, potassium, sulfate, iron, manganese, aluminum, and zinc were higher in reclaimed-mine watersheds than in the other land-use watersheds.

Numbers and community diversity of benthic invertebrates were less at sites affected by mining than at agricultural or forested sites, owing to (1) synergistic effects of low pH, metals, and unsuitable habitat and (2) lack of colonizing drift organisms because of the short drainage area upstream from the mined area. Only a few organisms, such as the caddisflies CHEumatopsyche and Hydropteryx and the chironomids CHIROMUS and Cricotopus, were found in streams draining mine areas.

Preliminary water-quality assessment of the Upper White River near Indianapolis, Marion County, Indiana. (Soon to be published).

Wangsness, D. J.; Elkenberry, S. E.; Wilber, W. G.; Crawford, C. G.
Wisconsinian glaciers that covered two-thirds of the area. Most of the coal is mined from Pennsylvanian coal units. As of 1978, more than 1-billion short tons of coal had been mined from the 11 counties. More than 12-billion short tons remained in reserve. During 1977, 6-billion short tons were mined. Coal mining disturbs less than 1% of the land in the study area. Sixty-two percent of the land is agricultural, and 29% is forested. More coal is mined in the southern and western parts of the study area than elsewhere. Surface water in these parts had lower pH and alkalinity than water in the north and east parts. Specific conductance and concentrations of sulfate, iron, and manganese in surface water were higher in the south and west than elsewhere. (USGS)

Hydrologic assessment of Area 33 eastern region, Interior Coal Province, southwestern Indiana and northern Kentucky. (Soon to be published).

Wangness, D. J., and others

Ground-water resources of west-central Indiana, preliminary report-Vigo County
Watkins, F. A., Jr., and Jordan, D. G., 1963
Indiana Division of Water Bulletin 17, 286 p.

Ground-water resources of west-central Indiana, preliminary report-Vermillion County
Watkins, F. A., Jr., and Jordan, D. G., 1963
Indiana Division of Water Bulletin 29, 90 p.

Groundwater appraisal of the big walnut creek basin above little walnut creek and big walnut creek reservoir site, Indiana
Watkins, Frank A., Jr.
Geological Survey, Washington, D.C.
US 90TH CONGR, 2ND SESS, SENATE DOC 96, VOL 2, APPEND J, P 278-288, 1968, 11 P, 4 FIG, 1 TAB.
Journal Announcement: SWA90223

Loss of water from a proposed reservoir is possible where the channel of big walnut creek, Indiana is cut into bedrock in the flood area. During dry-weather periods the creek loses water in this reach. Water supply is not a problem in the basin at the present time but could become a problem in the greencastle area in a period of severe drought. (KNAPP-USGS)

Reconnaissance for determining effects of land use and surficial geology on concentrations of selected elements on streambed materials from the coal-mining region, southwestern Indiana, October 1979 to March 1980
Wilber, William G., and Boje, Rita E.
U.S. Geological Survey Water-Resources Investigations 82-4013,

39 p.
Streambed materials were collected from 69 sampling sites in areas of predominantly forested, agricultural, and reclaimed and unclaimed mined land in the glaciated and unglaciated parts of southwestern Indiana to determine whether concentrations of sorbed metals and other trace elements were affected by land use and surficial geology.

Streambed materials smaller than 0.062 millimeter were collected in October 1979 and analyzed for sorbed and acid-soluble metals including aluminum, cadmium, chromium, copper, cobalt, lead, manganese, mercury, nickel, and zinc and several nonmetals, total arsenic, boron, and selenium.

Analysis of variance indicated that differences in land use accounted for 10 percent or more of the variation in aluminum, arsenic, cobalt, iron, nickel, selenium, and zinc concentrations on streambed materials. Differences in glacial province (surficial geology) did not significantly affect the concentrations of metals and other trace elements on streambed materials. Concentrations of aluminum, cobalt, iron, nickel, selenium, and zinc on the less than 0.062-millimeter fraction of streambed materials from mined watersheds were significantly greater than the concentrations of these elements on streambed materials from agricultural and forested watersheds. The greater concentrations of these elements are due to (1) their concentrations in mine drainage and their subsequent adsorption and (or) coprecipitation with the oxides and hydroxides of aluminum and iron and (2) their concentrations in coal and pyritic material in streambed materials.

Concentrations of aluminum and iron on streambed materials from reclaimed, mined watersheds were significantly less than the concentrations of these metals on streambed materials from unclaimed, mined watersheds.

Preliminary assessment of the factors affecting water quality in the coal-mining region, southwestern Indiana, March to October 1979. (Soon to be published).

Wilber, W. G., Crawford, C. G., Renn, D. E., Ragone, S. E., and Wangness, D. J.

Hydrologic Evaluation of a Hypothetical Coal-Mining Site Near Chrisney, Spencer County, Indiana
Journal Announcement: SWA15060

Protecting the nation's water resources is a major emphasis of the Surface Mining Control and Reclamation Act,
PL 95-87. Permanent regulations established for this Act by the Office of Surface Mining (OSM) require the issuance of a permit before mining begins. An application for a mining permit must include an assessment of the hydrologic characteristics of the mining site and adjacent area, and a projection of the potential impacts of mining activities on surface water and ground water. OSM's permanent regulations and guidelines provide little insight on the "how to" aspect of making the required hydrologic assessment. This investigation was completed to improve the understanding of the kinds of information needed to make such assessments by: (a) reviewing the regulations to determine what hydrologic information is required; (b) preparing an example hydrologic assessment using the regulations as a guideline; and (c) using the experience gained in (a) and (b) to identify areas lacking or needing additional data to make the required assessment. Hydrologic data for the study area were obtained from published and unpublished reports, maps, aerial photographs, personal interviews with residents in the area of the hypothetical mine site, and discussions with experts in the field. Where data were unavailable, "synthetic" data were generated by extrapolation from proximate or similar watersheds and (or) by assumptions based on experience or theory. A limited amount of field data was collected to corroborate and augment information originating from all these sources. (USGS)

Water Resources Data for Indiana. Published annually since 1975.  
Water resources data for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Indiana. (USGS)
Availability of groundwater in Wayne County, Iowa

Cagle, J. W.

Geological Survey Iowa City, Iowa.


Journal Announcement: SWRA0310

Information is presented on the availability and quality of groundwater in Wayne County, one of several counties in Southern Iowa affected by a shortage of good-quality water. Only locally and in limited areas, or only after extensive water-quality treatments, are suitable supplies of groundwater available to satisfy the water needs.Bedrock aquifers yield variable small amounts of moderately to highly mineralized water. Surficial aquifers comprising glacial drift and alluvium are estimated to yield up to 45 gpm in some areas; an availability map indicates areas where water supplies can be developed. Dissolved-solids concentrations range from about 470 mg/l in the alluvium to over 3,000 mg/l in the deep (more than 100 feet) glacial drift. Many shallow (100 feet or less) supplies presently in use contain high concentrations of nitrate and chloride, and these concentrations are attributed to localized contamination. Wells in the alluvium and shallow drift that are properly constructed and located are expected to yield satisfactory quality water. (Knapp-USGS)

Definition and hydrology of the sandstone aquifers in the coal-bearing Pennsylvania strata of sout...Cagle, J. W., 1979,

Unpublished data on file in Iowa City Office of U. S. Geological Survey

Water Resources of South-Central Iowa

Cagle, J. W.; Heinitz, A. J. W.


Journal Announcement: SWRA1212

Information is presented on the availability, quality, and use of ground and surfacial water in an eleven-county area in south-central Iowa. The best sources of water supply in the area are Red Rock and Rathbun Lakes and other impoundments. The Des Moines River is the only stream in the area that can supply adequate amounts of water without storage. Yields from deep wells in Surficial aquifers are variable, and there is only the gallons per day in 1972-73 groundwater accounted for 66 percent of the total withdrawals and surface water sources made up 34 percent. (Woodard-USGS)

Mississippian Aquifer of Iowa

Horick, P. J.

Geological Survey, Iowa City, Iowa.

Iowa Geological Survey Miscellaneous Map Series 3, 1973. 3 sheets, 13 fig, 4 tab, 3 map, 10 ref.

Journal Announcement: SWRA0709

The purpose of this 3-Sheet Atlas is to present information on the occurrence, movement, availability, use, and chemical quality of water from the Mississippian Aquifer in Iowa. Included is a brief description of the physical characteristics and spatial relations of the rocks that contain the water. Also discussed and evaluated are the areas of high pollution hazard to this and underlying aquifers. The Mississippian Aquifer underlies about 60% of the state, but in only about 15% of this area can the aquifer be considered a major source of potable water. This area comprises all or parts of 10 counties in the north-central part of the Mississippian Outcrop, where the aquifer will yield moderate to large supplies of good to excellent quality water to wells. Estimates of recharge and storage in that region indicate that many times the current withdrawal rate of about 12 MGD can be developed from the aquifer. Elsewhere the aquifer yields either small quantities of moderately to highly mineralized water (subcrop area), or small to moderate quantities of fair to good quality water (southeast outcrop area). Additional supplies
J. Jordan Aquifer of Iowa
Horick, P. J.; Steinhlber, W. L.
Geological Survey, Iowa City, IA.
Journal Announcement: SWRA1216
The purpose of this atlas was (1) to define and describe the spatial relations and physical characteristics of the Jordan aquifer, (2) to present information on the occurrence, availability, use, and chemical quality of water in the aquifer, and (3) to define and delineate changes in the potentiometric surface of the aquifer. The geohydrologic information was divided into 3 subject headings that were presented on separate atlas sheets—geology, hydrology, and chemical quality. The Jordan aquifer is the most productive water-yielding unit of the Cambrian-Or dovician aquifer system and is one of the most dependable sources of water supply for large capacity wells in Iowa. The total thickness of the aquifer ranges from about 400 to 450 feet in east-central and southeastern Iowa to about 150 feet or less in western Iowa. The transmissivity of the aquifer is

Baseline Water Quality of Iowa’s Coal Region
Skeel, L. J.
Geological Survey open-file report 79-980, 1979, 74 p., 1 Fig., 7 Tab., 7 Ref.
Journal Announcement: SWRA1303
To assist the Iowa Department of Environmental Quality in determining the effects that coal mining and attendant activities will have on the water quality of Iowa streams, the U.S. Geological Survey collected three sets of water-quality samples (representative of high, average, and low streamflow) in the White Breast, English, and Cedar Creek basins in south-central Iowa. These samples were analyzed by the U.S. Geological Survey Central Laboratory at Denver, Colorado, and by the Iowa State Hygienic Laboratory (Iowa City and Des Moines). The report presents the data collected from May to November 1978 at 15 stations in the study area. (Woodard-USGS)

WATER RESOURCES DATA FOR IOWA, published annually since 1970.
GEOLoGICAL SURVEY, IOWA CITY, IOWA.
AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE,
SPRINGFIELD, VA 22151
WATER RESOURCES DATA FOR IOWA CONSISTS OF RECORDS OF STAGE, DISCHARGE, AND WATER QUALITY OF STREAMS, STAGE, CONTENTS AND
GEHYDROLOGY OF DONIPHAN COUNTY, NORTHEASTERN KANSAS

BAYNE, C. K.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

FOR SALE BY USGS, WASHINGTON, D.C., 20242, PRICE $0.75.

GEOHYDROLOGIC INVESTIGATIONS ATLAS HA-462, 1973, 1 SHEET, 1 FIG, 6 MAP, 1 TAB, 13 REF.

Journal Announcement: SWA1104

THIS ONE-SHEET ATLAS DESCRIBES THE GROUNDWATER RESOURCES OF DONIPHAN COUNTY, THE NORTHEASTERN MOST COUNTY IN KANSAS. REPORTS DESCRIBING THE WATER RESOURCES OF THE AREA CONTIGUOUS TO DONIPHAN COUNTY ARE LISTED IN THE SELECTED REFERENCES. THE LOCATIONS OF WELLS AND TEST HOLES ARE IDENTIFIED ACCORDING TO THE FEDERAL SYSTEM OF LAND SUBDIVISION SHOWN BY A WELL-NUMBERING SYSTEM DIAGRAM. ADEQUATE SUPPLIES OF WATER FOR DOMESTIC AND STOCK USE GENERALLY ARE AVAILABLE FROM WELLS IN THE GLACIAL DEPOSITS UNDERLYING THE UPLAND AREAS OF DONIPHAN COUNTY. ADJACENT TO THE MAJOR STREAMS, THE GLACIAL DEPOSITS ARE THIN OR HAVE BEEN REMOVED BY EROSION. IN THESE LOCALIZED AREAS, SMALL SUPPLIES OF WATER ARE AVAILABLE FROM WELLS DRILLED INTO BEDROCK AQUIFERS. LARGE SUPPLIES OF WATER ARE AVAILABLE ONLY FROM WELLS IN ALLUVIAL DEPOSITS IN THE MISSOURI RIVER VALLEY. GROUNDWATER IN DONIPHAN COUNTY IS OF THE CALCIUM BICARBONATE TYPE. THE CONCENTRATION OF DISSOLVED SOLIDS IN GROUNDWATER VARIES FROM ABOUT 100 TO 300 MGC/Lerson.

A Procedure for Predicting Concentrations of Dissolved Solids and Sulfate Ions in Streams Draining Areas Strip Mined for Coal

BEVANS, H. E.

GEOLOGICAL SURVEY, LAWRENCE, KANSAS, WATER RESOURCES DIV.

GEOLOGICAL SURVEY OPEN-FILE REPORT 80-766 (WR1), AUGUST, 1980, 17 P, 8 FIG, 2 TAB, 14 REF.

Journal Announcement: SWRA1424

CURRENT TRENDS IN INCREASED COAL PRODUCTION NECESSITATE THE DEVELOPMENT OF TECHNIQUES TO CORRELATE THE ENVIRONMENTAL DEGRADATION RESULTING FROM STRIP MINING. A PROCEDURE IS INTRODUCED FOR THE PREDICTION OF DISSOLVED-SOLIDS AND SULFATE-ION CONCENTRATIONS IN STREAMS DRAINING STRIP-MINED AREAS. CONCENTRATIONS ARE A FUNCTION OF THE PERCENTAGE OF THE DRAINAGE AREA THAT HAS BEEN STRIP MINED. THESE RELATIONSHIPS ARE EXPRESSED BY REGRESSION EQUATIONS COMPUTED FROM DATA COLLECTED IN STREAMS DRRAINING STRIP-MINED AREAS OF CRAWFORD COUNTIES IN SOUTHEAST KANSAS. HIGH CORRELATION COEFFICIENTS INDICATE THAT THE RELATIONSHIPS MAY BE USEFUL IN THE EVALUATION OF PRESENT OR FUTURE STRIP-MINING OPERATIONS.

Description of Data-Collection System and Synopsis of Selected Hydrologic Data for Soldier Creek Basin, Kansas

CARSWELL, W. J., JR.

GEOLOGICAL SURVEY, LAWRENCE, KANSAS, WATER RESOURCES DIV.

OPEN-FILE REPORT 78-676, JULY 1978, 80 P, 32 FIG, 5 TAB, 8 REF., 2 APPENDIX.

Journal Announcement: SWRA1207

SOLDIER CREEK BASIN IS A LONG, NARROW BASIN ENCOMPASSING AN AREA OF ABOUT 290 SQUARE MILES ALMOST DIRECTLY NORTH OF TOPEKA, KANSAS. A WIDE RANGE OF HYDROLOGIC DATA HAS BEEN COLLECTED IN THE BASIN SINCE THE SPRING OF 1964. THESE DATA INCLUDE RAINFALL, STREAM DISCHARGE, SEDIMENT CONCENTRATIONS, CHEMICAL QUALITY OF WATER, AND GROUND-WATER ALTITUDES. THE DATA COLLECTION SYSTEM CONSISTS OF 7 RECORDING STREAMFLOW STATIONS...
Hydrologic Data for Soldier Creek Basin, Kansas


Selected hydrologic data collected in the Soldier Creek basin in northeastern Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily time intervals; rainfall in fifteen-minute and daily time intervals; concentrations and particle sizes of suspended sediments; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents. The data-collection system includes: (1) 7 recording streamflow stations; (2) 15 recording rainfall stations; (3) 51 nonrecording rainfall stations located within and adjacent to the basin; (4) 31 ground-water observation wells (two recording); and (5) intermittent chemical quality of water and sediment sampling sites. Examples of the information on magnetic tape for each type of data collected are presented in computer-printout format. (woodard-USGS)

Selected Hydrologic Relationships for Soldier Creek, Northeastern Kansas

Carswell, W. J., Jr.


Hydrologic data from Soldier Creek basin, northeastern Kansas, were compared with relations from statewide data. The quantity and quality of streamflow were affected mostly by soils, slopes, and land use. Average annual precipitation during the study (1964-76) was 35.12 inches, or 2.3 percent greater than the long-term (1920-76) average. The average streamflow in Soldier Creek at Topeka was 23 percent greater than the long-term average. In general, frequency curves of annual peak discharges compared poorly with curves from statewide relations due to the absence of extremely low peaks during the short period. A comparison of low-flow frequency for drainage areas of more than 100 square miles suggests that reasonable results may be obtained by extrapolating the statewide relations to small basins. Comparisons of flow-duration curves confirms the extrapolation for basins of less than 100 square miles, although the percentage duration of mean flow is variable. Water surveys showed that calcium bicarbonate and sulfate were the predominant ions and dissolved solids were derived mostly from limestones and shales. Suspended sediment at gaged sites ranged from 9.84 to 86.4 tons per day; yield per unit area increased significantly between two sites due to changes in slopes and land use. (woodard-USGS)

Multyear Low Flow in Southeastern Kansas

Carswell, William J., Jr.


Many existing water supplies in southeastern Kansas are proving inadequate to meet current and expanded future needs. One of the methods in which the use of highly variable streamflow in the area can be evaluated is with the aid of multyear low-flow frequency information. Data from 19 stream-gaging stations in the study area and a base period of 1940-77 were used to develop maps from which discharge values for the 2- and 50-year recurrence interval for durations of 12, 24, 36, and 60 months can be obtained for ungaged sites that have drainage areas of less than 1,000 square miles. Discharge values for these recurrence intervals can be obtained by interpolation. Extrapolation of regionalized values in this report to drainage areas smaller than 110 square miles and larger than 1,000 square miles has not been validated.

A General Classification of Source Areas of Fluvial Sediment in Kansas

Collins, Dannie L.

U.S. Geological Survey Bulletin Number 832

A map showing the mean annual sediment yields of large subdivisions of the Kansas has been compiled by synthesizing the available data on areas geology, topography, soil characteristics, precipitation, runoff, sedimentation in reservoirs, and measured suspended-sediment loads of selected streams. The mean annual sediment yield in tons per square mile, or less than 50 in parts of southwestern and south-central Kansas and is more than 5,000 in the extreme north-eastern part. The intermediate values characteristic of the state tend to increase from west to east.
Ground Water in the Verdigris River Basin, Kansas and Oklahoma


Flood magnitudes for selected recurrence intervals for ungaged sites in Kansas were found to be related most significantly to the contributing drainage area and the 2-year 24-hour rainfall. Equations are provided for estimating flood peak rates for selected recurrence intervals at ungaged sites on the basis of gaging stations having short records. The accuracy of 100-year floods calculated from the equation is equivalent to the accuracy that would be obtained from about 12 years of record of flood peaks at the site.

Floods are most common from May through August in western Kansas and from April through July in eastern Kansas. Maximum known floods on an envelope curve for western Kansas range from 2,440 cubic feet per second for 1.6 square miles to 178,800 cubic feet per second for 6,770 square miles. Maximum known floods on an envelope curve for eastern Kansas range from 7,080 cubic feet per second for 2,06 square miles to 436,000 cubic feet per second for 3,818 square miles.

The ATLAS DESCRIBES THE AVAILABILITY OF GROUND AND SURFACE WATER IN A COUNTY IN SOUTHEASTERN KANSAS. CONSOLIDATED BEDROCK AQUIFERS GENERALLY CONTAIN FAIR TO POOR QUALITY WATER AT SHALLOW DEPTHS. MOST WELLS YIELD LESS THAN 5 GPM, BUT SOME YIELD AS MUCH AS 40 GPM. WATER IS DRAWN FROM DRILLED GALLERIES, AND ORODOVICIAN ROCKS HAVE YIELDED HIGHLY MINERALIZED WATER. UNCONSOLIDATED ALLUVIAL DEPOSITS ALONG THE NEOSHO RIVER AND OTHER STREAMS ARE THE BEST AQUIFERS. GROUPS OF WELLS FOR COLLECTION GALLERIES IN THESE DEPOSITS MAY PRODUCE 100 GPM. AN AQUIFER TEST IN A WELL IN ALLUVIAL RIVER AT PARSONS IS ABOUT 2,400 CFS AND IN LABETTE CREEK NEAR OSWEGO ABOUT 150 CFS. BOTH STREAMS HAVE EXPERIENCED PERIODS OF NO FLOW. THE QUALITY OF THE SURFACE WATER IS GOOD. A 1:63,360 SCALE MAP SHOWS GEOLOGIC UNITS, DEPTH, WATER TYPE, AND ALTIMETRY OF WELLS. TALES GIVE WATER-BEARING CHARACTERISTICS OF THE GEOLOGIC UNITS AND ANALYSES OF WATER FROM 76 REPRESENTATIVE WELLS. (25 REFERENCES)

Physical and Hydrologic Environments of the Mulberry Coal Reserves in Eastern Kansas


Strippable reserves of Mulberry coal underlie an area of approximately 300 square miles in Miami, Linne, and Bourbon Counties of eastern Kansas, Although subject to State reclamation law, current and projected strip mining of this relatively thin coal seam could alter the hydrologic environment of the study area. Drained by the Marais des Cygnes and Little Osage Rivers and their tributaries, this area is characterized by low relief and moderately impermeable soils. Streamflows are poorly sustained by ground-water discharge and fluctuate widely due to changes in water use at surface-supplied urban centers. Because ground-water supplies are generally unreliable in quantity and quality, surface water is used to meet most water requirements in the study area. Primary uses of surface waters are for domestic supplies, maintenance of wildlife and recreational areas, and cooling needs at the LaCygne Power Plant. The prevailing chemical type of the natural streamflow is calcium bicarbonate, with concentrations of dissolved solids generally less than 500 milligrams per liter and pH near neutral.
Additional streamflow and water-quality data are needed to evaluate pre-mining characteristics and any changes in the hydrologic environment as strip mining proceeds within the study area. A network of data collection stations and a sampling scheme have been established to acquire this additional information.

Geology and Ground-water Resources of Miami County, Kansas
Miller, Don E.

Ground Water in the Grand (Neosho) River Basin, Kansas and Oklahoma
Morton, Robert D., and Faders, Stuart W.
U.S. Geological Survey Open-File Report 75-386

Geology and Ground-water Resources of Montgomery County, Southwestern Kansas
O'Connor, Howard G.
U.S. Geological Survey Ground-Water Series No. 1

Discharge Estimates in Surface-Mine Areas using Channel-Geometry Techniques
Usterkamp, W. R., and Hedman, E. R.
U.S. Geological Survey

Surface mining and reclamation practices generally require extensive hydrologic knowledge of an area. Adequate streamflow data from instrumented sites rarely are available for surface-mine areas, and estimates of streamflow based on rainfall-runoff models, drainage area and basin characteristics, or transfer of streamflow records from gaged to ungaged basins, sometimes have proven unreliable. Channel-geometry measurements offer an alternative method of estimating streamflow characteristics at ungaged sites. The method uses the empirical development of simple or multiple power-function equations yielding a discharge value from channel-configuration and channel-material data. The equations have been developed by collecting geometric and sediment data at numerous gaged sites and statistically relating those data to specified discharge characteristics.

The principal advantage of the channel-geometry method is that estimates of discharge can be obtained quickly and inexpensively. Often results are as reliable as 5 to 10 years of continuous streamflow records. Relatively recent changes in flow regime, such as those caused by depletion of streamflow by ground-water withdrawals or diversion for irrigation, are detectable by channel-geometry techniques.

Discharges of perennial streams in coal-mine areas can be estimated using equations developed from data of the central and western United States. Equations intended specifically for ephemeral channels in areas of stripable coal resources in arid and semiarid areas have been developed from data collected in the western half of the conterminous United States.

Quality-of-water data and statistical summary for selected coal-mine strip pits in Crawford and Cherokee Counties, southeastern Kansas
Hopper, L. R., and Diaz, A. M., 1962

GEOL OGY AND GROUNDWATER RESOURCES OF LINN COUNTY, KANSAS
Seevers, William J.
KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.
KANSAS GEOLOGICAL SURVEY BULLETIN 193, NOVEMBER 1969, 65 P., 9 FIG., 1 PLATE, 4 TABS, 66 REF.
Journal Announcement: SWRAS12
LINN COUNTY IS LOCATED ALONG THE KANSAS-MISSOURI BOUNDARY IN EAST-CENTRAL KANSAS AND IS A NEARLY SQUARE AREA OF ABOUT 605 SQUARE MILES. ONLY VERY SMALL QUANTITIES OF WATER ARE OBTAINED FROM PENNSYLVANIAN ROCKS IN LINN COUNTY. YIELDS RARELY EXCEED 1 GALLON PER MINUTE AND ARE NORMALLY BARELY SUFFICIENT FOR DOMESTIC PURPOSES. LIMESTONES ARE THE MOST PRODUCTIVE AQUIFERS, AND LIMESTONES OF THE LOWER PART OF THE KANSAS CITY GROUP ARE THE BEST OF THE BEDROCK AQUIFERS. GROUNDWATER BELOW A DEPTH OF ABOUT 100 FEET IN THIS AREA IS NORMALLY TOO HIGHLY MINERALIZED FOR USE. LARGE QUANTITIES (30 TO 100 GPM) OF GOOD QUALITY WATER ARE OBTAINED FROM PROPERLY CONSTRUCTED AND DEVELOPED WELLS IN ILLINOISAN AND WISCONSINAN VALLEY-FILL DEPOSITS MAINLY FROM STRIP PITS NEAR THE BASE. (KNAPP-USGS)

Geology and Ground-water Resources of Jackson County, Kansas
Walser, Kenneth L.

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN KANSAS
Ward, J. F.
GEOL OGICAL SURVEY, WASHINGTON, D.C.
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242.
PRICE $1.25 PER SET, HYDROLOGIC INVESTIGATIONS ATLAS HA-467, 1973, 2 SHEETS, 1 TAB, 13 REF.
Journal Announcement: SWAS1712
INFORMATION IS PRESENTED ON THE GROUNDWATER RESOURCES OF ATCHISON COUNTY, KANSAS. BEDROCK OF LATE PENNSYLVANIAN AGE IS EXPOSED THROUGHOUT THE COUNTY. UNCONSOLIDATED GLACIAL DRIFT, LOSS, DEPOSITS BENEATH TERRACES, AND ALLUVIUM OVERLIE THE BEDROCK SURFACE. BOTH TOPOGRAPHY AND TEXTURE OF THE GLACIAL DRIFT EXERT A STRONG INFLUENCE ON RECHARGE TO AND DISCHARGE FROM THE AQUIFERS. DISCHARGE FROM THE AQUIFERS IS PRIMARILY TO STREAMS THAT DRAIN THE COUNTY. SOME DISCHARGE OCCURS FROM SEEPS AND SPRINGS ALONG VALLEY WALLS AND FROM WELLS. A FEW WELLS IN THE COUNTY FLOW CONTINUOUSLY. THE UNCONSOLIDATED PLEISTOCENE...
DEPOSITS ARE THE WEST POTENTIAL SOURCES OF GROUNDWATER IN THE COUNTY. THE MOST FAVORABLE AREAS OVERLIE THESE DEPOSITS. ALL FIVE AREAS EXIST WHERE WATER FLOWS AT THE SURFACE DUE TO ARTESIAN PRESSURE. WELLS ARE COMPLETED IN BEDROCK, GLACIAL DRIFT, AND ALLUVIAL AQUIFERS. A SUMMARY OF THE CONCENTRATIONS OF SELECTED DISSOLVED MINERAL CONSTITUENTS IS SHOWN ON THE CORRELATION OF STRATIGRAPHY AND WATER QUALITY DIAGRAM. MOST OF THE WATER IS OF THE CALCIUM BICARBONATE TYPE. ALTHOUGH HARD, IT IS GENERALLY ACCEPTABLE. DISSOLVED-SOLIDS CONCENTRATIONS ARE GENERALLY HIGH, BUT ACCEPTABLE. THE HIGHEST CONCENTRATIONS OF DISSOLVED SOLIDS ARE IN WATER FROM THICK GLACIAL DEPOSITS.

GEHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN KANSAS


Geological Survey Open-File Report, 1971, 22 P, 6 FIG, 3 PLATE, 1 TABLE, 12 REF.

Journal Announcement: SWRAU424

Data concerning groundwater resources in Atchison County, Kansas. Data of the unsaturated Pleistocene deposits are the best potential sources of groundwater in the county. Because the Wisconsin terrace deposits and the alluvium are principally silt and clay throughout most of the county, yields are generally small. However, along the Missouri River is composed of very permeable sand and gravel from which well yields of 2,000 GPM are possible. An aquifer test in the alluvium showed a water-level drawdown of 11.3 feet after pumping 1,305 GPM continuously for 155 minutes. The specific capacity for the test was 115 GPM per foot of drawdown. The hydraulic conductivity was about 2,050 GPM per square foot. Four areas exist where water flows at the surface due to artesian pressure. DISSOLVED-SOLIDS CONCENTRATIONS THROUGHOUT THE COUNTY GLACIAL DEPOSITS. (Knapp-USGS)

GEHYDROLOGY OF JEFFERSON COUNTY, NORTHEASTERN KANSAS


Journal Announcement: SWRAU519

Geohydrologic data for Jefferson County, Kansas, are based on geologic mapping, geologic interpretation, stratigraphic photography, test-hole logs and drillers' logs, inventory of selected wells, and analysis of water samples from selected wells. The largest quantities of ground water recharge from wells in alluvium in the Kansas River Valley with yields of as much as 1,350 GPM. Because the use of groundwater for irrigation is seasonal, and because pumping for municipal or public-supply use is small compared with the amount of groundwater available, the natural slope of the water table is essentially unaffected. The concentration of dissolved tabulated (Woodard-USGS)

WATER RESOURCES DATA FOR KANSAS - Published annually since 1971.


Geological Survey Basic Data Reports.

Water resources data for Kansas include records of data for the chemical and physical characteristics of surface water and groundwater. Records for a few pertinent water-quality stations in bordering states are also included. The water-quality records for surface waters include descriptions of the sampling stations and tabulations of the data for the samples analyzed. The description of the sampling station gives the location, drainage area, periods of record for the various water-quality data, extremes of the pertinent data, and general remarks. For groundwater sampling sites, the well number, depth of well, rate of sampling, and other pertinent data are given in the table containing the chemical analyses of groundwater. Tables include chemical, biological, microbiological, water temperature, and fluvial sediment data. (Woodard-USGS)


Water resources data for Kansas presented in two volumes, consist of records of stage, discharge, and water quality streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. All data in this report represent that part of the national water data system operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (USGS).
Public and industrial water supplies of the Eastern Coalfield Region, Kentucky


U.S. Geological Survey Circular 369

About 115,100,000 gal/d (gallons per day) of water is pumped for 119 large public and industrial water supplies in the 29 counties of the Eastern Coalfield Region of Kentucky. About 12 percent of water is used for public supply and about 88 percent for industrial supply. Public supplies provide 191,000 people with water, and per capita consumption ranges from 12 to possibly 460 gal/d. The quantity of water pumped in a public supply for industrial use is sometimes more than half the total water provided. Industries in the region use water primarily for cooling. The largest amounts are used for coal washing, gas transmission, petroleum processing, railroad supply, and coal-steel-products manufacture.

About 6 percent of the water pumped for public and industrial supplies is ground water and about 94 percent is surface water. However, of the total number of cities, industries, and institutions supplied, ground water provide 37 percent of the supply, surface water, 52 percent, and ground and surface water combined, 11 percent.

Large ground-water supplies in the region are obtained principally from wells and abandoned coal mines, but a few are obtained from springs. Wells yield from 2 to 330 gal/min (gallons per minute) and yet most of their water from sandstone in rocks of Pennsylvanian age and from sand and gravel in alluvium of tertiary age. Most water is of the calcium or magnesium bicarbonate or sodium bicarbonate type; however, some water is high in iron content and some has a large proportion of sulfate.

Most of the surface water pumped in the Eastern Coalfield is from the big Sandy River and its tributaries, and from the Ohio River. In the future, surface water will be the principal source for towns and industries needing large quantities of water. (Authors' abstract).

Drainage Areas of Streams at Selected Locations in Kentucky

Hower, D. E.; Jackson, W. M.


Journal Announcement: SWRA1506

The drainage areas for more than 2,000 selected sites throughout Kentucky were determined. Areas of limestone terrain characterized by sinkholes are indicated in basins where they have been determined. Each location is referenced by U.S. Geological Survey station number (where assigned), latitude, longitude, county code, topographic quadrangle, river distance, and in some cases by nearby town or landmark. All values are given in both English and metric units and an alphabetical index by stream name is provided. (USGS)

Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky, 1955-59

Collins, C. R., and others


Influences of strip mining on the hydrologic environment of parts of Beaver Creek basin, Kentucky, 1955-66

Collins, C. R., Pickering, R. J., and Mussery, J. J., editors

1970


A Fluvial Sediment Study of Fishtrap and Dewey Lakes Drainage Basins, Kentucky - Virginia

Curtis, W. F.; Flint, R. F.; George, F. H.; Santos, J. F.


Journal Announcement: SWRA1123

Fourteen drainage basins above Fishtrap and Dewey Lakes in the Levisa Fork and Johns Creek drainage basins of eastern Kentucky and southwestern Virginia were studied to determine sedimentation rates and origin of sediment entering the two lakes. The basins ranged in size from 1,68 to 297 square miles. Sediment yields ranged from 2,890 to 21,000 tons per square mile where surface-mining techniques predominated, and from 732 to 3,570 tons per square mile where underground mining methods predominated. Yields, in terms of tons per acre-foot of runoff, ranged from 2.2 to 15 for surface-mined areas, and from 0.3 to 2.7 for underground-mined areas. Water and sediment discharges from direct runoff during storms were compared for selected surface-mined and underground-mined areas. Data points of two extensively surface-mined areas, one from the current project and one from a previous project in Beaver Creek basin, McCreary County, Kentucky, grouped similarly in magnitude and by season. Disturbed areas from mining activities determined from aerial photography reached 17 percent in one study area where extensive surface mining was being practiced. For most areas where underground mining was practiced, percentage disturbed area was almost negligible. Trap efficiency of Fishtrap lake was 89 percent, and was 62 percent for Dewey Lake. Average annual deposition rates were 464 and 146 acre-feet for Fishtrap and Dewey Lakes, respectively. The chemical quality of water in the Levisa Fork basin has been altered by man's
A Flood Model for the Tug Fork Basin, Kentucky, Virginia, and West Virginia. 

Dyker, R. - 1977


Surface mining of coal in the United States increased from 406 million tons to almost 800 million tons from 1978 to 1979. In the coal-rich 1,560-square-mile Tug Fork basin located in Kentucky, Virginia, and West Virginia, there has been a 2,500 percent increase since 1950 in areas affected by surface mining activities.

This study used a rainfall-runoff model to determine if land-use changes associated with surface mining in the Tug Fork basin have affected basin streamflow characteristics. The model was calibrated and verified for two periods: one representing 1960-1963 and one representing 1950-1953. Two 29-year synthetic daily streamflow time series representing the two land-use conditions were generated. Statistical tests performed on the two time series at 15 points in the basin showed no difference at the 0.01 percent confidence level at any of the locations.

In addition, analyses were made to determine if future increases in surface-mining activities might affect basin streamflow. One analysis showed that increasing mining in an upland watershed by as much as 200 percent had little effect on streamflow in the intermediate area and no effect on streamflow at downstream locations along the Tug Fork. Even for a scenario where all areas disturbed by mining were assumed totally impervious, the modeling process demonstrated that the increase in area was not enough to cause high flows for recurrence intervals of 2, 5, 10, 25, 50, 100, and 100 years was less than 4 percent at the basin outlet.

The effects of mine acid on the Pond River watershed in western Kentucky.

Dyker, R. - 1977


Effects on water quality of coal mining in the Basin of the North Fork Kentucky River, Eastern Kentucky.

Dyker, Kenneth L.


A detailed investigation of the effects of mine drainage on streamwater quality was carried out on the watershed of the North Fork Kentucky River in 1975. Specific conductance measurements were made at 415 sites, repeatedly at some of them. Discharge estimates and pH values were also obtained in most instances while sulfate and chloride data were obtained about half the time.

Based on a daily sulfate record simulated from daily conductivity values, trends in sulfate loads were assessed for the North Fork Kentucky River at Hazard for the 1963 water year to 1973 water years. The mean annual sulfate concentration declined from a maximum of 140 milligrams per liter in the 1963 water year to 72 milligrams per liter in the 1973 water year, about 50 percent of what it had been 11 years earlier. The irregular appearance of acid and high sulfate discharges in the earlier years indicates that these probably originated as sudden releases of water from underground mines or as water flushed from coal washing ponds.

Over the area as a whole, coal mining has caused the mean annual dissolved-solids concentration to increase from about 50 to 150 milligrams per liter while the most responsive ion, sulfate, increased in concentration from about 8 to 50 milligrams per liter.

The most damaging effect of strip mining on water quality appears to be the ionic contamination. Even in those watersheds where streams are adequately protected by silt-catchment dams and ponds, both road construction and the dam construction itself may for a time introduce large quantities of sediment into the streams. Strip mining of the Hazard number 9 seam near Hazard has introduced large quantities of acid sulfate mine drainage into Lotts Creek, Yellow Creek, and other streams but still only a very small part of the total study area is severely affected by acid water.

The bulk of acid mine drainage produced in the study area is immediately neutralized or precipitated by exchangeable bases from the aquifer material before it even reaches the streams. The most acid water sample collected during this study had already lost 85 percent of the acidity presumed to have originated in the bedrock. Unusually high concentrations of several trace elements were observed in acid mine drainage and in streams affected by it, but in no case were these at levels harmful to human health; although both iron and manganese concentrations were commonly high enough to give the water a bad taste and to leave deposits on containers. The highest concentrations observed for some of the trace elements include: 76 micrograms per liter total arsenic, 400 micrograms per liter dissolved cobalt, 100 micrograms per liter dissolved copper, 82,600 micrograms per liter dissolved iron, 28,600 micrograms per liter dissolved manganese, 22,000 micrograms per liter total lead, 0.01 micrograms per liter dissolved nickel, and 67 micrograms per liter dissolved vanadium.

Some watersheds, especially those where only the Fire Clay and Leatherwood seams have been mined, have recovered to the point where the water draining from them is similar in pH and in concentrations of dissolved solids to that which was present prior to mining.

Effects of coal mining on small streams of the Levisa Fork
Kentucky

Dysart, J. E.
U.S. Geological Survey Water-Resources Investigation

Downstream effects of coal mining on the surface-water quality of the Levisa Fork basin, Kentucky-Virginia

Dysart, J. E.
U.S. Geological Survey Water-Resources Investigation

Effects of coal mining on the water resources of the Tradewater River Basin, Kentucky

Grubaugh, H.


Journal Announcement: SWR0030

The effects of coal-mine drainage on the water resources of the Tradewater River Basin, in the western Coal Field region of Kentucky, were evaluated (1) by synthesis and interpretation of 16 years of daily conductance data, 465 chemical analyses covering an 18-year period, 28 years of daily discharge data, and 14 years of daily suspended-sediment data from the Tradewater River at Olney and (2) by collection, synthesis, and interpretation of chemical and physical water-quality data and water-quality data collected over a 2-year period from mined and nonmined sites in the basin. Maximum observed values of 13 chemical and physical water-quality parameters were three to 50 times greater in the discharge from mined subsurfaces than in the discharge from nonmined subsurfaces. Potassium, chlorine, and nitrate concentrations were not significantly different between mined and nonmined areas. Mean sulfate loads carried by the Tradewater River at Olney were about 75% greater for the period 1955-67 than for the period 1952-54. Suspended-sediment loads at Olney for the November-April storm-runoff periods generally vary in response to strip-mine coal production in the basin above Olney. Streamflow is maintained during extended dry periods in mined subsurfaces after streams in nonmined subsurfaces have ceased flowing. Some possible methods of reducing the effects of mine drainage on the streams are considered. (Woodard-USGS)

Floods on Licking River near Salyersville, Kentucky, were studied to obtain hydrologic data that can be used to evaluate the effect, depth, and frequency of floods that affect the economy of developments on the flood plains. Data provides a basis for solving existing flood problems and for regulating future land use and development to reduce flood damage by building and zoning regulations, locating waste disposal and water treatment facilities, and developing recreational areas. Areas inundated by 5, 25, and 50-year floods are shown on a topographic map, scale 1:12,000. Heights of floods are tabulated. Annual floods are shown graphically demonstrating the irregularity of flood heights and the typical magnitudes of floods. For each gaging station in the area, flood discharges and gage heights are tabulated. Major flood profiles are drawn. The frequency-gage height relationship is shown graphically. (Knapp-USGS)

Occurrence of fresh water in the Lee Formation in parts of Elliott, Johnson, Lawrence, Magoffin, and Morgan Counties, Eastern Coal Field Region, Kentucky

Hopkins, H. T.


GROUNDWATER

Hopkins, H. T.; Mull, D. S.

Geological Survey, Washington, D.C.


The effects of mining on the occurrence, movement, and quality of groundwater were studied in the cane branch study area, Kentucky. Groundwater in the essentially unmined West Fork Cane Branch study area was also investigated to provide a basis for comparison. There has been no significant change in the occurrence and movement of groundwater in the vicinity of the southwest spoil bank since beginning of observations in the spring of 1958. Shallow groundwater in bedrock is recharged by precipitation and moves from topographically high areas to streams. Groundwater in the southwest spoil bank is recharged by direct infiltration of precipitation and seepage from adjacent pools, and it discharges mostly eastward into tributaries draining the spoil bank area. Fluctuations of the water table in the spoil bank are largely controlled by direct infiltration of precipitation during the winter-spring season, but their are strongly influenced by seepage from pools adjacent to the spoil bank during the summer-autumn season. The shape and slope of the water table in the spoil bank have not changed significantly since observations.
This report concerns acid mine drainage and other forms of chemical water pollution attributed to surface mining in the Eastern Kentucky Coalfield and gives primary emphasis to identifying coal seams with the highest acid-producing potential. The parameters, criteria, and methodology developed and used to achieve this end are described. The research effort included a general evaluation of existing water-quality data for all the major drainage basins in the Eastern Kentucky Coalfields, followed by a concentrated study in Kentucky Big Sandy, and Cumberland River basins. (Adapted from Summary.)

Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1973-74.
Krieger, Robert A., and Others.
U.S. Geological Survey Professional Paper 427-D.

WATER IN KENTUCKY
KRIEGER, R. A.; CUSHMAN, R. V.; THOMAS, N. O.
GEOL. SURVY., WASHINGTON, D. C.
KENTUCKY GEOLOGICAL SURVEY, SER. 10, SPEC. PUBLICATION NO. 16, 1969, 51 P.
23 FIG., 39 PHOTO., 4 TAB., 126 REF.
Journal Announcement: SWAU219

THE WATER RESOURCES, WATER USE, WATER PROBLEMS, AND WATER LAW OF KENTUCKY ARE DISCUSSED IN A PUBLICATION INTENDED FOR PUBLIC EDUCATION TO INCREASE KNOWLEDGE OF THE NATURE, AVAILABILITY, AND MANAGEMENT OF WATER. DATA ON WATER QUALITY, WATER USE, STREAMFLOW, GROUNDWATER LEVEL, RESERVOIR CAPACITY AND PRECIPITATION ARE TANULATED. A BIBLIOGRAPHY OF KENTUCKY WATER INFORMATION IS INCLUDED. (KNAPP-USGS)

Hydrology of area 15, Eastern Coal Province, Kentucky, Tennessee
Leisler, D. W., Guinones, F., Mull, D. S., and Young, M.
U.S. Geological Survey

PRECEPITATION AND RUNOFF
MCCABE, J. A.
U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C.

Journal Announcement: SWAU415

THE RUNOFF CHARACTERISTICS OF CANE BRANCH AND HELTON BRANCH BASINS OF KENTUCKY WERE STUDIED TO RELATE ANY OBSERVED DIFFERENCES BETWEEN THE TWO BASINS TO DIFFERENCES IN THEIR EXPOSURE TO STRIP MINING. THE DRAINAGE BASIN OF CANE BRANCH INCLUDES STRIP-MINED AREAS, WHEREAS THE DRAINAGE BASIN OF HELTON BRANCH HAS NOT BEEN DISTURBED BY STRIP MINING. THERE WERE MEASURABLE DIFFERENCES IN RUNOFF CHARACTERISTICS BETWEEN THE TWO BASINS, DESPITE THE FACT THAT SIMILAR PERCENTAGES OF ANNUAL PRECIPITATION GO TO RUNOFF AND EVAPOTRANSPIRATION IN EACH BASIN. APPLICATION OF BOTH FLOW-DURATION AND ANNUAL-FLOOD METHODS TO ANALYSIS OF STREAM HYDROGRAPHS INDICATED THAT CANE BRANCH HAS GREATER PEAK FLOWS PER SQUARE MILE OF DRAINAGE AREA AND MORE RAPID CHANGES IN DISCHARGE, BUT HELTON BRANCH HAS GREATER BASE FLOWS. HOWEVER, AN EXAMINATION OF THE HYDROLOGIC DATA FOR PROGRESSIVE CHANGE IN RUNOFF CHARACTERISTICS OF CANE BRANCH THAT COULD BE RELATED TO THE HISTORY OF MINING IN THE AREA FAILED TO INDICATE ANY SUCH CHANGE. (SEE ALSO W71-07935) (KNAPP-USGS)

Influences of strip mining on the hydrologic environment of parts of Beaver Creek Basin, Kentucky, 1973-74
McCabe, J. A., 1982
U.S. Geological Survey Professional Paper 427-D

Public and industrial water supplies of the Western Coal Region, Kentucky
Maxwell, B. W., 1954
U.S. Geological Survey Circular 339

Data on the sources, pumping, treatment, and storage of water for public and industrial water supplies in the 10 counties of the Western Coalfield Region of Kentucky are presented. The total daily pumping of water in the region is about 50,000,000 gallons. Seventy-two percent of this is obtained from wells and 28 percent is obtained from surface supplies. The Quaternary alluvium provides about 91 percent of the ground water used in the region. Of the total pumping, 74 percent is used for all purposes from public supplies. The daily consumption of water pumped from public supplies ranges from 21 to 197 gallons and averages 110 gallons. The chief industrial consumption of water is for coal washing, production of chemicals, distilling, and secondary recovery of petroleum.
The region is the southern part of a large basin of shales and sandstones of Pennsylvanian age which is overlain in places by alluvial sands and gravels and silts of Quaternary and Recent age. The chief aquifers are the Pennsylvanian sandstones and the sands and gravels of the alluvium. The water in the Pennsylvanian sandstones is fresh in the outcrop areas and becomes progressively more mineralized towards the center of the basin. Yields from the Pennsylvanian sandstone ranges from a few gallons per minute up to 500 gal/min. Water in the alluvium ranges from hard to very hard and may be pumped from vertical wells at rates up to at least 1,000 gal/min. (Author's abstract.)

Reconnaissance ground-water resources in the western Coal field region, Kentucky

Maxwell, B. W., and DeVaul, R. W., 1962d


Ground-water resources of the Jenkins-Whitesburg area, Kentucky

Mull, D. S., 1965


Availability and quality of water from underground coal mines in Johnson and Martin Counties, Kentucky

Mull, D. S.; Cordiviole, S. J.; Risser, D. W.


14 Fig., 2 Plates, 12 Tab., 35 Ref.

Journal Announcement: SWRA6152

The location and mine volume is shown for all abandoned coal mines that contained water in Johnson and Martin Counties, KY. The principal factors that affect the occurrence of water in coal mines is mine size, intensity and duration of precipitation and the location of the mine relative to the developed above drainage whereas water usually must be pumped from flooded galleries of mines below drainage. Ten above-drainage mines discharged on average 87.0 gallons of water per minute. Sustained discharge from the largest above-drainage mine ranged from 750 to 1,200 gallons per minute. Eight below drainage mines are considered potential sources of water. Test pumping and hydrographs indicate the seasonal recharge rate into below drainage mines varies from 660 to 105,500 gallons per day. Estimates of water stored in individual mines ranged from 22 to 1,462 million gallons. This water could sustain a supply through periods of limited recharge to the mine. Most mine water is a calcium magnesium sulfate type. Hardness ranged from soft to very hard and pH ranged from 3.5 to 8.0 units. The concentration of most dissolved constituents was

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Public and industrial water supplies of Kentucky, 1968-69

Mull, D. S.; Cushman, R. J.; Lambert, T. W.

Geological Survey, Louisville, KY

Kentucky Geological Survey

Journal Announcement: SWRA0424

Data concerning public and industrial water supplies of Kentucky during 1968-69 are presented; an average of about 612 million gallons of water was used daily in 1968-69 for public and industrial water supplies in Kentucky. This is an increase in total water use of 2% over 1957-59 and 4% over 1951-53. Public supplies accounted for 81% and industrial supplies 19% of the total water used in 1968-69. Municipalities and utility water systems furnished water to 21.4% of the population being supplied from surface-water sources and 15.3% from groundwater sources. The average daily use was about 190 million gallons; a 23% increase over 1957-59 and 30% over 1951-53. The average daily per capita use was 86.4 gallons. The per capita use shows a wide range among communities, in general the larger the city or town, the larger the per capita use. Industrial water use in 1968-69 increased about 32% over 1957-59, a larger increase than for public supplies. The average daily use was nearly 423 million gallons, of which about 328 million gallons were self supplied; the remainder was supplied by public water systems. (Woodard-USGS)

Water resources of the Middlesboro area, Kentucky

Mull, D. S.; Pickering, R. J.

US Geological Survey

Journal Announcement: SWRA6802

Water resources information for the Middlesboro area is summarized as part of the statewide study of water and mineral resources. The quantity and quality of groundwaters and surface waters re described; the aquifers, water use, and natural as well as man-made conditions affecting optimal development of water resources are discussed. A dependable water supply is available from a reservoir in a protected drainage basin; ample groundwater is available for present use and future needs. Most of the groundwater is in conglomerates and sandstones of the Middle Devonian age, artesian wells capable of producing as much as 100 gpm each can be developed; a well and a spring each of that capacity are already in use. Shallow over rock of the Pennsylvanian Breadthitt group and the shallow alluvium can be developed for domestic and modest industrial supplies. Fractures in the disturbed rocks aid recharge and circulation so that generally aquifer water is satisfactory for most uses with little more

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TREATMENT THAN IRON REMOVAL. FURTHER DEVELOPMENT OF SURFACE WATER WOULD REQUIRE IMPoundMENT. SURFACE WATER QUALITY IS SLIGHTLY IMPAIRED BY ACID MINE DRAINAGE AND WASTE DISPOSAL. FLOOD HAZARDS ARE REDUCED BY CONTROL STRUCTURES.


This report describes the topography, drainage, geology, soils, climate, hydrologic environment, and forest vegetation of the study areas and gives a history and description of the mining. The following study areas are included: (1) The Cane Branch basin, in which there has been mining; (2) the Helton Branch basin, in which there has been no mining and which is assigned also to the Cane Branch basin in physical characteristics; and (3) the West Fork Cane Branch basin, in which there has been some prospecting.

The bedrock of the Beaver Creek basin has been eroded by streams to form a maturely dissected, irregular land surface with narrow, winding ridges and deep, steep-sided, narrow valleys. The drainage area of each study area, in square miles, is as follows: Helton Branch, 0.85; Cane Branch, 0.67; and West Fork Cane Branch, a major tributary to Cane Branch, 0.26. Profiles of the stream channels and areas delineated by the land slopes show that the study areas are similar topographically. The Helton Branch channel has a bedrock floor. Numerous reaches of the Cane and West Fork Cane Branch channel floors are composed of sediment deposits.

The stratigraphic section is divided into three parts, as follows: (1) the strata below the main cliff-forming sandstone, which consists mostly of siltstone and claystone; (2) the main cliff-forming sandstone that makes the steep valley walls; and (3) the strata above the main cliff-forming sandstone that consists of sandstone, siltstone, claystone, and the Barren Fork coal in the Cane Branch area. In the Cane Branch area and mostly of sandstone in the Helton Branch area.

The spoil banks in the Cane Branch basin are composed of a heterogeneous mixture of sandstone, siltstone, claystone, soil, and water-soluble sulfur compounds. Downstream from the spoil banks, the stream beds and the lower flood plains are composed of fluvial deposits consisting predominately of clay and silt-size particles that were derived from the spoil banks. In the Helton Branch basin, fluvial deposits consist of sand- to boulder-size fragments, and in the West Fork Cane Branch basin these deposits consist of silt- to boulders-size fragments.

Several great soil groups occur within the study areas, including the Red-Yellow Podzolic group, the Planosol group, and the Alluvial group. The main soil series present are the Muskingum, Hartsells, Wellston, Johnsburg, Tilsit, and Enders, which have formed from parent sandstone, siltstone, and claystone beds. The hydrologic classification of soils indicates that the Helton and Cane Branch study areas are similar in terms of potential runoff, insofar as the soils are concerned.

The climate of southeastern Kentucky is virtually continental in character. The temperature ranges annually from about 5 to 100 degrees F. The mean annual is 66 inches. Thunderstorms are common during the spring and summer months. The mean annual snowfall is about 11 inches. Annual runoff averages 22 inches for the Cane and West Fork Cane Branch study areas, and rarely reach zero flow. West Fork Cane Branch is an intermittent stream and is dry for long periods in the summer and fall.

Chemical weathering has produced the gentle slopes in the uplands of the study areas and physical weathering has resulted in the formation of the steep valley walls. The forest vegetation of the study areas consists of stands of pines and oaks on the ridges and of stands of hardwoods and hemlocks in the coves and bottomlands. There are some differences in the percentages of the various forest types in the study areas, but the total percentages of types based on environmental conditions are similar. The Helton Branch area has a larger number of stems per acre than the Cane Branch area.

From 1955 to 1960, phases of prospecting and mining took place in the Cane and West Fork Cane Branch study areas. From May 1955 to April 1956, the Warren Fork coal seam was strip mined in the southwestern portion of the Cane Branch area. After mining was completed, the mine operator leveled the spoil bank resulting from the operation and cleared two ditches to allow drainage into the Cane Branch.

From October 1957 to January 1959, a second operator drifted the coal seam in the highwall on the southwest side of the Cane Branch area. Acid water was frequently pumped from the drift mine into Cane Branch during the mining operation.

From the fall of 1958 to August 1959, a third operator strip mined coal in the northeast side of the Cane Branch area. After mining was completed, the spoil bank was leveled and a ditch cleared to allow drainage into Cane Branch.

During February and March 1960, a fourth operator, in prospecting for coal along the divide between the Cane and West Fork Cane Branch basins, built a small spoil bank in each of these basins. No coal was mined in the areas during this activity.


One of the environmental factors most obviously influenced by strip mining in the Cane Branch basin of Kentucky is the chemical composition of the water. Cane Branch is an acid stream heavily influenced by strip mining. This report describes and evaluates (1) changes in the chemical composition of water in the Cane Branch study area, (2) the chemical composition of water in nearby study areas unaffected by mining, and (3) the general persistence of acid water downstream from the Cane Branch mining area. Although fluctuations of annual mean concentrations due to climatic variations have made it difficult to identify a definite trend during the period 1962-66, apparently there was little change in the rate of chemical weathering or in the chemical composition of the water in Cane Branch during the last half of the study. As the acid mine drainage from the Cane Branch area moves downstream, it is diluted and neutralized by inflow from streams containing bicarbonate alkalinity. The effects of the mine drainage are almost undetectable at the point where water from Little Hurricane Fork enters Beaver Creek, and Beaver Creek below this point has a slightly acid pH like that of neighboring streams unaffected by acid mine drainage. (See also W71-07935) (KNAPP-U562)


The availability of ground water in different parts of this region was determined chiefly by analyzing ground-water data collected during the reconnaissance. The resulting water-availability maps, published as Hydrologic Investigations Atlases, were designed to be used in conjunction with this report.

Water from wells and springs in the Eastern Coalfield Region varies widely in chemical character, but most of the water is of the calcium magnesium bicarbonate or sodium bicarbonate type. Chloride and iron are the most objectionable constituents in the ground water of the region. Salty water is known to occur at depths of less than 300 feet in all the physiographic sections of the region, except the Cumberland Mountain section. In general, the chloride content of the ground water becomes higher with increasing depth below drainage and water that is salty enough to be called a brine eventually will be met in wells drilled deep enough in any part of the region.

Iron is present in noticeable quantities in the water from wells and springs in all formations in the region. Areas in which vadose water drains through beds of black shale or coal or areas in which acidic mine drainage recharges the ground water probably will have a high iron content. Under these circumstances, the iron-bearing water probably will occur only at shallow depths.


This report lists water quality stations operated by the Geological Survey in the southeastern U.S. for which data are available in machine-readable form. The data are the results of analyses of water samples and indicate the chemical and physical characteristics of surface water and groundwater. The stations are listed according to station number and state, and are grouped into 21 parameter categories. The analytical results for all samples in any one year are then grouped within the parameter categories. The report lists the available retrieval options, the machine-readable output options, user charges, and how to obtain the data. (KNAP-UGS)

Tree growth

SIGAFOOS, R. S.

Geological Survey, Washington, D.C.


Journal Announcement: SWA0415

The net effect of strip mining upon the forests in the cane branch basin, Kentucky is negative. The area mined was cleared of trees at the time of mining, and after a recovery period of 10 to 20 years support the number of trees that a comparable area of abandoned cultivated land supported. Furthermore, some trees that were not destroyed at the time of mining subsequently died, probably because of burial by sediments, and other trees may have had their growth inhibited as a result of irrigation by mine drainage. (See also W71-07935) (KNAP-UGS)

Floods of December 1978 in Kentucky

Sullivant, J. N.; Guionnes, F. ; Flint, R. F.


Geological Survey open-file report 79-977A. April 1979, 53 p, 15 FIG, 6 TAB, 4 REF.

Journal Announcement: SWA1302

In 1978, severe flooding throughout the state of Kentucky occurred from December 3-10 as a result of intense precipitation from two storms. The storms of December 3-5 and December 7-10 produced record peak discharges in several areas throughout central and eastern Kentucky, resulting in damages of nearly 50 million dollars and the loss of five lives. This report summarizes data collected during the floods by the U.S. Geological Survey, Water Resources Division, and other federal and state agencies in Kentucky. The data include precipitation, streamflow, and water-quality data (including suspended sediment). Estimates of property damages

In selected basins are also provided. The information is preliminary and subject to revisions. (Woodard-UGS)

Low-flow characteristics of Kentucky Streams

Whitesides, D. V.

Geological Survey, Washington, D.C.

Low-flow data are used to define a frequency curve. The discharge at 10-year recurrence interval from that curve is the 7-day Q10. This report presents the 7-day Q10 discharge at 85 continuous-record stations and at 49 partial-record stations. These values are shown on a map along with the station number and the drainage area. (KNAP-UGS)

Water levels in observation wells in Kentucky 1935 through 1976

Kernodle, J. M.; Knapp-UGS


Geological Survey open-file report 78-129, February 1978, 156 p, 196 FIG, 1 TAB, 113 REF.

Journal Announcement: SWA1117

Hydrographs show water levels in observation wells in Kentucky from 1935 through 1976. The water levels in these wells are measured as part of the national observation well network and in cooperation with the University of Kentucky. Kentucky Geological Survey. The hydrographs are arranged by five physiographic regions of Kentucky, alphabetically by county, and in ascending order of latitude. The collection and tabulation of ground-water levels and aquifer data are used to determine short-term changes and long-range trends in water-level fluctuations which reflect the changes in storage within ground-water reservoirs. (Woodard-UGS)

Yields and specific capacities of bedrock wells in Kentucky

Whitesides, D. V.

Geological Survey, Louisville, KY.

Kentucky Geological Survey Information Circular 21, 1971, 18 P, 5 FIG, 1 TAB, 57 REF.

Journal Announcement: SWA0505

Specific-capacity and well-yield data are presented from controlled pumping tests on 106 selected bedrock wells in 41 counties in Kentucky. Occurrence and movement of groundwater in bedrock aquifers are discussed. Depths of wells tested range from 21 to 115 feet and yields range from aquifers will need to be developed and utilized as demand for water increases along with population growth and industrial expansion in Kentucky. Adequate groundwater supplies from bedrock wells for domestic and small industrial use could in all probability be developed in some areas which are far removed

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The U.S. Geological Survey in cooperation with the Kentucky Geological Survey has been gathering temperature data on streams throughout Kentucky under a number of different programs for several decades. Periodic water temperature observations, which were made at a frequency of approximately once per month during the past 15 years, were analyzed with the aid of a computer program to describe the annual water temperature cycle at sites in the Commonwealth. Shown on a map of Kentucky, at each site of water-temperature collections, are maximum median monthly temperatures, minimum median monthly temperatures, and annual average temperature. Stream temperatures in Kentucky vary between 0 and 30 degrees Celsius (deg C) during the year. Maximum median monthly water temperatures occur in July and are typically between 23 and 27 deg C, whereas minimum median monthly water temperatures are recorded in January and are usually within the 2 to 6 deg C range. Annual average water temperatures are between 10 and 18 deg C. (Woodard-USGS)


Water resources data for Kentucky consist of records of stages, discharges, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs.

Data collected at various miscellaneous sites is also published. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kentucky. (USGS)

WATER RESOURCES INVESTIGATIONS IN KENTUCKY, 1972 GEOLOGICAL SURVEY, WASHINGTON, D.C.


Water-resources studies and investigations made in Kentucky
during 1976 by the U.S. Geological Survey in cooperation with State and local agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic data network, areal hydrologic or interpretative studies, and research projects. The hydrologic data network consists of surface-water stations, groundwater observation wells, and water-quality observation sites. Small State maps give a broad picture of variations in some of the hydrologic characteristics pertaining to Kentucky's water resources. A larger map shows the hydrologic data network and investigations in the State. (Woodard-USGS)
Hydrology of Area 5, Eastern Coal Province, Pennsylvania, Maryland, and West Virginia

Herbs, W. J.; Shaw, L.; T. R. urowka, D. E.


Geological Survey, Open-File Report 81-538 (WR1), September 1981, 92 p. 66 Fig. 22 Tab. 37 Ref., Appendix.

Journal Announcement: SWRA1511

Hydrologic data are presented for area 5 of the Eastern Coal Province the 7,384 square-mile Monongahela River basin in western Pennsylvania, western Maryland, and north-central Western Virginia. One hundred thirty-four streams were sampled about three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity dissolved and total iron, dissolved and total manganese, dissolved sulfate, and dissolved solids. Benthic invertebrate populations were determined and bottom material samples sediments were analyzed for major metals. Eleven streams had pH, acidity, alkalinity, total iron, total manganese, and dissolved-sulfate levels indicative of acid-mine drainage. These streams were most common in the Tygart Valley River basin, although indicators of acid-mine drainage were found throughout the Monongahela basin. No benthic invertebrates were found in 25 of 129 streams sampled. Such streams were most common in the Cheat and Tygart Valley River basins. Low flow, mean flow, peak flow, and flow duration data are presented for gaging stations in area 5. Techniques for evaluating these data for ungauged sites are presented and referenced. The functions of, and access to, the National Water Data Exchange, WATSTORE, and indexes to water-data activities in coal provinces are presented. (USGS)
MINERALIZED WATER, AND ADVERSE EFFECT ON GROUNDWATER RUNOFF. ACIDIC MINE-DRAINAGE WATER, LOCAL HIGHLY EFFECTIVE HAS ESTIMATED SQ COEFFICIENTS, 0.005. CRYSTALLINE AND SEDIMENTARY ROCKS ESTIMATED TO RIDGE PROVINCE ARE COVERED WITH THICK REGOLITH. ESTIMATED REGOLITH, DAY, AND S, 0.01. CARBONATE ROCK, AVERAGE VALUES FOR AQUIFER CHARACTERISTICS OF THIS WATER ORIGINATES OUTSIDE OF MARYLAND. MARYLAND IS NOT IN FLOOD-PLAGUED REGION AND FLOODS ARE RARELY A PROBLEM. MARYLAND'S WATERS ARE GENERALLY OF EXCELLENT QUALITY.

MARYLAND GROUND-WATER INFORMATION: CHEMICAL QUALITY DATA

WATER IN MARYLAND: A REVIEW OF THE FREE STATE'S LIQUID ASSETS WALKER, PATRICK N.

GEOLoGICAL Survey TOWSON, MD.

MARYLAND GEOLOGICAL Survey EDUCATIONAL SERIES No 2 1970. 52 P.

This report is intended to present to the citizens of Maryland an account of the state's water resources. Chapters are titled as though they dealt with parts of a financial budget because water resources just as managed just as finances must be managed. The climate of Maryland is temperate and subhumid. Average annual temperature ranges from about 48 degrees F in the mountains to about 58 degrees F in the southern coastal plain. In a typical year the state receives 20,000 billion gallons of water as precipitation of streamflow. In addition, an estimated 130,000 billion gallons of groundwater are contained in the rocks of the state. Maryland's average precipitation is about 42 inches per year. In general, precipitation is higher in the eastern and extreme western parts of the state than it is in the western-central part, of 42 inches of precipitation each year, about two-thirds or 28 inches is lost to evapotranspiration. Each year about 14,000 billion gallons of water leave the state as streamflow. Some 11,000 billion gallons of this water originates outside of Maryland. Maryland is not in a flood-plagued region and floods are rarely a problem. Maryland's waters are generally of excellent quality.

MARYLAND'S WATERS ARE GENERALLY OF EXCELLENT QUALITY.
This report is a compilation of selected water-well records, selected spring records, gas-well records, chemical-quality data, water-use data, coal test-hole records, and surface-water data for Garrett County, Maryland. Included are records of about 1,100 water wells, 120 springs, 210 gas wells, 70 coal test holes, 56 chemical analyses of ground water, surface-water data from 6 continuous-record sites, and miscellaneous measurements from 11 sites. (USGS)

Water Resources Data for Maryland and Delaware, published annually since 1975.


Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
Evaluation of Missouri's Coal Resources

Missouri possesses coal resources of 31.7 billion tons as determined by mapping and exploration. The remaining reserves, which total 10.4 billion tons, include 2.1 billion tons of thick (42 inches) coal, 8.5 billion tons of intermediate thickness (28 to 42 inches), and 21.1 billion tons of thin (12 to 28 inches) coal.

Missouri possesses coal resources of 31.7 billion tons as determined by mapping and exploration. The remaining reserves, which total 10.4 billion tons, include 2.1 billion tons of thick (42 inches) coal, 8.5 billion tons of intermediate thickness (28 to 42 inches), and 21.1 billion tons of thin (12 to 28 inches) coal.

Remainin...
hierarchical analysis of variance design and randomly chosen test show that the concentrations of many chemical constituents in waters of Missouri vary both among and within the major geohydrologic units by statistically significant amounts. These differences in constituent concentrations in surface waters are statistically significant differences between geohydrologic units than the ground waters, and in some geohydrologic units the surface water is chemically quite different from the ground water, especially in its trace element content, where geohydrologic units overlie one another, there may be large differences in the quality of water obtained from closely spaced wells pumping water from different geohydrologic units. Analysis of the ground-water data by G-mode factor analysis indicates that general chemical character of the waters can be moderately well described in terms of four water-types. These include (1) a Ca-Mg-HCO₃ water with relatively high Cu₂⁺ (2) a Na-HCO₃-CI water with high K, Li, Al and or Fe, and (3) a Ca-HCO₃-Cl water with high Fe and Mn and (4) a water low in total dissolved solids and with low concentrations of trace elements. (kosco-USGS)

WATER RESOURCES OF NORTHEASTERN MISSOURI
GANN, E. E.; HARVEY, E. J.; BARKS, J. H.
GEOLOGICAL SURVEY, WASHINGTON, D.C.
FOR SALE BY USGS, WASHINGTON, D.C., 20242, PRICE $1.50 PER SET
HYDROLOGIC INVESTIGATIONS ATLAS HA-444, 4 SHEETS, 1973, 26 FIGS, 7 TABLES, 48 REF.
Journal Announcement: SWR00713


WATER RESOURCES OF WEST-CENTRAL MISSOURI
GANN, E. E.; HARVEY, E. J.; BARKS, J. H.; FULLER, D. L.
GEOLOGICAL SURVEY, ROLLA, MO.
HYDROLOGIC INVESTIGATIONS ATLAS HA-491, 1974, 4 SHEETS, 66 REF.
Journal Announcement: SWR00907

FUTURE DEVELOPMENT IN WEST-CENTRAL MISSOURI IS EXPECTED TO RESULT FROM CONTINUED URBAN EXPANSION AND FROM INCREASING RECREATIONAL DEVELOPMENT. EIGHT FLOATING RESERVOIRS EITHER IN CONSTRUCTION OR UNDER CONSTRUCTION. KNOWLEDGE OF THE WATER RESOURCES IS NEEDED IN PLANNING THE USE AND DEVELOPMENT OF THE AREA. THIS ATLAS PRESENTS A GENERAL SUMMARY OF INFORMATION CONCERNING THE OCCURRENCE, AVAILABILITY, USE, AND QUALITY OF WATER, A GENERAL DEFINITION OF EXISTING AND POTENTIAL PROBLEMS RELATED TO THE DEVELOPMENT OF THE WATER RESOURCES IS ALSO INCLUDED. THE ATLAS COVERS APPROXIMATELY 15,000 SQ MI AND INCLUDES ALL PARTS OF 33 COUNTIES. THE AREA IS HOUNDED ON THE NORTH BY THE SOUTH EDGE OF THE MISSOURI RIVER FLOOD PLAIN, ON THE EAST BY THE EASTERN DRAINAGE DIVIDES OF THE OZARK AND HIGH PLAINS RIVER BASINS, AND ON THE WEST AND SOUTH BY THE MISSOURI STATE LINE. WATER RESOURCES OF THE MISSOURI RIVER VALLEY ARE DESCRIBED IN THE PUBLISHED ATLAS SHOWED ON THE MAP. (WOODARD-USGS)

WATER RESOURCES OF NORTHEASTERN MISSOURI
GANN, E. E.; HARVEY, E. J.; JEFFERY, M. G.; FULLER, D. L.
GEOLOGICAL SURVEY, WASHINGTON, D.C. AND MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES, ROLLA.
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. - PRICE $2.00 PER SHEET
GEOLOGICAL SURVEY HYDROLOGIC INVESTIGATIONS ATLAS HA-452, 4 SHEETS, 1971, 25 FIGS, 13 MAPS, 7 TABLES, 22 REF.

Journal Announcement: SWR04204

THESE ATLAS PRESENT A GENERAL SUMMARY OF INFORMATION CONCERNING THE AVAILABILITY, DISTRIBUTION, AND QUALITY OF WATER IN NORTHEASTERN MISSOURI. ALSO INCLUDED ARE PROBLEMS AND POSSIBILITIES RELATED TO DEVELOPMENT OF THE WATER RESOURCES OF THE AREA. MAPS, TABLES, GRAPHS, AND ILLUSTRATIONS ARE USED TO PRESENT DATA AND INFORMATION FOR SURFACE WATER AND GROUNDWATER HYDROLOGY CONCERNING POLLUTION, IRRIGATION, SEDIMENT TRANSPORT, URBANIZATION, FLOODING, INDUSTRY, AND RECREATION. (WOODARD-USGS)

Summary: Appraisals of the Nation's Ground-water
Resources—Missouri Basin Region
Available from Supt. of Documents, GPO, Washington, DC 20402.
1 p., 12 figs, 3 plates, 8 tabs, 53 refs.
Journal Announcement: SWRA121
The Missouri Basin Region, about one-sixth of the contiguous United States, utilizes large water supplies for irrigation, industrial, public supply, and rural use. Groundwater resources occur in sand and gravel alluvium, glacial deposits, dune sand, daisfill deposits of sand and gravel, sandstone, siltstone, fractioned sandy clay, limestone, and dolomite. Ground water is undeveloped in many areas. Unconsolidated and non-consolidated aquifers have potential for conjunctive use with surface water, reuse of available supplies, artificial recharge, and salvage of evaporative transpiration. Sandstone aquifers have potential for artificial recharge; induced interaquifer leakage; conjunctive use with surface water; and temporary mining of ground water. Limestone and dolomite aquifer have potential for development of a large water supply. Induced increase in recharge, and induced interaquifer leakage. Saline ground water occurs throughout the region, but is most abundant in deep aquifers in Wyoming, North Dakota, and South Dakota. Improved water use in the Missouri basin Region would require a periodic inventory of current supplies in precipitation, streamflow, surface-water storage, and ground water; an awareness of the options; and implementation of sound water-management plans. (Woodard-USGS)

Physical Environment and Hydrologic Characteristics of Coal-Mining Areas in Missouri
Journal Announcement: SWRA1413
Hydrologic information for the north-central and western coal-mining regions of Missouri is needed to define the hydrologic system in these areas of major historic and planned coal development. This report describes the physical setting, climate, coal-mining practices, general hydrologic system, and the current (1980) hydrologic database in these coal-mining regions. Streamflow in both mining regions is poorly sustained. Stream water quality generally varies with location and the magnitude of coal-mining activity in a watershed. Streams in non-coal-mining areas generally have dissolved-solids concentrations less than 400 milligrams per liter. Acid-mine drainage has seriously affected some streams

Water Resources Data for Missouri, published annually since 1975
Available from the National Technical Information Service, Springfield, VA 22161.

Water-Resources Investigations of the U.S. Geological Survey in Missouri—Fiscal Year 1981
Journal Announcement: SWRA1515
Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretative investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1981 fiscal year and provides an extensive list of water-resources references for the State.

Water-Resources Investigations of the U.S. Geological Survey in Missouri—Fiscal Year 1980
Journal Announcement: SWRA1412
Water-resources investigations of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and conducting interpretative investigations. The data and the
results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. The report describes the data-collection activities and investigations in Missouri for the 1980 fiscal year and provides an extensive list of water-resources references for the State. (USGS)
TEMPERATURE OF SURFACE WATERS IN MONTANA

MONTANA FISH AND GAME DEP REP, 1969, 613 P, 4 FIG, 3 TAB.

This publication is a compendium, in tabular and graphic form, of all available surface water temperature data in the state of Montana through 1985. The data were obtained from federal and state agencies, cities and private industries. The report includes records of water temperatures at 272 sites on streams and lakes ranging from spot observations at time of discharge measurements or water quality samples to continuous record by a recording thermograph. Copies are available from the Montana Fish and Game Department, Helena, Mont. (Aagaard-USGS)

Ecology and distribution of major diatom ecotopes in the southern Fort Union coal region of Montana

Hahls, L. L., Weber, E. E., and Jarvie, J. D.
U.S. Geological Survey Professional Paper


This report describes the stratigraphy of the Fort Union formation and the geology of about 975 square miles in southeastern Montana. It includes a detailed township-by-township description of the coal resources, and a geologic map at a scale of 1:62,500 showing the outcrop of coal beds and the location of 839 measured coal sections.

Completion and Testing of Madison Limestone Test Well 3, NWH4SE1/4 Sec. 35, T. 2 N. R. 27 E. Yellowstone County, Montana

Blankenagel, R. K.; Howells, L. W.; Miller, W. R.

Selected intervals in the lower and upper parts of the Mission Canyon Limestone of Mississippian age, and the Amsden Formation and Tensleep Sandstone of Pennsylvanian age, containing water with dissolved-toluene concentrations of 3,000 milligrams per liter or less were perforated through 7-inch casing that was cemented to the wells of the borehole.

Total flow from all perforated intervals after development of each interval by swabbing and flowing was 125 gpy and flowing was 125 gallons per minute. Total flow increased to 2,900 gallons per minute after acidizing and fracturing each unit through perforations. Radioactive tracer surveys indicate about 95 percent of the flow was from perforations in the upper part of the Mission Canyon Limestone. Based on analysis of data from a step-drawdown test, the values of transmissivity and coefficient of storage considered as most reasonable are 38,000 gallons per day per foot and 0.00002 respectively. Maximum temperature of water measured at land surface was 56.2 degrees Celsius. (USGS)

Preliminary Data for Madison Limestone Test Well 3, NWH4SE1/4 Sec. 35, T. 2 N. R. 27 E. Yellowstone County, Montana

Blankenagel, R. K.; Howells, L. W.; Miller, W. R.; Hansen, C. V.

This report provides preliminary data for Madison Limestone test well 3 in Yellowstone County, Mont., including test-well history, geology of the test well, hydraulic testing and geochemistry. It also discusses the preliminary results and future testing. The test well was drilled as part of the study to determine the water-resource potential of the Madison Limestone and associated rocks to meet future water needs in a 180,000-square-mile region that includes the coal-rich area of the Northern Great Plains. Drilling and testing were designed to yield a maximum of stratigraphic, structural, geophysical, and hydraulic information. (Woodard-USGS)

Preliminary data for Madison Limestone test well No. 2, SE 1/4 SE 1/4 sec. 18, T. 1 N., R. 34 E., Guster County, Montana


This report presents the preliminary data for the Madison Limestone test well 2 including test-well history, geology of the test well, hydraulic testing and geochemistry. It also discusses the preliminary results and future testing plans. The test well was drilled as part of the study to determine the water-resource potential of the Madison Limestone and associated rocks to meet future water needs in a 180,000-square-mile region that includes the coal-rich area of the Northern Great Plains. Drilling and testing were designed to yield a maximum of...
stratigraphic, structural, geophysical, and hydrologic information.

The test well was drilled in the SE 1/4 SE 1/4 sec. 18, T. 1 N., R. 54 E., Custer County, Montana, to a depth of 9,378 feet below land surface. The well is cased with 13-3/8-inch casing from land surface to 4,661 feet and 9-5/8-inch casing from 4,519 to 6,487 feet below land surface. It is an 8-1/2-inch-diameter open hole from 6,487 feet to 8,422 feet. The well is plugged below that depth by two cement plugs—one from 9,378 to 9,084 feet and the other from 8,884 to 8,422 feet. The well is so constructed that additional hydrologic tests and geophysical logs can be made at a later date.

Nineteen cores were taken from selected intervals totaling 754 feet; 722.4 feet of core was recovered. The cores were photographed, slabbed, and plugged, and selected parts were tested for density, porosity, and vertical and horizontal permeability. Gamma and density scans of the cores were made, and thin sections are being prepared for detailed examination.

Seventeen conventional drill-stem tests and packer-swabbing tests were attempted, 13 of which give clues to the pressure heads of water in the intervals tested. Water samples were obtained during 10 of the tests, 7 of which were flow tests.

Water from the open-hole part of the well had a shut-in pressure of 333 pounds per square inch and flowed about 44 gallons per minute. The temperature of the water, measured at the surface, was about 48 degrees Celsius.

With the possible exception of the Dakota Sandstone, no major potential sources of ground water were found in the test well. Also, no freshwater (less than 1,000 milligrams per liter dissolved solids) was found in any of the zones tested in the well. Water salinities ranged from about 2,000 to 46,500 milligrams per liter dissolved solids.

Additional geophysical logs and tests will be made in the test well during the summer and fall of 1977. The logs may include televiwer, gamma spectrometer, trace ejector, and spinner-surveys. A vertical seismic profile will be made in the well in August.

The Coalwood coal field, Powder River County, Montana
Bryson, R. P., 1952

This report contains a geologic map at a scale of 1:63,360 for a large area along the crest and western flank of the Black Hills uplift. Shown on the map are the outcrop areas of 30 coal beds. Also included are analyses of two coal samples; measured stratigraphic sections for the 1,320 ft of exposed Hell Creek and Fort Union Formations; a table of fossil-collection sites; and diagrams showing correlations, ranges in thickness, and average intervals between coal beds. The text describes the stratigraphy of the geologic units and the characteristics of the coal beds.
Bdsin. mdp d~scrib~s th~ maj~r showing Glendive, Sidney, coal beds more than 2 ft 2,250-ft column of 1:63,360 River M~m~ber holes A potent;al Report 82-681, the rocks Geolcgy of Moorhead units. samples, measured with ind~cate ~sessment Geological ~lhi~. ~t~o~sf~r~p~ophys~cal ~s~~s,~¢~s~g~e t~e ~t~o~sf~r~p~ophys~cal ~s~~s~g~e to~o~sf~r~p~ophys~cal ~s~~s~g~e t~e ~t~o~sf~r~p~ophys~cal ~s~~s~g~e Mining the Knobloch and Sawyer coal beds would remove two alluvial springs, one bedrock spring and two wells, which are all used for watering of livestock. The potentiometric surface within the Knobloch coal aquifer and the alluvial aquifer in the downstream part of the Tongue River Member would be substantially affected by mining. Lowered water levels in these aquifers might result in spring water levels in five wells outside the mine boundary. After mining, water in the alluvial aquifer downstream of the mine area might show a long-term degradation in quality as a result of leaching of soluble salts from overburden material used to backfill mine pits. Although mining would alter the existing hydrologic systems and remove several springs and shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining. Potential effects of surface coal mining on the hydrology of the Snider Creek area, Rosebud and Ashland coal fields, southeastern Montana Cannon, M. R. U.S. Geological Survey Water-Resources Investigations 82-4051, 28 P.

The Snider Creek area of the Rosebud and Ashland coal fields contains strippable reserves of Federal coal that have been identified for potential lease sale. A hydrologic study has been conducted in the potential lease area to describe the existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected from stock, wells, observation wells, and drill holes show that shallow aquifers exist within the Tullock, Lebo Shale, and Tongue River Members of the Fort Union Formation (Paleocene age) and within valley alluvium (Pleistocene and Holocene age). Most of the wells in the area are completed in the basal part of the Tongue River Member or in the upper part of the Lebo Shale Member and are used for watering of livestock. Small stock reservoirs are the primary source of surface water; Snider Creek and all other streams that originate in the area are ephemeral.
The Terrett coal bed of the Tongue River Member is the primary coal bed of the area and is located above the water table. Mining of the Terrett coal bed would destroy one stock well and several small reservoirs. Four other wells near the coal outcrop might be destroyed by mining. Alternative ground-water supplies are available to replace those lost by mining. Degradation of the quality of ground water, caused by the leaching of soluble salts from mine spoils, is not anticipated.

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basins, Southeastern Montana, Water Year 1980
Cary, L. E.; Johnson, J. D.

Hydrologic and climatologic data are being collected in a 25-square-mile (65-square-kilometer) basin in southeastern Montana to provide a base for development, calibration, and verification of a precipitation-runoff model. The study area and data-collection stations within the area are shown on a map. A summary of data collected at each station during the second year, beginning in October 1979, is provided in tables. The data include precipitation, snow depth and water content, air temperature, relative humidity, wind speed and direction, solar radiation, soil temperature and moisture, stream discharge, chemical analyses of water, and suspended sediment. (USGS)

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basins, Southeastern Montana, Water Year 1979
Cary, L. E.; Johnson, J. D.

Hydrologic and climatologic data are being collected in a 19-square-mile (49-square-kilometer) basin in southeastern Montana to provide a base for development, calibration, and verification of a precipitation-runoff model. The study area and data-collection stations within the area are shown on a map. A summary of data collected at each station during the first year, beginning in October 1978, is provided in tables. The data include precipitation, snow depth and water content, air temperature, relative humidity, wind run, solar radiation, soil temperature and moisture, stream discharge, chemical analyses of water, and suspended sediment. (USGS)

The coal resources of McCone County, Montana
This report contains a generalized stratigraphic section of the exposed rocks from the top of the Bearpaw Shale through the Tongue River Member of the Fort Union Formation, a regional-scale structure map, a geologic map of the area at a scale of 1:125,000, and three geologic sections. The text describes the general structural features and the stratigraphy of the map units although formation terminology has since been revised. A lengthy township-by-township discussion of coal resources for the county is accompanied by 531 graphic sections of 11 coal beds.

The Flaxville gravel and its relation to other terrace gravels of the northern Great Plains; 19 Shorter contributions to general geology 1917
Collier, A. J., and Thom, W. T., 1917

Coal resources of Montana

Three deposits of strippable lignite west of the Yellowstone River, Montana
Culbertson, W. C., 1954
This report describes three lignite deposits that are suitable for strip mining in an area of about 700 square miles. The lignite is mapped on the basis of overburden in categories of less than 60 ft, 60 to 90 ft, and 90 to 120 ft. Nine analyses of lignite samples are given. A columnar section shows the stratigraphic position and correlation of lignite beds. Thirty-seven coal sections were measured. Included are three maps that show the coal deposits, the amount of overburden, and the coal-section sites.

Measurements of discharge, gain or loss in flow, and chemical quality of the Poplar and Redwater Rivers, northeastern Montana
October 24-25, 1979
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.25 in paper copy, $3.50 in microfiche, Geological Survey Open-File Report 80-1210, November 1980, 16 p. 2 Fig. 3 Tab.
Base flow and chemical utility of streams in the Northern Great Plains area, Montana and Wyoming, 1977-78.

Druse, Stanley A., Dodge, Kent A., and Hotchkiss, W. R.

Base-flow discharge and chemical-quality measurements were made at 233 selected sites on streams during October-November 1977, August-September 1978, and October 1978 to provide data on the interaction between surface-water and groundwater systems. Streamflow gains or losses were computed for those stream reaches not significantly affected by irrigation. Water samples were collected at 17 of the sites for detailed chemical-quality analysis. The tabulated data provide an areally broad data base of concurrent base-flow conditions.

Geochemistry of ground waters in the Powder River coal region in 4th Annual Progress Report in Geochemical Survey of the Western Energy Regions.

Water Resources of Shallow Aquifers in the Upper Poplar River Basin, Northeastern Montana.
Feltis, R. G.
Geological Survey Water-Resources Investigations 79-51 (open-file report); June 1979, 23 p, 3 fig, 2 plates, 5 tabs, 6 ref.

Journal Announcement: SWRA1304
The aquifer system studied in the upper Poplar River basin in Montana ranges in age from Late Cretaceous to Holocene. Most wells obtain water from the Paleocene Fort Union Formation or younger rocks. The potentiometric surface of the Fort Union and overlying rocks indicates movement of water from the high interstream areas toward principal stream valleys. Recharge is principally through sand and gravel deposits of the Flaxville Formation, which occur as large terrace remnants, and the Wiota Gravel. Water in these formations locally recharges the underlying Fort aquifers are of the sodium bicarbonate, magnesium bicarbonate, or calcium bicarbonate type. The range in dissolved-solids concentration for the measurements of the Poplar River and East Fork Poplar River from the international boundary to the south edge of the study area. On October 21, 1977, a net gain of 2.84 cubic feet per second from a total flow of 11.7 cubic feet per second. This gain is discharge of water from the alluvium to the river.
(Woodard-USGS)

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana.
Feltis, R. G., Wood, Wayne A.

Journal Announcement: SWRA1601
Selected Hydrogeologic Data from Sweet Grass County, South of the Yellowstone River have been compiled to show baseline ground-water conditions. Included are records from a 1981 onsite inventory of 94 water wells and 30 springs. Chemical analyses of water show the major cation and anion...
Mean Annual Streamflow of Selected Drainage Basins in the Coal Area of Southeastern Montana

Ferrier, R. F.


Journal Announcement: SWR41510

Streamflow characteristics of drainage basins within the Fort Union coal region of southeastern Montana were estimated to provide preliminary data for evaluating the future effects of mining on the environment. Estimated annual mean streamflow at 22 data-collection stations for water years 1975-77 ranged from 0 to 887 cubic feet per second. These estimates are based on miscellaneous-streamflow records at each station and continuous-streamflow records from other stations in the study area. Estimated mean annual streamflow for a 10-year period (water years 1968-77) ranged from 0 to 572 cubic feet per second. These long-term estimates were based on data from stations in the area having continuous-streamflow records. Estimates mean annual runoff in inches for selected drainage basins within the study area showed no discernible pattern. Many of the drainage basins had a mean annual runoff of less than 0.60 inch; the maximum observed mean annual runoff was 4.45 inches. (USGS)

Restored stratigraphic cross sections and coal correlations in the Tongue River Member of the Fort Union Formation, Powder River area, Montana

Flores, R. H., 1979


Geology and coal resources of the Foster Creek coal deposit, eastern Montana


WATER RESOURCES OF THE YELLOWSTONE RIVER VALLEY, BILLINGS TO PARK CITY, MONTANA

Gosling, A. W. J., and Pashley, E. F., Jr.

Geological Survey, Washington, D.C.

Hydrologic investigations atlas HA-454. 2 Sheets, 1973. 7 Fig.,
The Glendive lignite field, Dawson County, Montana, 10 Contributions to economic geology, 1910--Part II
Hance, J. H., 1912
This report consists of a township-by-township description of the occurrence of coal in the Fort Union Formation for the areas delineated by Tps. 13 and 14 N., Rs. 53 to 60 E.; Tps. 15 and 16 N., Rs. 53 to 58 E.; and T. 17 N., Rs. 53 to 57 E. The physical properties and chemical composition are given for six coal samples. Included is a map at a scale of 1:125,000 showing geology and the outcrops of coal and burned areas.

The Terry lignite field, Custer County, Montana, 10 Contributions to economic geology, 1910--Part II
Herald, F. A., 1912
This report consists of a township-by-township description of the occurrence of coal in the Fort Union Formation for a strip of land in Tps. 9 to 12 N. that is bounded on the west by the Powder River and Yellowstone Rivers and on the east by the State line. Included are stratigraphic sections of the Lance Formation equivalent and Fort Union formation as well as descriptions of 21 coal samples. One coal sample was analyzed. Included is a map at a scale of 1:125,000 showing geology, coal outcrops, and burned areas.

WATER RESOURCES OF THE NORTHERN CHEYENNE INDIAN RESERVATION AND ADJACENT AREA, SOUTHEASTERN MONTANA
Hopkins, W. B., Geological Survey, Washington, D.C.
For sale by USGS, Washington, D.C. 20242. Price $1.00 per set.
Hydrologic Investigations Atlas HA-469, 1975. 2 sheets, 2 maps, 2 tables, 6 reference.

AND FROM SANDSTONE BEDS IN THE HELL CREEK FORMATION, WELLS THAT WOULD YIELD MORE THAN 50 GPM WOULD BE LIMITED TO THE ALLUVIUM ALONG THE PERENNIAL STREAMS, MOST OF THE REPORT AREA IS DRAINED BY THE TONGUE RIVER AND ITS TRIBUTARIES, THE CONCENTRATION OF DISSOLVED SOLIDS IN THE TONGUE RIVER IN WATER-RESOURCES DATA FOR DEEP AQUIFERS ON EASTERN MONTANA
Water-Resources Investigation 76-40 (open-file report), June 1976. 37 p, 6 figs, 5 tables, 9 ref.
Water from aquifers of Mesozoic and Paleozoic age in eastern Montana is little used. This report presents maps and tables to assist in the evaluation of the water in terms of possible utility. In the southern third of eastern Montana water from the Madison Group or from the Tensleep Sandstone contains less than 2,000 milligrams per liter dissolved solids and is available in amounts of as much as 3,700 gallons per minute (230 liters per second) from individual wells. Elsewhere, dissolved-solids concentrations of water from Mesozoic and Paleozoic aquifers commonly exceed 1,000 milligrams per liter, well yields range from 5 to about 1,500 gallons per minute (0.3 to 95 liters per second), and well depths generally are greater than 1,500 feet (460 meters).

A METHOD FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN MONTANA
METHODS ARE PROVIDED FOR ESTIMATING FLOOD CHARACTERISTICS AT MOST NATURAL FLOW SITES ON RURAL STREAMS IN MONTANA. FLOOD DATA AND RELATED INFORMATION FOR MANY GAGED SITES ON MONTANA STREAMS ALSO ARE PRESENTED. FREQUENCY CURVES ARE INCLUDED FOR 442 GAGED SITES AS DEFINED BY LOG-Pearson Type III ANALYSIS. TO ALLOW ESTIMATES AT UGAGED SITES, MATHEMATICAL EQUATIONS RELATE THE 2, 5-, 10-, 25-, 50-, AND 100-YEAR FLOOD MAGNITUDE TO MAIN CHANNEL SLOPE, AND MEAN ANNUAL PRECIPITATION WERE THE MOST SIGNIFICANT ESTIMATING VARIABLES. EQUATIONS PRESENTED ARE LIMITED TO USE ON STREAMS WITH DRAINAGE AREAS FROM ABOUT 0.1 TO 100.4 INCHES, HYDROGRAPHS PROVIDE A SIMPLE GRAPHICAL MEANS OF SOLVING THE ESTIMATING EQUATIONS, AND ILLUSTRATIVE EXAMPLES ARE PRESENTED.

Evaluation and Correlation of Water-Quality Data for the...
Quality of Streams in the Bull Mountains Region, South-Central Montana


This report is a compilation and evaluation of water-quality measurements that have been made by the U.S. Geological Survey at two stations on the North Fork Flathead River in Montana. Historical streamflow records show an annual mean daily discharge of 3,010 cubic feet per second near the mouth-a threefold increase compared to discharge at the international boundary. The chemical character of the water is dominated by calcium and magnesium cations and the bicarbonate anion. Base flow, in contrast to high flows from runoff, is characterized by lower dissolved constituents and lower concentrations of suspended sediment. The several lakes that contribute water throughout the middle and lower drainage have a dampening effect on both streamflow and constituent concentrations, using the available data and computer techniques, regression equations were developed between certain water-quality variables. (Woodard-USGS)

RESULTS OF PHYTOPLANKTON SAMPLING AT NATIONAL STREAM QUALITY ACCOUNTING NETWORK STATIONS IN MONTANA—1975 WATER YEAR


Twelve National Stream Quality Accounting Network Stations were operated in Montana during the 1975 Water Year (Oct. 1, 1974—Sept. 30, 1975). The Network was established to acquire a base of hydrologic data for use by agencies engaged in water-resources planning on a national or regional scale. Among the characteristics analyzed were phytoplankton identification and cell counts. Samples consisted of composites of equal aliquots collected at the center of each quartile of flow, using modified suspended-sediment collectors, and sediment collection techniques. Identification and counting were done using the SEDGWICK-RAFTER CELL METHOD. Cell counts ranged from 183 to 2,100 million cells per milliliter at Flathead River at Flathead, British Columbia to 27,000 cells per milliliter at Yellowstone River near Sidney. The class ULCILLARIOPHYCEAE was most abundant in both number and variety at all sampling sites. AHNALDA AND APONIOGONDA OF THE PHYLUM CYANOPHYTA were found at six stations, and two stations respectively. These two genera of blue-green algae often become abundant in enriched waters resulting in nuisance conditions. (Woodard-USGS)

Statistical Analyses of Surface-Water Quality Variables in the Coal Area of Southeastern Montana


Since 1974 a network of water-quality stations has been operated in the coal area of southeastern Montana. This
report updates a previous report with 2 years of additional data collection and presents statistics and regression equations for water-quality variables. The most apparent feature of the study is the variability of water quality. Time-trend differences are most noticeable, with areal differences being present but more subtle. In comparing stations at the mouths of the five major drainages entering the Yellowstone River from the study area, water from the Powder River ranks near the middle of the group in dissolved-solids concentration (mean overall quality) with respect to dissolved constituents; extremes are moderated by mixing in the Tongue River Reservoir. Suspended sediment increase in dissolved-solids concentration from one most-upstream station to the mouth. Ar nell Creek and Sarpy Creeks, smallest of the five drainages, have a pool-riffle configuration that causes both dissolved and suspended constituents. Pools permit greater evaporation, thus increasing dissolved-constituent concentrations. They also act as sediment traps. (USGS)

Water Quality of Selected Streams in the Coal Area of Southeastern Montana

Knapton, J. R.; McKinley, P. W. 


Journal Announcement: SWRA1107

This report summarizes and evaluates water-quality data collected at 35 stream sites in the coal region of southeastern Montana. Sarpy Creek, Ar nell Creek, and Rosebud Creek, sometimes have dissolved-solids concentrations that cause water to be marginal for agricultural purposes. At times of rainfall and snowmelt, the runoff water mixes with the base-flow component to increase overall quality. Water in the Tongue River generally showed a downstream degradation in which some changes were related to lithology of the aquifers contributing water to improve water from Pumpkin Creek and Mizpah Creek is used mostly for cattle watering. To some extent water is used for irrigation although the salinity hazard was often high. The chemical quality of the Powder River changed little during flow downstream. High sediment loads of the river acted as transporting agents for many of the plant nutrients and trace-element constituents. (Woodard-USGS)

Preliminary digital model of ground-water flow in the Madison Group, Powder River Basin and adjacent areas, Wyoming, Montana, South Dakota, North Dakota, and Nebraska

Konikow, L. F. 1976


Geochemistry of water in the Fort Union Formation of the Northern Powder River Basin, Southeastern Montana

Lee, R. W.


Journal Announcement: SWRA1407

Shallow water in the coal-bearing Fort Union Formation of southeastern Montana was investigated to provide a better understanding of the geochemistry. Springs, wells less than 200 feet deep, greater than 200 feet deep, and basins near were observed to have different water qualities. Overall, the ground water exists as two systems: a mosaic of shallow, chemically dynamic, and localized recharge-discharge cells superimposed on a deeper, chemically static regional system. Water chemistry is highly variable in the shallow system, whereas sodium and bicarbonate waters characterize the deeper system. Within the shallow system, springs, and wells less than 200 feet deep show predominantly sodium and sulfate enrichment processes from recharge to discharge. These processes are consistent with the observed aquifer mineralogy and aqueous chemistry. However, intermittent mixing with downward moving recharge waters or upward moving deeper waters, and bacterially catalyzed sulfate reduction, may cause apparent reversals in these processes. (USGS)

Ground-Water-Quality Data from the Northern Powder River Basin, Southeastern Montana

Lee, R. W.


Journal Announcement: SWRA1318

Water-quality data collected during 1973-77 for hydrologic studies in the northern Powder River basin of southeastern Montana provide a data base for shallow ground water. The 665 water samples collected were analyzed for major cations and anions, dissolved oxygen, pH, temperature, and specific conductivity. About 10 percent of the samples were also analyzed for trace constituents and radiochemistry. The majority of analyses were performed by the Montana Bureau of Mines and Geology laboratory in Butte, Montana. The remaining analyses...
The coal fields of parts of Dawson, Rosebud, and Custer Counties, Montana 10 Contributions to economic geology 1966--Part II

Potential effects of Surface Coal Mining on the Hydrology of the Greenleaf-Miller area, Ashland coal fields, southeastern Montana

Levings, Gary W.

U.S. Geological Survey Water-Resources Investigations, 86-4101, 31 P.

The Greenleaf-Miller area of the Ashland coal field contains reserves of Federal coal that have been identified for potential lease sale. A hydrologic study was conducted in the potential lease area in 1981 to describe the existing hydrologic system and to assess potential impacts of surface coal mining on local water resources.

The hydrologic data collected from wells, test holes, and springs were used to identify aquifers in the alluvium (Pleistocene and Holocene age) and Tongue River Member of the Fort Union Formation (Paleocene age). Coal, cinder, and sandstone beds comprise the aquifers in the Tongue River Member. The chemical quality of water from these aquifers is characterized by sulfate as the dominant anion, sodium and magnesium as the dominant cations, and extremely small concentrations of chloride.

Most streams are ephemeral and flow only as a result of precipitation. The only perennial surface-water flow in the study area is a 1-km-long reach downstream from springs.

A mine plan for the area is not available; thus, the location of mine cuts, direction and rate of mine expansion, and duration of mining are unknown. The mining of the Sawyer and Knoblock coal beds of the Tongue River Member would potentially affect groundwater flow in the area. Declines in the potentiometric surface would be caused by dewatering the mine pits intersect the water table, wells and springs would be removed in the mine area. The chemical quality of the ground water may change after moving through the spoils, the change would be an increase in the concentration of dissolved solids. Although mining would alter the existing hydrologic systems and remove several springs and shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining.

Selected Hydrogeologic Data from the Judith Basin, Central Montana


Journal Announcement: SWRA1505

Selected hydrogeologic data from the Judith Basin, central Montana have been compiled for use as the physical basis of a ground-water model prepared as part of a 4-year study of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of Cenozoic and Mesozoic aquifers of the northern Great Plains area of Montana. Records of 1x124 wells and 540 springs are tabulated in the report; most of these
data have been collected since 1959. Lithologic logs of 68 wells are also included. Chemical data for wells and springs include 290 water samples analyzed for major cation and anion concentrations and 282 water samples analyzed for miscellaneous-constituent concentrations. The locations of wells and springs listed in the report are shown on a map at a scale of 1:250,000. (USGS)

Selective Annotated Bibliography of Geology and Groundwater Resources for the Montana Part of the Northern Great Plains Regional Aquifer-System Analysis


Journal Announcement: SWRA1420

Increasing demand for water to meet needs for energy, industry, irrigation, domestic, and municipal uses has resulted in a study of the geology and hydrology of rocks of Mesozoic and Cenozoic age. This report presents the results of a literature search for the part of the study area in Montana. It consists of an annotated listing of pertinent published reports, a partial subject and area index of the reports, and a correlation chart of geologic and aquifer units listed in the annotations. (USGS)

Geology and Water-Yielding Characteristics of Rocks of the Northern Powder River Basin, Southeastern Montana

Levis, Barne N., and Robert S., Robert S.


Suspended-sediment data collected from October 1974 through September 1979 at 44 stations in the Powder River drainage area of southeastern Montana were statistically summarized to define sediment relationships between stations and basins and to identify environmental factors that are important in determining sediment yield. Sediment-transport curves were developed for 30 of these stations. Mean-annual suspended-sediment discharges were determined at 15 stations using the flow-duration sediment-discharge method. Sediment-discharge curves were calculated within 20 percent at three stations where alternative satellite data could be used. Mean sediment discharges ranged from 770 to 5,470,000 tons per year. Mean sediment yields ranged from 0.09 to 0.67 tons per square mile per year and were

somewhat less than yields predicted by the Lungbein-Schum precipitation-sediment-yield relation. Low delivery ratios for small drainage areas indicate that streams may be aggrading. Geographic variations in sediment yield are attributed to precipitation and geology.

Use of Geophysical Logs to Estimate Water-Quality Trends in Carbonate Aquifers

MacCary, L. M.


Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221424. Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-57, 1980. 23 p., 5 Fig. 2 Tab. 18 Ref.

Journal Announcement: SWRA1407

The water quality in carbonate aquifers can be determined by analysis of resistivity and porosity logs. When supporting data from water analyses are available, the value of the cementation exponent can be determined more precisely. Data for this study were taken from logs of oil-test wells. Amstrat sample studies, drill-stem tests and water test wells in parts of Montana, North and South Dakota, and Wyoming. The preferred resistivity curves for apparent water-resistivity (Sw) analyses are the deeply focused laterolog and the induction log. The standard electric log can be used if the drilling mud is not saturated with salt. The preferred porosity logs are the sonic, sidewall neutron, compensated neutron, and the density logs. Older, uncalibrated neutron curves can be empirically calibrated in some instances, however, resulting porosities are frequently ambiguous when compared to core or modern logs. When apparent water resistivity is determined for many wells, the data can be plotted and contoured to outline areas of recharge, direction of probable ground-water movement, and location and salinity of brine areas. (USGS)

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana

McClymonts, N. E.


Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124850. Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-37, March 1982. 64 p., 15 Fig. 2 Tab. 18 Ref.

Journal Announcement: SWRA1403

The Prairie Dog Creek drainage basin in southeastern Montana was investigated during 1978-79 to establish a basic understanding of its surface-water and ground-water resources and to determine the quality of water in areas having coal-mining potential. The principal minable coal is the 40-to 60-foot-thick Wall and lower Wall coal beds near the middle
part of the Tongue River Member of the Fort Union Formation (Paleocene age), Prairie Dog Creek, which originates from springs and seeps from coal and sandstone layers, maintained perennial flow and its upstream and middle reaches when not in flood until the channel near its mouth had only standing water or was dry. The dissolved-solids concentration of streamwater during periods of lesser flow (1 cubic foot per second) ranged from 700 to about 1,900 milligrams per liter and during periods of flow ranging from about 1,300 to 1,600 milligrams per liter. Relatively clean sandstone aquifers that transmissivities of about 15 feet squared per day and water of the magnesium sulfate or sodium sulfate type, with dissolved-solids concentrations ranging from about 2,000 to 4,100 milligrams per liter, the water was of a different type, sodium bicarbonate. It also contained large concentrations of sulfate (more than 10 milligrams per liter) and had a very high sodium-adsorption ratio (more than 60). (USGS)

Potential effects of surface coal mining on the hydrology of the Coral Creek area, Hanging Woman Creek coal field, southeastern Montana, (in review).


Potential effects of surface coal mining on the hydrology of the west Otter Creek coal area, southeastern Montana, (in preparation).


Water Quality of Selected Streams in the Coal Areas of East-Central Montana


In October 1975, the U.S. Geological Survey established a network of nine data-collection stations on eight streams in Montana to monitor water quality in potential coal-mining areas. The report summarizes and evaluates the water-quality data that have been collected during the first 2 years (3 years for 1 station) of network operation. Big Dry Creek, Little Dry Creek, Timber Creek, and Nelson Creek are the principal streams forming the Bik Dry Creek basin, which is tributary to the Missouri River. These streams all contain water of the sodium sulfate type. Concentrations were high for elements, Prairie Elk Creek, Sand Creek, and the Redwater River flow directly into the Missouri River. Prairie Elk and Sand Creeks have mainly spring water, whereas the Redwater River is predominately sodium sulfate water. All three streams contained water of high and trace-element concentrations. Burns Creek is tributary to the Yellowstone River. The water type is generally sodium sulfate during the spring and summer, and sodium bicarbonate during the fall and winter. Water in Carbonate Rocks of the Madison Group in Southeastern Montana, A Preliminary Evaluation


Yields from wells in carbonate rocks of the Madison Group in southeastern Montana range from about 50 gpm (gallons per minute) at several places to 1,400 gpm from a flowing well on the north side of the Porcupine dome. Yields estimated or reported from drill-stem tests range from about 1 to 157 gpm. Dissolved solids in water from the study area range from less than 50 percent of the dissolved constituents in the Missou River basin, sodium, potassium, and chloride ions constitute more than 5 percent of the dissolved constituents in the Williston basin, sodium, potassium, and chloride ions constitute more than 75 percent of the total. Water Resources of the Central Powder River Area of Southeastern Montana


Water for domestic, stock, and public use is available from the Fox Hills-Lower Hell Creek aquifer of Late Cretaceous age. Water for irrigation can be obtained from alluvium of Holocene and Pleistocene age along the Powder River. The Fox Hills-Lower Hell Creek aquifer yields as much as 188 gallons per minute to wells as deep as 199 feet, but most well yields are 20 gallons per minute or less. The upper part of the Hell Creek Formation yields as much as 12 gallons per minute to wells as deep as 605
the program has
Montana

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| feet. The lower part of the Fort Union Formation yields a maximum of 25 gallons per minute to wells as deep as 573 feet. The alluvium of the Powder River yields 601 gallons per minute to the only known irrigation well, which is 40 feet deep.

Water from the Fox Hills-Lower Hell Creek aquifer generally contains sodium and bicarbonate, or sulfate as the major ions; dissolved-solids concentration is as much as 1,000 milligrams per liter. Sodium, bicarbonate, and sulfate were the major ions in two samples from the upper part of the Hell Creek Formation; the dissolved-solids concentration was 440 milligrams per liter in each sample. Water from the Fort Union Formation contains principally sodium, sulfate, and bicarbonate ions; the dissolved solids concentration ranges from 780 to 2,300 milligrams per liter.

The Powder River is the only perennial stream in the study area. The average annual discharge of the Powder River near Locate for the period of record, 1938-69, was 601 cubic feet per second. Instantaneous discharge ranged from 0 to 31,000 cubic feet per second. Dissolved-solids concentration of water from the Powder River for the period of record, 1949-63, ranged from 278 to 3,430 milligrams per liter. Calcium, sodium, and sulfate were the major ions.


### Annual Peak Discharges from Small Drainage Areas in Montana

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| Stations Discontinued Before 1978
| Olang, R. J.; Hull, J. A.; Parrett, C.

Annual peak discharges from Small Drainage Areas in Montana for stations discontinued before 1978.

### Occurrence of Ground Water in the Judith River Formation, North-Central Montana


A 1:62,500 HYDROLOGIC ATLAS DESCRIBES THE OCCURRENCE OF GROUNDWATER IN THE CRETACEOUS JUDITH RIVER FORMATION, NORTH-CENTRAL MONTANA, A GEOHYDROLOGIC MAP SHOWS GEOLOGY, GEOLOGIC STRUCTURE CONTOURS, LOCATIONS OF LISTED WELLS, POTENTIOMETRIC SURFACE CONTOURS, AND AREAS OF FLOWING WELLS. CHEMICAL ANALYSES OF 4 REPRESENTATIVE WELLS ARE LISTED, A LIST OF 114 WELLS INVENTORIED FOR THE STUDY INCLUDES LOCATION, OBSERVED WATER QUALITY, STATIC WATER LEVEL, SHUT-IN PRESSURE OF FLOWING WELLS, ALTITUDE OF POTENTIOMETRIC SURFACE, ALTITUDE OF THE TOP OF THE JUDITH RIVER FORMATION, WATER TEMPERATURE, SPECIFIC CONDUCTIVITY, AND USE. GEOLOGIC CROSS SECTIONS SHOW STRATIGRAPHIC AND POTENTIOMETRIC RELATIONS. A GEOLOGIC COLUMN SHOWS CRETACEOUS MONTANA GROUP STRATIGRAPHY, LITHOLOGY, TOPOGRAPHY AND GEOLOGIC SETTING, AND HYDROLOGY. THE JUDITH RIVER FORMATION IS CONFINED ABOVE AND BELOW BY SHALES. IT YIELDS 1 GPM PER 10 FT OF DRAWDOWN TO WELLS; PROBABLY THE HIGHEST WATER LEVEL TO BE EXPRESSED IN A 6-INCH WELL IS LESS THAN 200 GPM. FEW WELLS FLOW OVER 10 GPM. SODIUM, SULFATE, BICARBONATE, AND TOTAL DISSOLVED SOLIDS CONCENTRATIONS ARE HIGH. (KNAPP-USGS)


This report describes the coal resources of a 900 square mile area. It includes a description of the geologic structure and stratigraphy and a township-by-township description of the occurrence of coal. Two hundred seventy-six coal sections were measured, and generalized geologic sections show the relative position of the coal beds with respect to one another. The geologic map at a scale of 1:62,500 shows outcrops of coal beds, burned areas, and sites of measured coal sections.
The Mizpah coal field, Custer County, Montana
Pierce, W. G., 1936

This report contains a geologic map and three geologic sections at a scale of about 1:62,500 of the Fort Union and Hell Creek Formations, whose boundaries have since been revised. Shown on the map are the outcrop and burned area for 24 coal beds. Also included are analyses of seven coal samples and a correlation chart for the coal beds with those in adjacent fields. The text discusses the stratigraphy of the map units and characteristics of the coal beds. A township-by-township description of coal sections is accompanied by more than 1,500 graphic coal sections.

The Rosebud coal field, Rosebud and Custer Counties, Montana
Pierce, W. G., 1936

This report describes the coal resources for a 1,050 square mile area. It includes a description of the stratigraphy of the Tongue River Member of the Fort Union Formation. The township-by-township description of the occurrence of coal in 700 measured sections and the physical and chemical properties of 5 coal samples. The geologic map at a scale of 1:62,500 shows the outcrops of coal beds, burned areas, and sites of charged coal sections. Two generalized sections show the relative position of the coal beds with respect to one another.

Proposed 20-year plan of mining and reclamation, Westmoreland Resources Tract III, Crow Indian ceded area, Montana

Geology and ground-water resources of central and southern Rosebud County, Montana, with chemical analyses of the waters by H. G. Rifenburg and H. L., 1929

In the northwest corner of the area covered by this report the Claggett, Judith River, and Bearpaw Formations of the Montana group (Upper Cretaceous) named in ascending order, crop out. These formations are about 450-300 and 950 feet thick, respectively. The Bearpaw Shale is overlain without observable stratigraphic hiatus by the fresh-water Lance Formation (Tertiary) age, which has a total thickness of about 925 feet. In the upper part of the Lance Formation there are thin unworkable coal beds. Overlying the Lance is the Fort Union Formation (Tertiary), which consists of the dark-colored Lebo Shale member at the base (100 to 100 feet thick) and a younger light-colored member known as the Tongue River member (1,460 feet thick) which alternates of alternating beds of limestone, shale, and coal. Many of these beds of coal are workable. In most of central and southern Rosebud County either the Lance formation or the Fort Union lies at the surface. Terrace gravel of Tertiary and Pleistocene age is present on many of the higher hills. Adjacent to the streams, especially the larger ones, there are belts of alluvium consisting of gravels, sands, and clay, which are derived from the consolidated rocks and from the terrace gravel.

The most pronounced structural feature in this region is the Porcupine dome which is a discordant dome of the southwestern nose of the northwest corner of the area shown on the map. There are minor faults on the flanks of the dome. South of the Porcupine dome is a southeast prolongation of the Bull Mountain syncline. Along the axis of the syncline in the vicinity of Hopsonville there are faults of slight displacement. It is probable that the faulting was coincident with the deformation that resulted in the uplift of the Porcupine dome.

The chief water-bearing formations in this area are the sandstone and coal beds of the Lance formation and the sandstone, coal, and clinker beds of the Fort Union formation. A supply of water can generally be had where the Lance and Fort Union formations are thick enough to extend below the water table. In the Lance and Fort Union formations, water is generally supplied from the underlying Cretaceous formations water from shallow depths (that is, less than perhaps 125 feet) contains considerable calcium and magnesium; therefore, water from these depths contains only small amounts of calcium and magnesium and is therefore soft. This natural softening with increase in depth is due to the ursat that waters downward and moves laterally, the silicate minerals in the rocks exchange their sodium for the calcium and magnesium in the water. The salt water from the Lance and Fort Union formations, which is a sodium bicarbonate water, is generally satisfactory for domestic purposes, although in many places not entirely satisfactory for cooking; but it foams when used in boilers and is unfit for irrigation, as it produces a hard crust of black alkali on the surface of the land. The hard water from shallow depths in the areas of Lance and Fort Union domestic purposes, but it contains a considerable amount of scale-forming constituents.

The Colorado, Claggett, Judith River, and Bearpaw formations consist chiefly of highly mineralized shales that yield either no water or only very meager supplies of poor water. The Judith River formation contains some beds of water-bearing sandstone, whereas the Bearpaw formation contains unworkable beds of thin gravel, and the lower member of the Judith River or Bearpaw formations they yield water of good quality which is satisfactory for domestic use, for stock, and for irrigation. Such water generally contains less dissolved
mineral matter than the water in the Lance and Fort Union formations. The Kootenai (?), which is highly mineralized and generally unsatisfactory for all uses, is less mineralized and generally unsatisfactory for all uses.

In much of the area where the Pleistocene and older terrace gravels are present, it is of sufficient thickness to extend below the water table and will yield considerable supplies of water. This water contains less dissolved mineral matter than the water from any other formation in the region and is satisfactory for domestic use, stock, and irrigation, but is somewhat hard and contains an appreciable amount of scale-forming ingredients. The alluvium along the Yellowstone River, the Tongue River, and the other streams in the region of Lance and Fort Union rocks yields hard water to shallow dug or bored wells. Such water is generally satisfactory for stock, for drinking, and for irrigation but is rather hard for domestic use and is generally unsatisfactory for industrial uses because of the relatively large amount of scale-forming constituents that it contains.

Flowing artesian wells along the flood plain of the Yellowstone River in the eastern part of the area derive their water from the Lance formation; those along the flood plain of the Tongue River in the vicinity of Ashland and Birney derive their water from the Fort Union formation. The water from all the artesian wells in both areas is soft. It is probable that flowing wells may be obtained by drilling into the Tongue River member at some places along the flood plain of the Tongue River between Ashland and Birney but it is not feasible to predict exactly where such wells may be obtained.

Many of the flowing wells along the Yellowstone and Tongue Rivers yield a high concentration of carbonates, mostly methane, derived from the coal and carbonaceous material of the Lance and Fort Union formations. In places there is evidence that the methane reduces the sulphate in the ground water, with the resulting formation of hydrogen sulphide and carbonate or bicarbonate.

Hydrogeologic Data for Selected Coal Areas, East-Central Montana


Hydrogeologic data were collected in selected coal areas of eastern-central Montana to provide a basis for evaluating the effects of future coal development on the groundwater resources. Inventory records for 916 domestic stock, public supply, and test wells are tabulated in the report. The data were collected principally from 1975 through 1976.

Locations of the wells are shown on a map at a scale of 1:250,000. Lithologic logs are also included for 149 wells. Chemical analyses of water samples from selected wells consist of 167 samples analyzed for major cations and anions and 24 samples analyzed for miscellaneous constituents. (USGS)

Ground-water resources and potential effects of coal strip mining in the northern Powder River Basin, southeastern Montana


Hydrology of Area 49, Northern Great Plains and Rocky Mountain coal provinces, Montana and Wyoming


Coal geology of the Girard area, Richland and Roosevelt Counties, Montana

Spencer, J. M., 1980


The Sidney lignite field, Dawson County, Montana


Hydrogeology of the Fort Union coal region, eastern Montana

Stoner, J. D., and Lewis, B. D., 1980


This report consists of a hydrogeologic map at a scale of 1:500,000 showing the configuration of the top of the Beartooth confining layer, a regional-scale map showing the structural features of eastern Montana, three geologic sections, a table describing the stratigraphy and water-yielding characteristics of the map units from the Beartooth confining layer through the alluvial aquifer, and representative electric logs correlating geologic and hydrogeologic units.
Geology and ground-water resources of the Missouri River valley in northeastern Montana, with a section on the quality of the ground water by W. H. Duram

Swenson, F. A., 1935


Possible development of water from Madison group and associated rock in Powder River basin, Montana-Wyoming

Swenson, F. A.

Geological Survey, Denver, Colo.

Report to the Northern Great Plains Resources Program, July 1, 1974.

6 p., 4 plate.

Journal Announcement: SWA9080

The potential for developing large ground-water supplies for industrial use in the Powder River basin of Wyoming and Montana is summarized. Records of many oil tests and several water tests indicate that the Madison group and the underlying carbonate rocks are hydrologically connected and transmit water as a unit. Also, in many localities, the overlying tennsleap and Minnelusa sandstones are also connected with the Madison. These rocks underlie the entire basin and are exposed on the flanks of the surrounding mountains. The Madison rocks, and to a considerable extent the underlying carbonates, are fractured and cavernous. Large quantities of water have been derived from these rocks in the middle-Wyoming area since 1917. The Madison and underlying carbonates contain water of moderate-to-good quality that is probably suitable for industrial use. It contains too high a percentage of sodium for irrigation use.

(Knap-USSG)

Potential of Madison group and associated rocks to supply industrial water needs, Powder River basin, Wyoming and Montana.

(Duplicated see Wyoming)

Swenson, F. A.

Geological Survey, Denver, Colo.


5 fig., 4 ref.

Journal Announcement: SWA9002

Ground water resources of the northern Powder River valley, southeastern Montana

Taylor, James O.


Journal Announcement: SWA9003

The domestic, stock, industrial, and municipal water supplies of the northern Powder River valley depend on ground water from the aquifers in the late cretaceous Fox Hills sandstone and Hell Creek formation, the Paleocene Fort Union formation, and Pleistocene to recent terrace deposits. The middle Cretaceous Fox Hills sandstone is continuous and dependable aquifer is the Fox Hillsbasal Hell Creek artesian aquifer which averages 250 ft in thickness, has a measured transmissivity of about 720 gpd per ft, and about 0.0026 hydraulic conductivity. The recharge area is in the southeastern Montana, and water moves northwest to discharge into the Yellowstone River valley by leakage through overlying confining beds. The artesian aquifers in the Fort Union formation are discontinuous and are recharged at various places, but the direction of movement is also northwest to discharge through springs. Dissolved solids content in the groundwater is less than 1,000 ppm. Water in the Fox Hills and Hell Creek formation is soft; water from the higher formations is hard. Dissolved gas, mostly nitrogen, is found in the Fox Hills-Hell Creek aquifer. In general, the water is satisfactory for domestic and stock use but unsatisfactory for irrigation. Supplies are adequate for present and projected future use.

(Knap-USSG)

Geology of Big Horn County and the Crow Indian Reservation with special reference to the water, coal, oil, and gas resources.


Geology and ground-water resources of the lower Yellowstone River valley in the vicinity between Glendive and Sidney, Montana, with a section on chemical quality of the water by H. A. Swenson


This report contains a geologic map at a scale of about 1:27,000 and a table describing the stratigraphy and the water-bearing characteristics of the Fox Hills sandstone, the Hell Creek and Fort Union formations, and the Quaternary deposits. Except for a short discussion of geology, the text primarily describes the hydrology and chemical quality of ground and surface waters.

Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive, Montana, with a section on the chemical quality of the water by H. A. Swenson

Torrey, A. E., and Swenson, F. A., 1951


This report describes the geology and hydrology of exposed bedrock and alluvial deposits in the Yellowstone River valley. The text contains a description and a generalized section of the lithology and water-bearing properties of the Pierre Shale through the Fort Union formation and alluvial deposits. Included
is a geologic map of the Yellowstone River valley at a scale of 1:63,360.

PROSPECTS FOR DEVELOPING STOCK-WATER SUPPLIES FROM WELLS IN NORTHEASTERN GARFIELD COUNTY, MONTANA


AVAILABLE FROM SUP DOC, GPO, WASH, D. C. 20402 . PRICE 75 CENTS. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1977-F, 1971. 38 P, 6 FIG, 1 PLATE, 7 TAB, 14 REF.

Journal Announcement: SWR40424

PRACTICAL AND RELIABLE SOURCE OF LIVESTOCK WATER EXISTS ON BOTH PUBLIC AND PRIVATELY OWNED GRAZING LAND IN NORTHEASTERN GARFIELD COUNTY, MONTANA. THIS COMPRISES AN AREA OF SOME 1,200 SQUARE MILES. THE PRINCIPAL BEDROCK AQUIFER IS THE FOX HILLS SANDSTONE FORMATION OF UPPER CRETACEOUS AGE. IT IS EXPOSED ON THE SURFACE IN THE NORTHERN AND NORTHEASTERLY PART OF THE COUNTY PENETRATING THIS AQUIFER REACH WATER AT ABOUT 200 FEET. AMPLE WATER IS AVAILABLE FOR LIVESTOCK USE FROM WELLS DRILLED IN THIS AQUIFER. MOST OF THESE WELLS REACH THE AQUIFER AT 150 FEET. UNDERFLOW IN ALLUVIAL DEPOSITS ALONG THE LARGER STREAM VALLEYS IS ANOTHER SOURCE OF LIVESTOCK WATER. CHEMICAL ANALYSIS OF SAMPLES COLLECTED AT 63 WELLS AND 3 SPRINGS SHOW THE WATER QUALITY TO BE GENERALLY POOR. WATER FROM THE FOX HILLS AQUIFER AND OTHERS ASSOCIATED WITH IT CONTAINS 550-5, 340 MILLIGRAMS PER LITER OF TOTAL DISSOLVED SOLIDS. THE PRINCIPAL CONSTITUENTS ARE SODIUM, BICARBONATE, AND SULFATE. ALL WATER SUPPLIES TESTED WERE SUITABLE FOR LIVESTOCK USE. (GLASBY-USGS)

Bibliography of Geology and Ground-water Resources for the Montana Part of the Northern Great Plains Regional Aquifer-System Analysis.

Striping coal deposits of the northern Great Plains, Montana, Wyoming, North Dakota, and South Dakota

U.S. Geological Survey, 1974


Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming

U.S. Geological Survey, 1975


This report summarizes the present (1975) knowledge of the geohydrology of the Madison and associated rocks, identifies the need for additional data, and outlines a 5-year plan for a comprehensive study of the hydrology of these rocks.

Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell and Sheridan counties, Wyoming; Custer, Prarie s, and Garfield counties, Montana; and Mercer county, North Dakota


Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell, Converse, and Sheridan counties, Wyoming; and Big Horn, Richland, and Dawson counties, Montana


Preliminary report on 1976 drilling of coals in Campbell and Sheridan counties, Wyoming; and Big Horn, Dawson, McCones, Richland, Roosevelt, Rosebud, Sheridan, and Wibaux counties, Montana


Geophysical logs for Powder River and Dawson counties, Montana; Chapter C Preliminary report of 1977 coal drilling in eastern Montana and northeastern Wyoming


Geophysical logs for Dawson, Garfield, McCones, and Prairie counties, Montana; chapter D Preliminary report of 1977 coal drilling in eastern Montana and northeastern Wyoming


Geophysical logs for Dawson, McCones, Richland, and Rosebud counties, Montana; chapter F Preliminary report of 1977 coal drilling in eastern Montana and northeastern Wyoming


Shallow ground water in selected areas in the Fort Union Coal region

U.S. Geological Survey, 1974


Ground Water of the Fort Union Coal Region, Eastern Montana


Journal Announcement: SWA0120

The hydrologic findings of numerous studies recently completed or currently underway by the Montana Bureau of Mines and Geology and the U.S. Geological Survey are described. Pertinent facts are given on the occurrence, movement, and quality of ground water in the Fort Union Coal Region of Montana. The present development, effects of seismic shot holes on ground water systems, and effects of strip mining on shallow ground-water systems are described also. The primary purpose of the report is to provide basic factual material on ground-water conditions to assist nontechnical readers in understanding the complex ground-water problems existing in eastern Montana. (Woodard-USGS)

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PART 6, MISSOURI RIVER BASIN

Geological Survey, Reston, VA.


Journal Announcement: SWA0824

The geological survey maintained 258 stations on 123 streams in the Missouri River basin for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 226 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 35 and daily at 67 stations. Daily water temperatures were measured at all of the stations at the time samples were collected for chemical or sediment content. So far as practicable, the water temperatures were taken at about the same time each day. Quantities of suspended sediment are reported for 40 stations during the year ending September 30, 1969. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Particle-size distributions of sediments were determined at 44 stations. The stream discharge reported for a composite sample is usually the average of daily mean discharges for the composite period. The discharges reported in the tables of single analyses are either daily mean discharges or discharges obtained at the time samples were collected and computed from a stage-discharge relation or from a discharge measurement. (Woodard-USGS)

MONTANA MONTANA

DISCHARGE MEASUREMENT. (WOODARD-USGS)

QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1969; PART 6, MISSOURI RIVER BASIN

Geological Survey, Reston, VA.

Water-Supply Paper 2145, 1974, 441 p., 1 fig., 40 ref.

Journal Announcement: SWA0823

During the water year ending September 30, 1969, the geological survey maintained 212 stations on 110 streams for the study of chemical and physical characteristics of surface water in the Missouri River basin. Samples were collected daily and monthly at 172 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 35 and daily at 77 stations. Daily water temperatures were measured at most of the stations at the time samples were collected for chemical quality or sediment content, so far as practicable. The water temperatures were taken at about the same time each day. Quantities of suspended sediment are reported for 40 stations during the year ending September 30, 1969, sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream, particle-size distributions of sediments were determined at 44 stations. The stream discharge reported for a composite sample is usually the average of daily mean discharges for the composite period. The discharges reported in the tables of single analyses are either daily mean discharges or discharges obtained at the time samples were collected and computed from a stage-discharge relation or from a discharge measurement. (Woodard-USGS)

Water Resources Data for Montana. Published annually since 1975.


Water resources data for Montana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. Available water data were collected at various sites, as part of the systematic data-collection programs, and are published as miscellaneous measurements. These data represent that part of the National Water-Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (USGS)

Water Resources Investigations of the U.S. Geological Survey
in Montana published annually since 1975.


Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225.

These reports describe the investigative efforts of the U.S. Geological Survey toward the water resources of Montana, hydrologic information and knowledge of the water resources are gained and disseminated principally by programs of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies. (USGS)

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76

GEOLoGICAL SURVEY, HELENA, MONT.

OPEN-FILE REPORT: JANUARY 1976, 29 P., 10 FIG., JOURNAL ANNOUNCEMENT: SWRA0912

This report presents the water data-collection program and interpretive hydrologic investigations that are being conducted by the U.S. Geological Survey in the northern great plains region of eastern Montana. The area is of intense interest for coal-commercial utilities, state and federal agencies, universities, private citizens, landowners, and environmental groups. In October 1975 there were 45 streamflow and 64 water-quality data-collection stations in the region for collection of streamflow, chemical-quality, sediment, and temperature data. These stations are located on all types of streams from the mainstem Yellowstone and Missouri rivers to small ephemeral and intermittent streams that drain proposed mine areas. Groundwater investigations are being conducted to determine the area's hydrology of the Madison Group and associated Paleozoic rocks and the areal and site hydrology of shallow aquifers in the Fort Union formation, including the coal beds. Available data, mostly from oil tests, indicate that the Madison may yield water suitable for use in energy development in the northern great plains coal region. Fieldwork in the shallow groundwater study consists principally of an inventory of wells and springs and construction of wells for water sampling, aquifer testing, and water-level measurements. A computer model is being constructed to determine the effect on stream temperature of selected increases in withdrawal rates, and thus reduced flow, of the Yellowstone River from Billings to Sidney, Mont. (WOODARD-USGS)

Preliminary study of the coal deposits in the Circle area, Mccone, Dawson, and Garfield Counties, Montana

Wincentzen, Herbert, 1978


Coal geology of the northeast Circle area, Mccone and Dawson Counties, Montana

Wincentzen, Herbert, 1979


Documentation of a dissolved-solids model of the Tongue River, Southeastern Montana

Woods, P. F., 1981a


The model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations. The model allows spatial and temporal simulation of streamflow and dissolved-solids loads and concentrations under user-defined scenarios of surface coal mining and agricultural development. The model specifically addresses the Tongue River from the Tongue River Dam to Miles City, Mont., and its three major tributaries, Hanging Woman, Otter, and Pumpkin Creeks.

The model routes an input quantity of streamflow and dissolved solids from the upstream end to the downstream end of a stream reach while algebraically accounting for gains and losses of streamflow and dissolved solids within the stream reach. Input data needed to operate the model include the following: simulation number, designation of hydrologic conditions for each simulated month, elevation, user-defined, regression-defined concentrations of dissolved solids input by the Tongue River, reservoir, number of irrigated acres, number of mined acres, dissolved-solids concentration of mine leachates, and quantity of other water losses.

The computer program is written in FORTRAN language. A listing of the computer program, definitions of all variables in the model, and an example output will permit use of the model by interested persons.

Modeled impacts of surface coal mining on dissolved solids in the Tongue River, southeastern Montana

Woods, P. F., 1981b


A computer model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations in southeastern Montana. The model allows...
These reports describe the investigative efforts of the U.S. Geological Survey toward the water resources of Montana. Hydrologic information and knowledge of the water resources are gained and disseminated principally by programs of (1) collecting hydrologic data on a continuing basis, (2) conducting water-resources appraisals of surface and ground water, (3) conducting supportive research in hydrology and related fields, (4) disseminating water data and results of investigations to the public, (5) coordinating acquisition of water data by Federal agencies, and (6) providing technical assistance in hydrologic fields to other government agencies. (USGS)


THIS REPORT PRESENTS THE WATER DATA-COLLECTION PROGRAM AND INTERPRETIVE HYDROLOGIC INVESTIGATIONS THAT ARE BEING CONDUCTED BY THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS REGION OF EASTERN MONTANA. THE AREA IS OF INTENSE INTEREST FOR COAL-RELATED POTENTIALITIES, SURFACE MINING, LAND-USE DEVELOPMENT, AND ENVIRONMENTAL GROUPS.

IN OCTOBER 1975 THERE WERE 45 STREAMFLOW AND 64 WATER-QUAlITY DATA-COLLECTION STATIONS IN THE REGION FOR COLLECTION OF STREAMFLOW, CHEMICAL-QUALITY, TEMPERATURE, AND CONCENTRATION DATA. THESE STATIONS ARE LOCATED ON ALL TYPES OF STREAMS FROM THE MAINSTER YELLOWSTONE AND MISSOURI RIVERS TO SMALL Ephemeral AND Intermittent STREAMS THAT DRAIN PROPOSED MINING AREAS. GROUNDWATER INVESTIGATIONS ARE BEING CONDUCTED TO DETERMINE THE AREAL HYDROLOGY OF THE MADISON GROUP AND ASSOCIATED ALLUVIAL ROCKS AND THE AREAL AND SITE HYDROLOGY OF SHALLOW AQUIFERS IN THE FORT UNION FORMATION, INCLUDING THE COAL BEDS. AVAILABLE DATA, MOSTLY FROM OIL TESTS, INDICATE THAT THE MADISON MAY BE FIELD WATER SUITABLE FOR USE IN ENERGY DEVELOPMENT IN THE NORTHERN GREAT PLAINS COAL REGION. FIELDXORK IN THE SHALLOW GROUNDWATER STUDY CONSISTS PRINCIPALLY OF AN INVENTORY OF WELLS AND SPRINGS AND CONSTRUCTION OF WELLS FOR WATER SAMPLING, AQUIFER TESTING, AND WATER-LEVEL MEASUREMENTS. A COMPUTER MODEL IS BEING CONSTRUCTED TO DETERMINE THE EFFECT ON STREAM TEMPERATURE OF SELECTED INCREASES IN WITHDRAWAL RATES, AND TO REDUCE FLOW, OF THE YELLOWSTONE RIVER FROM BILLINGS TO SIDNEY, MT. (WOODARD-USGS)


A computer model has been developed for assessing potential increases in dissolved solids of streams as a result of leaching of overburden materials used to backfill pits in surface coal-mining operations. The model allows spatial and temporal simulation of streamflow and dissolved-solids loads and concentrations under user-defined scenarios of surface coal mining and agricultural development. The model specifically addresses the Tongue River from the Tongue River Dam to Miles City, Montana, and its three major tributaries, Hanging Woman, Otter, and Pumpkin Creeks.

The model routes an input quantity of streamflow and dissolved solids from the upstream end to the downstream end of a stream reach while algebraically accounting for gains and losses of streamflow and dissolved solids within the stream reach. Input data needed to operate the model include the following: simulation number, designation of hydrologic conditions for each simulated month, either user-defined or regression-defined concentrations of dissolved solids input by the Tongue River Reservoir, number of irrigated acres, number of mixed acres, dissolved-solids concentration of mine leachates, and quantity of other water losses.

The computer program is written in FORTRAN language. A listing of the computer program definitions of all variables in the model, and an example output will permit use of the model by interested persons.

spatial and temporal simulation of streamflow and dissolved-solids loads and concentrations for user-defined plans of surface coal mining and agricultural development. The model specifically addresses the Tongue River from the Tongue River Dam to Miles City, Montana, and its three major tributaries, Hanging woman, Otter, and Pumpkin Creeks. Provision is made to simulate releases from the present Tongue River Reservoir or the increased releases expected from a larger dam and reservoir proposed as a replacement for the present Tongue River Reservoir.

The model routes an input quantity of streamflow and dissolved solids from the upstream end to the downstream end of a stream reach while algebraically accounting for gains and losses of streamflow and dissolved solids within the stream reach. Data used in the computational routines of the model are evaluated in terms of the model's predictive capability.

A hypothetical plan was formulated for the mining of all Federally owned coal beds and all, judged potentially available for mining. Under this plan, a simulation using mean streamflow from the present Tongue River Reservoir indicates that the mean annual dissolved-solids concentration of 666 milligrams per liter with no mining is increased by mining to 677 milligrams per liter. When the proposed Tongue River Reservoir is used in the simulation, the shift in dissolved-solids concentration is from 636 to 451 milligrams per liter, which is illustrative of the dilutional effect of increased streamflow on concentration.

Calculations were performed with data representative of the study area to determine the relative impacts of irrigation and surface coal mining on unit area basis in a hypothetical stream. The dissolved-solids concentration of the hypothetical stream was determined to increase annually by 2.94 percent as a result of withdrawal and return flow of irrigation water and by 0.22 percent as a result of leachates from surface coal mines.

The computer program is written in FORTRAN language. A listing of the computer program, input data requirements, definitions of all variables in the model, and an example output will permit use of the model by interested persons. Input data needed to operate the model include the following: Simulation number, hydrologic conditions for each simulated month, designation of present or proposed Tongue River Reservoir, either user-defined or regression-defined concentrations of dissolved-solids input by the Tongue River Reservoir, number of irrigated acres, number of mined acres, dissolved-solids concentration of mine leachates, and quantity of other water losses.

Bear Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the West Moorehead Coal Field, southeastern Montana
BLM, Denver, Colorado
EMRIA Rep. No. 8-77

The 3,200-acre Bear Creek site is above the northern Powder River Basin where the strata dip southwardly less than 3 degrees. Nearly 166 million tons of coal are in the Anderson, Dietz and Canyon coal beds, 90 percent of which are more than 10 feet thick, and are covered by less than 200 feet of overburden. The site is mostly gently sloping valley floors merging laterally into steep, semi-badlands and irregular remnants capped by sandstone. The semiarid (precipitation less than 15 inches per year) site is mostly drained by Bear Creek and partly by Vance Creek, both intermittent. Stream dissolved solids ranged from 140 (at 53 cubic feet per second of snowmelt runoff) to 2,330 milligrams per liter at near-low flow. Solids dissolved in alluvial water (5 gallons per minute from one of the test holes) ranged from 2,720 to 5,040 milligrams per liter. Water also was found under water-table, semi-confined, and confined conditions in discontinuous sandstones and persistent coal layers. Yields are small, less than 3 gallons per minute, and dissolved solids ranged from 1,110 to 4,760 milligrams per liter. The site is a recharge area and large yields should not be expected from these aquifers. Madison Group aquifers 10,000 feet below the site have produced more than 1,000 gallons per minute from a single well nearby. Surface mining would dewater the shallow aquifers, reducing stream flow and affecting fish and one domestic well. Replacement wells and discharge of mine water would mitigate these impacts.

Hanging Woman Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Hanging Woman Creek Coal Field, south-central Montana
BLM, Denver, Colorado
EMRIA Report No. 12-77

The 34.3 square-mile Hanging Woman Creek study area is coincident with the elongate drainage basin of East Trail Creek. Relief is as much as 600 feet from the alluvium-entrenched creek, up gentle to moderately steep slopes to sandstone-supported flat ridges. Intermittent East Trail Creek slopes to Trail Creek, also intermittent, a tributary to Hanging Woman Creek. Precipitation ranges from about 12 to 19 inches depending on elevation. Most coal is found in two beds of the Fort Union Formation's Tongue River Member. The Anderson coal bed ranges from 26 to 33 feet thick and the Dietz bed, 50 to 100 feet below, is from 9 to 12 feet thick. More than 433 million tons of coal in these two beds underlie less than 200 feet of overburden. Perched and semi-confined aquifers in and above the coal beds yielded as much as 10 gallons per minute during fractional day pump tests. One test of 30 feet of
alluvium produced 18 gallons per minute for more than 9 hours. Dissolved solids in water from wells in bedrock ranged from 438 to 9,460 milligrams per liter and in East Trail Creek alluvium from 1,500 to 4,510 milligrams per liter. Surface mining would drain the shallow aquifers at a diminishing rate beginning at 0.7 cubic feet per second, and dry up 17 stock wells or springs and remove 15 perennial and 4 ephemeral stock ponds. All could be replaced. Water would not be needed for reclamation.

Meridian Coal Exchange, northeastern Montana

BLM, Miles City, Montana

This document assesses relative impacts of surface mining of coal on two tracts involved in an exchange of coal ownership between the Meridian Land and Mineral Company and the Bureau of Land Management. About 856 million tons of stripable coal underlie the 69.5 square miles of both tracts. The lignite coal is in two beds of the Tongue River Member of the Fort Union Formation, part of the Circle West coal deposit. The tracts are drained by tributaries to through-flowing ephemeral creeks. Annual runoff of 0.4 inch ranges from 300 to 7,700 milligrams per liter dissolved solids. The tracts contain 37 small stock ponds, most of which are dry by fall. Small amounts of water containing between 1,000 and 4,000 milligrams per liter of total dissolved solids occur in the coal layers and in sandstone lenses above the coal. One well obtains water from alluvium where water quality ranges from good to poor. No data is provided for the 19 observation and 18 stock wells in the tracts. Nearby wells tap the Cretaceous Fox Hills Formation 1,200 to 1,500 feet below the surface and yield as much as 200 gallons per minute of sodium bicarbonate water ranging from 500 to 2,000 milligrams per liter of total dissolved solids. Mining would remove most existing wells which could be replaced by more productive wells into deeper aquifers. Lowered water levels temporarily could extend as much as three miles downgradient to the north. No significant changes in quantity or quality of surface water are anticipated. Sedimentation ponds could be left to replace destroyed stock ponds. Water requirements could be obtained from Fort Peck Reservoir several miles to the northeast.

Otter Creek Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in the Otter Creek Coal Field, southeastern Montana

BLM, Denver, Colorado

ERHIA Report No. 1-75

The Otter Creek Coal Field underlies a dissected ridge sloping westward to the Otter Creek Valley, and is bounded on the north and south by Home and Threemile Creeks, intermittent tributaries to Otter Creek. Coal occurs chiefly as the 60-foot thick Knoblock bed, in thin beds above, and as the 10-foot thick Flowera-Goodale bed, 120 feet below the Knoblock, all in the Tongue River member of the Eocene age Fort Union Formation. The recoverable resource, the Knoblock coal, is covered by less than 200 feet of overburden, and can be surface-mined. Small quantities of poor quality unconfined water occur in thin sandstone and coal beds above the Knoblock coal. Slightly better quality water occurs in the coal. Yields to wells in these shallow aquifers are generally less than 10 gallons per minute and may not be sustainable for many uses. Confined water occurs about 150 feet below the Knoblock coal, and in various deeper aquifers, including those in the Madison Group, about 8,000 feet below land surface. Potential yields range from low in the shallower confined aquifers, to moderately high (several hundred gallons per minute) in the Madison. Potentiometric heads of deeper aquifers may be about 300 feet above land surface. Water quality is poor, ranging from more than 1,000 to as much as 6,000 milligrams per liter of total dissolved solids. Surface mining would dewater as much as 60 feet of saturated coal, affecting 6 stock wells. Special practices would prevent increased stream sedimentation. Water needed for operation could be obtained from impounded good-quality runoff supplemented by poorer quality ground water.
Montana

West Decker Coal Lease Application, Decker, Montana
BLM, Miles City, Montana
DTEA, 1979

This action would lease to the Decker Coal Company 440 acres of Federal coal, 160 acres of which would be surface-mined as an extension of its existing operations, and would provide access to an additional 11 million tons of coal. The mine is four miles northeast of Decker, Montana, and 21 miles northeast of Sheridan, Wyoming. The lease area consists of steep-sloped ridges adjacent to gentle slopes, draining ephemerally by ditches to intermittent Pond and Pearson Creeks. Annual runoff range is from 0.2 to 0.4 inches. The coal, in the Tongue River Member of the Paleocene Fort Union Formation, is about 52 feet thick, and dips slightly eastward into the Powder River Basin. The coals yield adequate water for domestic and stock use near the area, but no wells exist on the site. Depth to water in an observation well less than one-half mile from the site was 1,818 feet. Dissolved solids in nearby creeks ranged from about 1,200 milligrams per liter at high flow to about 2,500 milligrams per liter at low flow. The proposed mining in the application area would have no erosion or sedimentation impact in addition to that occurring from existing mining operations. Surface water quality should be as good if not better than pre-mined conditions. Occurrence and flow of ground water in the mine spoils would not be significantly different from pre-mined conditions. Spoil water would contain three times the dissolved solids of nearby ground water but would be acceptable for livestock.

Western Energy Coal Lease Modification, southeast Montana
BLM, Miles City, Montana
EA, 1976

This analysis evaluates impacts of allowing surface mining of 320 acres containing 12.6 million tons of recoverable Federal coal that otherwise would be by-passed. The mine area is immediately west of Colstrip and 36 miles south of Forsyth, Montana. The general area includes buttes, mesas, dissected plateaus and long narrow divides. The lease modification area is similar but lacks ridges and buttes, and its relief is only about 200 feet. Runoff from annual precipitation drains through normally dry gullies to East Fork Armello Creek. The recoverable coal, the Rosebud seam in the Tongue River Member of the Paleocene Fort Union Formation, averages 24 feet thick and is covered by less than 150 feet of sandstone, thin shale and coal layers. Little or no water occurs in the Rosebud seam or above. Productive aquifers occur beneath the Rosebud. No wells exist in the lease modification area. Mining of the lease modification area would not significantly increase impacts to water resources.

Nevada

Sierra Pacific Power Company Proposed 500 Megawatt Coal Fired Generating Station, North Valmy, Nevada
BLM, Reno, Nevada
FES, 1978

This statement analyzes the impacts of pumping 7,660 acre feet per year (4,750 gallons per minute) of water from Humbolt River alluvium, which is more than 1350 feet thick in places, for operation of two coal-fired electric generating plants. Sources of the 1.4 million tons per year of coal are existing underground mines in Fishlake National Forest, Sevier County, Utah. Water for the first of two generating units would be from a line of wells extending as much as 15 miles from the plant along the southeast side of the river. Each well is expected to produce 500 to 3,000 gallons per minute. Annual recharge in this area is estimated to be 72,000 acre feet per year. Fresh (total dissolved solids in 5 test holes ranged from 241 to 631 milligrams per liter) water occurs in the upper part of the alluvium and is isolated from the river by layers of silt and clay. The applicant would assume responsibility for mitigating impacts to the two nearby wells at North Valmy. Water for the second unit would be obtained from a well field about 10 miles east of the plant. Pumping from the second well field may affect irrigation wells more than two miles away. No impact to Battle Mountain wells is anticipated. Solid waste deposits (ash) and lined evaporation ponds for cooling tower blowdown are effectively isolated from ground water by relatively impermeable layers of silt and clay.
STRUCTURE AND STRATIGRAPHY IN THE VICINITY OF THE SHELL OIL CO., SANTA FE PACIFIC NO. 1 TEST WELL, SOUTHERN SANDVALO COUNTY, NEW MEXICO

BLACK, B. A.; NISS, W. L.

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.

NEW MEXICO GEOLOGICAL SOCIETY GUIDEBOOK, 25TH FIELD CONFERENCE, GREAT RANCH (CENTRAL-NORTHERN NEW MEXICO), P. 365-370, 1974. 4 FIG, 2 PLATE, 2 TAB, 13 REF.

Journal Announcement: SWRA0203

The stratigraphic section beneath the Santa Fe group in the northern part of the Albuquerque-Milam basin, New Mexico, was obtained from a wildcat oil-test well. A generalized stratigraphic section extending approximately 60 miles from the Rio Puerco on the west across Mesa Prieta and terminating in the Cerillos Hills is shown. The potential for development of additional oil, gas, uranium, coal, geothermal, and groundwater resources makes the geologic understanding of this area not only of academic interest but also of great economic importance for the future of New Mexico. (KNAPP-USGS)

Effects of uranium development on erosion and associated sedimentation in southern San Juan Basin, New Mexico

Cooley, M. E., 1979


GEOLOGY AND GROUND-WATER OCCURRENCE IN SOUTHEASTERN MCKINLEY COUNTY, NEW MEXICO

COOPER, JAMES B.; JOHN, EDWARD C.

GEOLOGICAL RESOURCES MAKE ADDITIONAL OIL, GAS, URANIUM, COAL, GEOTHERMAL, AND AREA NOT ONLY OF ACADEMIC INTEREST but also of great economic potential in areas where large bodies of uranium ores are present. The principal aquifers, their areal extent, and their areas of distinct aquifers, mostly artesian, in rocks that range in age from Permian to Quaternary. Yields of 300 GPM are obtained from wells that tap aquifers in the Goliad sandstone and San Andres limestone. Groundwater in adequate quantities and of usable quality for stock and domestic use is available throughout southeastern McKinley County. Uranium mines discharge millions of gallons of water; some of the water is used in the mills, but most of it is pumped to waste. Groundwater associated with the uranium deposits is slightly radioactive. Several samples from mines or wells contained concentrations of radium somewhat above the recommended maximum limit for drinkable water, recharge to aquifers in southeastern McKinley County is mainly from precipitation on outcrops of the rocks and from water along fault zones.

PRELIMINARY DATA REPORT FOR THE SANTA JUAN BASIN-CROWNPOINT SURVEILLANCE STUDY

Frenzel, Peter F.; Craig, S. D.; Paddock, E. T.


Geologic data that may be used to predict the effects of mining on Navajo water resources in the San Juan structural basin are reported, as well as the current availability of data from the offices involved. Emphasis is on the vicinity of Crownpoint, New Mexico, (USGS)

Estimates of vertical hydraulic conductivity and regional groundwater flow paths in rocks of Jurassic and Cretaceous age, San Juan Basin, New Mexico and Colorado

Frenzel, Peter F., and Lyford, Forest P.

U.S. Geological Survey Water-Resources Investigations 82-4015

The San Juan structural basin in northwestern New Mexico was modeled in three dimensions using a finite-difference, steady-state model. The modeled space was divided into seven layers of square prisms that were 6 miles on a side in the horizontal directions. In the vertical directions, the layers of prisms ranged in thickness from 300 to 1500 feet. The model included the geologic section between the base of the Entrada Sandstone and the middle of the Lewis Shale. Principal aquifers
in this section are mostly confined and include the Entrada Sandstone, the westwater Canyon Member of the Morrison Formation, and the Gallup Sandstone in the lower part of the Mesaverde Group.

Values for vertical hydraulic conductivities from 10 exp(-12) to 10 exp(-11) feet per second for the confining layers gave a good simulation of head differences between layers. But a sensitivity analysis indicated that these values could be between 10 and 100 times greater. The model-derived steady-state flow was about 30 cubic feet per second. About one-half of the flow was in the San Juan River drainage basin, about one-third in the Rio Grande drainage basin, and one-sixth in the Puerco River drainage basin.


The San Juan River is the second largest tributary to the Colorado River, originating on the west slope of the Continental Divide in southwestern Colorado and flows westward through Colorado, New Mexico, Arizona, and Utah.

Long-term streamflow and water-quality records are available at the U.S. Geological Survey gaging stations on the San Juan River at Shiprock, New Mexico. Mean values were calculated for daily measurements of streamflow, specific conductance, water temperature, sediment concentration, and sediment load for the period prior to 1963 and the period since 1963. The t-test procedure was used to compare the pre-1963 mean and post-1963 mean. Results show the means of daily streamflow and sediment load measurements for the San Juan River at the Shiprock gaging station have decreased for the post-1963 period due in part to the construction of the Navajo Reservoir. Other causes of the decrease may be related to increasing population, changes in agricultural irrigation, increased industrialization, climatic conditions, or a combination of these factors. The time-weighted mean of daily specific-conductance measurements appears to have decreased for the post-1963 period, but the reason for this change is not apparent. The discharge-weighted mean of daily specific-conductance measurements has increased for the post-1963 period. The means of daily water temperature and sediment concentration are not statistically different for the two time periods.


Journal Announcement: SWRA1605

This report presents hydrologic investigations and data collections conducted by the U.S. Geological Survey in the strippable coal areas of northwestern New Mexico. Streamflow, ground-water, and quality-of-water data were collected to provide a baseline or prevailing hydrologic conditions. A network of hydrologic data-collection sites in the strippable coal areas of the Fruitland Formation was designed to meet the need of detailed investigations, including area-specific studies, to provide hydrologic data in support of the expanding mining activity. The network consists of 34 continuous-record streamflow-gaging stations (32 included water-quality sampling), 20 miscellaneous water-quality streamflow stations, 12 annual maximum discharge stations, 27 observation wells completed in strata associated with the strippable coal areas, and 24 observation wells completed in channel alluvium downstream from strippable coal areas. (USGS)


Regression equations are presented to predict ephemeral streamflow characteristics in the San Juan Basin in northwestern New Mexico. The standard error of estimate for predicting runoff for water year 1976 using drainage area as the independent variable was 152 percent. Indications are that reliable equations for predicting annual runoff can be developed and the standard error of estimate might be reduced significantly with additional years of record. The coefficient of regression when relating discharge to drainage area was 0.78 and significant at the 1-percent level. Preliminary results also indicate it is feasible to predict streamflow characteristics using hydrologic soil-group classifications based on runoff potential. The standard error of estimate for predicting peak discharges with recurrence intervals of 2, 5, 10, 25, 50, and 100 years using active-channel width as the independent variable averaged about 50 percent, and the regression coefficient was significant at the 1-percent level. Using drainage area to predict peak discharges resulted in a standard error of estimate that averaged about 60 percent and a regression coefficient significant at the 5-percent when active-channel width and drainage area were related to peak discharges in multiple regression analyses.

INTERPRETATION OF GEOLGIC AND HYDROLOGIC DATA FROM THE RAY-1 WELLS, CITY OF GALLUP, MCKINLEY COUNTY, NEW MEXICO. Miss, W. L., MARSHALL, J. G.
New Mexico New Mexico

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.
OPEN-FILE REPORT 75-573, NOVEMBER 1975, 38 P. 3 FIG. 1 TAB. 4 REF.
JOURNAL AL ANNOUNCEMENTS SW 80709

The hypogastric well was to be the third production well completed in the city of Gallup, N. Mex., YAH-TA-HEY WELL field located approximately 600 feet north of the first string of casing collapsed during completion, however, and the well was abandoned before it could be tested. The lithology of the upper cretaceous dalton sandstone and dolico coal members of the crevasse canyon formation and the gallop sandstone was interpreted from geophysical logs and examination of the drill cuttings. These units appear to be similar to correlative strata encountered in the first two wells. The yield of approximately 700 GPM, similar to the other wells in the YAH-TA-HEY field, is anticipated from the same aquifers. When the YAH-TA-HEY REPLACEMENT WELL is completed, (WOODARD-USGS)

Coal resources of the Raton coal field, Colfax County, New Mexico
Lee, W. T., 1924
U.S. GEOLOGICAL SURVEY BULLETIN 752, 254 P.

Ground water in the San Juan basin, New Mexico and Colorado
Lyford, Forest P.
U.S. GeologicaL Survey, WRI 79-73

Principal aquifers in the San Juan basin of New Mexico and Colorado are the Entrada Sandstone, Westwater Canyon Member of the Morrison formation, Gallup Sandstone of the Mesaverde Group, several sandstones in the Mesaverde Group above the Gallup (Dalton) Sandstone of the Cretaceous (canyon point, Lookout Sandstone, Menefee formation, Cliff House Sandstone), and sandstones of tertiary age.

Polish water may flow from topographically high outcrop areas toward the San Juan river and Rio Grande valley. Much of the water may flow through confining layers to other aquifers or to the land surface rather than discharging directly to the streams. Transmissions of the sandstones range from 50 to 300 feet squared per day. Lowest dissolved solids concentrations occur in or near outcrops of the sandstones and increase in the direction of ground-water flow. Concentrations range from less than 50 milligrams per liter to more than 30,000 milligrams per liter.

Methodology for Hydrologic Evaluation of a Potential Surface Mine: The Tsosie Swale Basin, San Juan County, New Mexico
Shawn, L. M., Frickel, D. G., Hadley, R. F., and Miller, R. F.
U.S. Geological Survey WRI OPEN-FILE REPORT 81-74

Peter applications made to the Office of Surface Mining Reclamation and Enforcement for mining of near-surface coal deposits contain both mining and reclamation plans. These plans must be evaluated by regulatory authorities for compliance with the permanent regulations of the Surface Mining Control and

New Mexico New Mexico

Reclamation Act of 1977. Methodologies for assessment of the effects of mining and reclamation on the hydrologic system are presented for a potential permit area of 640 acres in the Tsosie Swale, a small tributary of Escavada Wash in northwestern New Mexico. Escavada Wash is the principal tributary of the upper Chaco River, which is the stream that drains much of the San Juan basin. Small lakes and ponds along the tributary swale and climatic area and a low relief landscape with a sandy mantle that is moderately vegetated with shrubs and grasses.

Reclamation soils, vegetation, geology, and hydrology of Tsosie Swale are described as a basis for evaluation of changes that may occur. Soil-moisture-vegetation relations show that the most grass cover occurs where 1 to 2 feet of sandy surface soils are underlain by fine-textured, less-permeable layers that percolate moisture.

Estimates are made of premining and postmining peak discharges and runoff volumes by the empirical Soil Conservation Service (SCS) method and by a basin-characteristic model. The SCS method was found to be superior because it considers infiltration rates. Postmining peak discharge estimates are 30 to 70 percent of premining estimates, and runoff volumes are 30 to 70 percent of premining values.

Methods are demonstrated for estimating soil loss by use of the Universal Soil Loss Equation (USLE) and by simulation of an intense rainstorm on a microwatershed. Estimates of sediment yield from the basin for premining conditions are made using reservoir simulation surveys and a watershed-factors rating method. USLE soil-loss estimates and a sediment delivery ratio is used to estimate postmining sediment yield. Estimated postmining sediment yield is about 50 percent of the premining estimate.

Changes in the topography resulting from removal of coalbeds and expansion of the overburden are shown to vary from a lowering of peak discharges by 20 percent in some areas and at values of 10,000 cubic feet per second or less to a lowering of peak discharges in other areas as much as 20 feet. The primary factors responsible for the reductions in streamflow and sediment yield are the assumptions that the minor areas now consisting of alluvial and alluvial plains, from which runoff is high, would be eliminated and the area would be covered with about 2 feet of sandy soil.

Hydrogeology and water resources of San Juan Basin, New Mexico
Stone, William J., Lyford, Forest P., Frenzel, Peter F., Michel, N., and Pudgette, Elizabeth T.
The San Juan Basin of northwest New Mexico contains a wealth of energy resources. Although petroleum reserves are nearly depleted, vast reserves of uranium and coal must be extracted. In this arid to semiarid region, surface-water resources are limited and fully appropriated. New water supplies for energy development and growing municipalities must therefore...
be derived from negotiated surface water or ground water. Major aquifers include Quaternary valley fill and sandstones of Tertiary, Cretaceous, Jurassic, and Triassic ages. Ground water in these aquifers is generally confined, but some interaquifer leakage occurs; transmissivities between 100 ft²/d and 200 ft²/d are characteristic. Specific conductance of ground water is variable (less than 500 ushms to more than 30,000 ushms). Regional flow is from elevated recharge areas on the basin margin toward discharge areas along the San Juan River in the northwest and along the Rio Puerco in the southeast. Occurrence, movement, and quality of ground water are subject to considerable geologic control provided by the distribution and characteristics of the sandstone aquifers, geologic structure, and regional stratigraphy. The principal uranium orebody is also a regional aquifer. Uranium-mine dewatering has caused water-level declines; greater declines will accompany construction of deeper mines and the persistence of toxic substances is unknown, but such material may remain near the mine cavity because of local geologic conditions. Water is not generally encountered in strip mining; supply is the major water problem in coal development. Potential sources of water include deep aquifers, excess uranium-mine effluent, and Tertiary sandstone aquifers in areas adjacent to the coal belt. Impacts of return flow from the El Vado Indian Irrigation Project on San Juan River quality may be difficult to distinguish from impacts of energy development and municipal activities. Irrigated acreage in river valleys is expected to increase as water rights are transferred to uses such as energy development. Future water needs of municipalities growing in response to energy development may be met in some areas by tapping deeper aquifers and in others by obtaining uranium-mine effluent. Water treatment may be required in both cases.

Erodibility of Selected Soils and Estimates of Sediment Yields in the San Juan Basin, New Mexico

Summer, R. M.
Journal Announcement: SWRA1511

Onsite rainfall-simulation experiments were conducted to derive field-erodibility-index values for rangeland and soils disturbed by mining in coal fields of northwestern New Mexico. Mean indexes on rangeland soils range from 0 grams (of detached soil) on dune soil to 921 grams on wash-transport zones. Mean field-erodibility-index values of soils disturbed by mining range from 16 to 32 grams; they can be extrapolated to nearby coal fields where future mining is expected. Because field-erodibility-index data allow differentiation of erodibilities across a variable landscape, these indexes were used to adjust values of Ks, the erodibility factor of the Universal Soil Loss Equation. Estimates of soil loss and sediment yield were then calculated for a small basin following mining. (USGS)

Techniques for Estimating Flood Discharges for Unregulated Streams in New Mexico
Thomas, Richard P., and Gold, Robert L.
Equations for estimating flood magnitudes at selected recurrence intervals from 2 to 500 years were developed using multiple-regression analyses. These equations relate flood magnitudes to basin characteristics, contributing drainage area, and site attitudes and only are applicable to unregulated streams in New Mexico that are relatively unaffected by urban runoff. Flood magnitudes at gaged sites are computed using a simple estimating equation. This equation adjusts discharges developed from the original regression equations using flood magnitude and frequency values at the gaged site.

Environmental impact statement of proposed Prewitt-Star Lake railroad branch line and Star Lake coal mine, section on water resources
U.S. Geological Survey, 1976
Draft Administrative Report, 84 p.

Geology and fuel resources of the southwestern part of the Raton coal field, Colfax County, New Mexico
U.S. Geological Survey Coal Investigations Map (C-45, scale 1:480,000); 2 sheets.

Bibliography of Geology and Hydrology, Southwestern New Mexico
Wright, A. F.

The southwestern part of New Mexico is recognized as a source of abundant and varied natural resources. This bibliography of over 2,700 references concerned with geology, hydrology, chemistry, and geography has been compiled to assist physical science researchers in their study and development of this region. (USGS)
Most of the Bisti 4-square-mile site in the San Juan Basin is a 50-foot-per-mile sloping, sandy plain dissected by dry washes. It is bounded on the northwest by the 100-foot escarpment of Alamo Mesa. Soils are thin, poor, and in places absent. Vegetation is primarily northern desert shrub having low vegetative yields. Large amounts of ground are bare. Measured cover ranged from 5.7 to 37 percent. Coal is found in the northward-dipping Cretaceous Fruitland Formation on the southeast side of the Basin. More than 81 million tons of coal occur in beds thicker than 2.5 feet less than 200 feet beneath the site. Annual precipitation is 8 inches and average evapotranspiration is about 50 inches. Runoff from the site may range between 22 and 54 acre-feet annually. The little water that occurred in the coal and in layers above contained 3,000 to 4,000 milligrams per liter of total dissolved solids. Water in deeper aquifers below the coal is too saline for irrigation, except for the Morrison Formation where water containing less than 1,000 milligrams per liter of total dissolved solids and yielding 50 gallons per minute has been found. Water for operation could be purchased and piped-lined at least 8 miles, possibly supplemented by ground water or impounded local runoff. Normal water-handling and restoration practices would minimize or prevent erosion, sedimentation and water-quality deterioration.

Coal Preference Right Leasing, New Mexico
BLM, Albuquerque, New Mexico
FEA, 1981

The proposed action is to lease 75,510 acres in northwestern New Mexico for 25 Preference Right Leases to mine coal. About 22,000 acres would be surface mineable, about 26,650 acres would be mined underground. The area is in the south-central part of the San Juan Basin and consists of west-southwest sloping poorly dissected, moderately rolling plain. Isolated steep-sided mesas and buttes and badlands remain in places. The area is underlain by the nearly flat-lying sedimentary upper Cretaceous Kirtland and Fruitland Formations. About 1.9 billion tons of recoverable coal in the lower Fruitland Formation underlie eight of the 13 townships in the area. Data is inadequate to quantify reserves in the remaining 5 townships. The climate is semiarid. Annual precipitation ranges from 8 to 11 inches and the annual moisture deficit ranges from about 10 to 14 inches. All drainages in the area are ephemeral. Drainage west of the Continental Divide is to Chaco Wash and to the Colorado River. The small part of the area east of the Divide drains to Torreon Wash and to the Rio Grande via Rio Puerco. Numerous ephemeral stock ponds and four plays lakes furnish water for stock and wildlife when water is present. Small quantities of water occur in shallow sandstone layers and is frequently under artesian pressure. Larger quantities are found in deeper sandstones, also under pressure. Quality ranges from good (less than 1,000 milligrams per liter total dissolved solids) at some places in the Morrison formation, 5,000 to 6,000 feet deep, to poor (more than 2,000 milligrams per liter total dissolved solids) in other deeper formations. Depending on reclaimed surface treatment, infiltration could increase and runoff reduce, or the opposite could occur. Surface mining could destroy as many as 23 shallow domestic and stock wells. Water quality in 16 of the wells ranged from 2,000 to 17,000 milligrams per liter total dissolved solids.

Kimbeto Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in San Juan County, northwestern New Mexico
BLM, Denver, Colorado
EMRIA Report No. 17-77.

The 19 square-mile Kimbeto study area in the southwest part of the Central San Juan Basin consists of badlands, boldly scoured mesas, and sand dunes. It is drained by three sand-choked ephemeral dry washes originating miles upstream. Relief is about 200 feet and annual precipitation is 8.6 inches. Surficial deposits are underlain by the Cretaceous Kirtland (shale) Formation and the Fruitland Formation. The Fruitland contains 61.6 million tons of coal in several beds more than 2.5 feet thick covered by less than 400 feet of overburden beneath the site. Most runoff from the site derives from the shale badlands. Water in the alluvium may yield as much as 50 gallons per minute of moderately mineralized (about 1,500 milligrams per liter dissolved solids) water to wells. Larger quantities of water are available from deeper aquifers more than 1,000 feet below the coal but mineralization increases with depth to as much as 14,000 milligrams per liter dissolved solids at 6,000 feet below land surface. Mining would temporarily impact current water uses—livestock grazing and wildlife—and downstream flow by increased infiltration in reclaimed areas. Water supply for operation, and irrigation, if needed, would be a combination of ground water and stored surface water.

Ojo Encino Study Site Coal Resource and Surface Mining Potential Reclamation Evaluation in McKinley County, northwestern New Mexico
BLM, Denver, Colorado
EMRIA Report No. 19-78

The 6.4 square-mile Ojo Encino site in the southeastern part of the San Juan Basin consists of low hills and gently rolling terrain. Relief is about 120
Coal is in the lower part of the late Cretaceous Fruitland Formation. The Fruitland contains 133 million tons of coal in three beds ranging in thickness from 5 to 21 feet, covered by less than 300 feet of overburden. No water was encountered in the overburden. Coal seams and interbedded sandstone could yield up to 20 gallons per minute of water containing about 2,400 milligrams per liter of dissolved solids. Several hundreds of gallons per minute of moderately saline water, specific conductance ranging from 2,000 to 15,000 micromhos, can be obtained in deeper aquifers from 500 to 6,500 feet below land surface. No long term adverse effects are expected from surface mining.

This EIS evaluates the impacts of constructing and operating a 2,000 megawatt coal-fired steam electric generating station in San Juan County in northwestern New Mexico, and a possible new town. Impacts of surface mines to be developed nearby in the San Juan Basin for the source coal (9 million tons per year) are not discussed. The proposed action would require 35,000 acre-feet per year (48 cubic feet per second) of water from the Navajo Reservoir to be taken from the San Juan River, either at Farmington or 14 miles upstream at Bloomfield. Average annual flow and minimum flow are 2,400 and 700 cubic feet per second at Farmington. During drought, an additional 48 cubic feet per second would be released from the Navajo Reservoir. Water quantity decreases downstream—total dissolved solids of 266 milligrams per liter at Bloomfield and 449 at Shiprock, 35 miles downstream. Salinity would increase 4 milligrams per liter at Imperial Dam. An alternative would produce 15,000 acre-feet per year of the required water from 16 wells in the Westwater Canyon Member of the Morrison Formation, 4,000 to 6,000 feet below the surface. Water quality ranges from 500 to 4,500 milligrams per liter in this aquifer. A mathematical model predicted 25-foot drawdowns would extend throughout the basin, and into Colorado through the year 2109. Pumping would cause an unquantifiable amount of subsidence and reduce flow in the Chuska Mountains springs, and by 0.09 cubic feet per second in the San Jose and Puerco Rivers and the San Juan and Puerco Rivers. Mitigation could be by replacement, improvement, or payment of added water costs. This alternative would not cause a shortage of water to present and projected water users in the San Juan River Basin. However, during drought (worst-case), the alternative upstream intake at Bloomfield would not take advantage of downstream irrigation return flows, and the required additional releases from the Navajo Reservoir could conceivably reduce the carryover storage, which could result in shortages to United States rights. Any shortage would have to be shared proportionately among users. The impacts of the ground water alternative were predicted using the U.S. Geological Survey's finite difference computer model which accommodates 3-dimensional ground water flow. The model simulated the 3-layer "Westwater Canyon" aquifer system consisting of, from bottom, 1) the Entrada Sandstone aquifer, 2) a leaky aquifer layer including the Todilto Limestone gypsiferous member, 3) the Westwater Canyon Member aquifer of the Morrison Formation, 4) a leaky aquifer confining unit and 5) the Dakota Sandstone aquifer. The system is hydraulically isolated by the Nancon Shale above and the Chiala Formation below. Before the year 2188, the pumping would result in Westwater Canyon Member drawdowns of more than 2,500 feet near the well field, more than 2,000 feet in an area of 400 square miles, 1,000 feet over 900 square miles, and more than 400 feet over 2,000 square miles. Drawdowns of more than 400 feet in the Dakota Sandstone would extend over 900 square miles. Water level declines of more than 25 feet would affect 145 Westwater Canyon Member wells, 100 Dakota Sandstone wells, and 13 Entrada Sandstone wells. Natural discharge to the Rio Puerco, Rio San Jose, and the Puerco and San Juan Rivers would be reduced by a total of 0.09 cubic feet per second. The drawdowns would reduce the dewatering of uranium mines by less than 5 percent. This report supports: 1) the San Juan River Regional Coal Leasing EIS, 2) the Bisti, De-na-zin and Ah-shi-ale-pah Wilderness Study Areas EIS, and 3) the New Mexico Generating Station EIS.
The report assesses the water quality effects of consumption of 35,000 acre-feet per year of water from the San Juan River Navajo Reservoir by a proposed 2,000 megawatt coal-fired electric generating plant, 35 miles south of Farmington. An alternative would be to obtain 15,000 acre-feet per year from the Westwater Canyon Member of the Upper Jurassic Morrison Formation, and only 20,000 acre-feet from the reservoir. Construction of the river intake would have little or no effect on the suspended sediment load of the San Juan River. The BLM's Bureau of Land Management Colorado River Simulation System was used to evaluate salinity impacts of the two levels of withdrawal at the year 2010, with and without proposed Colorado River system salinity control projects. Without the salinity control projects, the proposed annual withdrawals of 35,000 and 20,000 acre-feet would increase salinity at Imperial Dam by 0.39 and 0.22 percent over the baseline of 1,019 milligrams per liter. If the salinity control measures are implemented, the same withdrawals would increase salinity at Imperial Dam by 0.37 and 0.21 percent over an 859 milligram per liter base. The large drawdowns resulting from use of groundwater from the Westwater Canyon Member could induce leakage of poorer quality water in adjacent aquifers and might increase its dissolved solids content by about 5 percent over present levels, which are now so high as to be unsuitable for stock watering. Although ground water usage would decrease flow by less than one percent in the San Juan River and Rio San Jose, salinity increase would be negligible. Runoff from evaporation ponds and waste sites could degrade shallow groundwater in the immediate vicinity of the plant.

The San Juan River Region is a low plateau that approximates the New Mexican part of the San Juan structural basin. It is characterized by subdued low mesas, buttes and broad cuestas. The continental divide extends southwesterly across the southern part of the region. The Chaco River drains most of the region to the northwest into the San Juan River (Colorado-Pacific drainage). The Puerco and Zuni Rivers drain a small area in the southwest, eventually to the Colorado River. A small area in the southeast drains by Arroyo Chico via Rio Puerco to the Rio Grande (Atlantic drainage). The San Juan River is the only perennial stream in the area, receiving most of its flow from the San Juan Mountains to the north in Colorado. Stream water quality ranges widely, both in time and from stream to stream. Annual precipitation ranges from 10 to 14 inches. The annual moisture deficit is 10 to 12 inches. Highly lenticular coal beds occur in the late Cretaceous Fruitland, Menefee and Crevasse Canyon Formations, overlain and underlain by layers of sandstone, shale and siltstone. The formations dip gently northward and crop out in concentric arcs on the basin's southern border. Small quantities of marginal quality water occur locally in the coal and in shallow aquifers above. Water in alluvium ranges from less than 1,000 milligrams per liter dissolved solids in headwater basins to more than 2,000 milligrams per liter in downstream reaches. Several potential sandstone aquifers below the coals contain water ranging from less than 200 to more than 44,000 milligrams per liter of total dissolved solids. Surface mining, allowed by all alternatives, would disrupt shallow aquifers used mostly for stock watering. A series of maps shows predicted drawdowns to the deeper aquifers of the No Action Alternative and differences in drawdowns between this and four other alternatives through the year 2040.
The purpose of this ground-water investigation in Morton County, N. Dak., was to determine the quantity and quality of ground water available for municipal, domestic, livestock, industrial, and irrigation uses. Specifically, the objectives were: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields to wells tapping the aquifers; and (5) determine the chemical quality of the ground water. Most data in this report were collected between 1972 and 1975. All data-collection points are shown. The data consist of the following: (1) Geologic and hydrologic data for 1,209 wells, test holes, and springs; (2) water-level measurements for 148 observation wells; (3) lithologic and geophysical logs for 247 test holes and wells; (4) chemical analyses of 353 water samples; and (5) analyses of physical properties of 42 core samples. (Woodard-USGS)
HYDROLOGY

rocks and several aquifers

of ground water of the Hill Creek aquifer and (9) 273 test holes. Determination of the chemical potential yields of ground water and the quantities of water stored in the aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) determine the chemical quality of the ground water; and (6) estimate the water use. The data in this report were collected between 1974 and 1977. The data consist of the following: (1) geologic and hydrologic records for 723 wells, test holes, springs, and miscellaneous data-collection sites; (2) water-level measurements in 48 observation wells; (3) lithologic and geophysical logs of 367 test holes and wells; (4) 275 cores of bedrock and unconsolidated ground water; (5) 33 chemical analyses of surface water during low flow; (6) 18 chemical analyses of ground water for trace constituents; (7) 99 chemical analyses of ground water for dissolved gases; (8) 62 analyses of core samples for hydraulic parameters and particle-size distribution; and (9) 29 analyses of core samples for heavy mineral content.

North Dakota

Ground-Water Data for Billings, Golden Valley, and Slope Counties, North Dakota

Anna L. O.


The purpose of the investigation in Billings, Golden Valley, and Slope Counties, ND. was to determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to: (1) determine the locations, extent, and nature of the major aquifers and confining beds; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) determine the chemical quality of the ground water; and (6) estimate the water use. The data in this report were collected between 1974 and 1977. The data consist of the following: (1) geologic and hydrologic records for 723 wells, test holes, springs, and miscellaneous data-collection sites; (2) water-level measurements in 48 observation wells; (3) lithologic and geophysical logs of 367 test holes and wells; (4) 275 cores of bedrock and unconsolidated ground water; (5) 33 chemical analyses of surface water during low flow; (6) 18 chemical analyses of ground water for trace constituents; (7) 99 chemical analyses of ground water for dissolved gases; (8) 62 analyses of core samples for hydraulic parameters and particle-size distribution; and (9) 29 analyses of core samples for heavy mineral content.

Ground Water Resources of Billings, Golden Valley, and Slope Counties, North Dakota

Anna L. O.


Journal Announcement: SWRA1420

In Billings, Golden Valley, and Slope Counties, ND., rocks within 2,200 feet of the land surface contain several aquifers that bear relatively fresh water. The

North Dakota

aquifers, which are in rocks of Late Cretaceous and Tertiary age, consist of interbedded sandstone, siltstone, claystone, and lignite. The major aquifers in the three-county area are the Fox Hills-lower Hell Creek aquifer system, the upper Hell Creek-lower Ludlow aquifer system, and aquifers in the upper part of the Ludlow, Tongue River, and Sentinel Butte Members of the Fort Union Formation. The Fox Hills-lower Hell Creek aquifer system has a mean transmissivity of 313 feet squared per day and may yield as much as 300 gallons per minute of sodium bicarbonate type water. The other aquifers generally yield less water, but the water is also predominantly a sodium bicarbonate type, with discharges of water from flowing wells along the valley of the Little Missouri River have created a cone of depression and major deflection in the potentiometric surface of all the major aquifers. (USGS)

GEOLfOY AND GROUND WATER RESOURCES OF WILLIAMS COUNTY, NORTH DAKOTA; PART 1 - HYDROLOGY

ARMSTRONG C. A.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

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GROUND WATER STUDIES 9, 1969. 82 P. 27 Figs. 2 Plates, 2 Tabs. 34 Ref.

Journal Announcement: SWRA0305

GROUNDWATER IN WILLIAMS COUNTY, NORTH DAKOTA, IS OBTAINED FROM AQUIFERS IN THE GLACIAL DRIFT OF QUATERNARY AGE, THE FORT UNION GROUP OF TERTIARY AGE, AND THE DAKOTA GROUP OF CRETACEOUS AGE. THREE OF THE MORE PRODUCTIVE AQUIFERS ARE THE LITTLE MUDY, RAY, AND GRENORA; THESE AQUIFERS ARE COMPOSED OF SANDSTONE AND GASOLINE THAT WATER IS DEPARTING FROM THE CRETACEOUS YELLOWSTONE, LITTLE MISSOURI, AND MISSOURI RIVER VALLEYS RESPECTIVELY. PROPERLY CONSTRUCTED WELLS IN THE LITTLE MUDY, RAY, AND GRENORA AQUIFERS CAN YIELD MORE THAN 500 GALLONS PER MINUTE. WELLS MORE THAN 500 GPM ARE ALSO OBTAINABLE FROM THE MORE PECULIAR FORMATIONS OF THE TREATON AND HOFFLUND AQUIFERS IN THE PROGLACIAL YELLOWSTONE AND MISSOURI RIVER VALLEYS. YIELDS OF 50 TO 500 GPM ARE OBTAINABLE FROM SOME OUTWASH AND BURIED GLACIOFLUVIAL DEPOSITS IN THE NORTHERN PART OF THE COUNTY AND FROM SOME OF THE FINER SAND DEPOSITS IN THE 5 MAJOR AQUIFERS. WATER FROM THE RELATIVE PROFUSION OF GLACIAL DRIFT AQUIFERS DIFFERS GREATLY IN QUALITY, GENERALLY IT IS VERY HARD AND OF A CALCIUM BICARBONATE TYPE. WATER IN THE FORT UNION GROUP CONSISTS OF 2 TYPES; A SOFT SODIUM BICARBONATE WATER, AND A HARD SODIUM SULFATE BICARBONATE WATER. GENERALLY IT IS TOO SALINE FOR HUMAN CONSUMPTION OR IRRIGATION. WATER FROM THE DAKOTA IS USED FOR PRESSURE MAINTENANCE IN OIL FIELDS, BUT IS TOO SALINE FOR MOST OTHER USES. (KNAPP-USGS)

GEOLOGICAL SURVEY BULLETIN 81-7

GROUNDWATER RESOURCES OF BURKE AND MOUNTAIN COUNTIES

ARMSTRONG C. A.
North Dakota

GEOLgICAL SURVEY, BISMARCK, N. DAK.

NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 55—PART III, AND NORTH DAKOTA WATER COMMISSION—COUNTY GROUNDWATER STUDIES 14, PART III, 1971, 86 P., 22 FIGS. & PLATE; 1 TAB., 36 REF.,

Journal Announcement: SWRA423

This investigation was conducted to determine the quantity and quality of groundwater available in Burke and Mountrail Counties, North Dakota. The chief source of local groundwater is from the glacial deposits of the new town and Shell Creek aquifer systems in Mountrail County, and the Columbus aquifer in Burke County. The new town aquifer consists of about 300 feet of sands and gravels with a yield of about 500 gpm. Water quality varies from a hard sodium bicarbonate to a hard sodium sulfate type. The Shell Creek aquifer composed of glacial outwash has a yield of 300 gpm. Water quality changes with depth from a hard sodium sulfate to a hard sodium sulfate bicarbonate type. The Columbus aquifer composed of glacio-fluvial deposits is divided into two zones separated by glacial till and silt. The lower zone has water of sodium bicarbonate type while the upper water is a very hard sodium sulfate to calcium sulfate type. The aquifer has a yield of 200 gpm. Local bedrock yields are small and water from these underlying tertiary (Paleocene) and Cretaceous Jeds are generally too saline to be used for stock irrigation, or for human consumption. (Glasby-USSG)

Lignite resources of North Dakota
Brandt, R. A., 1963

Ground-water data for Sheridan County, North Dakota

Journal Announcement: SWRA1324

The purpose of the investigation in Sheridan County, ND, was to determine the availability and quality of ground water for municipal, domestic, industrial, and irrigation uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; (3) estimate the quantity of water stored in the aquifers; (4) estimate the potential yields of wells tapping the major aquifers; (5) evaluate the chemical quality of the ground water; and (6) estimate the water use. The data in this report were collected between 1976 and 1979. The data consist of the following: (1) Geologic and hydrologic records for 320 wells and test holes; (2) water-level measurements in 61 observation wells; (3) lithologic and geophysical logs of 108 test holes and wells; and (4) chemical analyses of 93 ground-water samples. (USGS)

Groundwater Resources of Sheridan County, North Dakota

Journal Announcement: SWRA1420

Groundwater in Sheridan County, ND, is obtainable from aquifers in the upper Cretaceous bedrock and Quaternary glacial drift. Bedrock aquifers have a greater areal distribution, but those in the glacial drift provide a greater potential yield to individual wells. The major bedrock aquifers are the Fox Hills aquifer system and the Shell Creek aquifer system. Yields from these aquifers are not expected to exceed 50 gallons per minute. The water generally is soft and a sodium bicarbonate type. Aquifers in the glacial-drift–lake-marsh system, Martin system, Butler, Painted Woods Creek, and North Burleigh—Underlie about 300 square miles in Sheridan County. Well yields of more than 500 gallons per minute may be generally fairly hard. (USGS)

1980 Geologic Map of North Dakota
Clayton, Lee
U.S. Geological Survey Map G77220

GEOLoGY OF MOUNTRAIL COUNTY, NORTH DAKOTA
CLAYTON, L. G., GEOLOGICAL SURVEY, GRAND FORKS, N. DAK.

NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 55—PART IV, AND NORTH DAKOTA STATE WATER COMMISSION COUNTY GROUNDWATER STUDY 14—PART IV, 1972, 70 FIGS. & V. FIG., 2 MAPS, 1 TAB., 27 REF.,

Journal Announcement: SWRA501

This is Volume IV of a four-volume report on the geology and groundwater resources of Burke and Mountrail Counties, ND. This volume is divided into two sections. Section A is a description of the topography, the rock and sediment, and the general hydrology of Mountrail County. In addition, Section A contains a brief summary of the age and origin of the topography, rock, and sediment of the county. Section B is a more detailed discussion of the problems involved in determining the age and origin of the geologic materials and landforms in Mountrail County. This section is written for those (especially nongeologists) who are interested in the physical nature of the near-surface earth materials underlying the county. Section C is a more detailed discussion of the geologic materials and landforms in Mountrail County. This section is written for those (especially geologists) who are interested in the geologic processes and sequence of events during late Cenozoic time in this area. Contractors and civil
ENGINEERS INTERESTED IN THE GROSS CHARACTERISTICS OF FOUNDATION MATERIALS AT POTENTIAL CONSTRUCTION SITES CAN DETERMINE THE KINDS OF MATERIALS TO BE EXPECTED FROM A MAP INCLUDED. GENERAL INFORMATION CONCERNING GROUNDWATER POLLUTION ALSO IS PRESENTED. (WOODARD-USGS)

Hydrologic Characteristics and Possible Effects of Surface Mining in the Northwestern Part of West Branch Antelope Creek Basin, Mercer County, North Dakota

Crawley, M. E.; Emerson, R. G.


Journal Announcement: SWRA1605

Lignite beds and abundant discontinuous sandstone beds of the Paleocene Sentinel Butte Member of the Fort Union Formation and sand and gravel beds in the Quaternary glaciofluvial deposits (Antelope Creek aquifer) are the most important aquifers for domestic and livestock water supplies in the West Branch Antelope Creek basin. In the Beulah-Zap lignite, ground water moves from highland area in the west toward the Antelope Creek aquifer. Water levels in the basal Sentinel Butte sandstone appear to be controlled by the level of Lake Sakakawea. In the glaciofluvial deposits of the Antelope Creek aquifer, ground water moves from a ground-water divide northwestward to Lake Sakakawea and southeastward toward the Knife River. Large water resources lie in wells completed in the lignite and shallower aquifers could be expected with mining. The effects probably would be limited to within 1 to 2 miles of an active mine. Surface runoff duration could be altered by increased infiltration and percolation in the reclamed area and possible temporal extension of base flow could occur. Shallow ground water beneath mine sites would be expected to increase in dissolved solids and contain large sodium and sulfate concentrations. In some locations movement of poor quality water toward the Antelope Creek aquifer would be expected. (USGS)

Ground-Water Resources of Adams and Bowman Counties, North Dakota

Crockett, M. G.


Journal Announcement: SWA1124

The most important aquifer in Adams and Bowman Counties, N.Dak., is in the Fox Hills Formation and the basal part of the Hell Creek Formation. The aquifer system, which ranges in thickness from 360 to 520 feet, crops out in western Bowman County and is as much as 940 feet below land surface in Adams County. The beds consist of fine- to medium-grained sandstone interbedded with siltstone and claystone. The transmissivity ranges from 110 feet squared per day in western Bowman County to 540 feet squared per day in eastern Adams County. Bowman, Hettinger, Reed, and Scranton pump about 570 acre-feet of water annually from the aquifer system. The water quality from the aquifer system is generally clear and lower in dissolved solids and sulfate than water in the overlying aquifer systems. Dissolved solids in water samples analyzed ranged from 504 to 1,680 milligrams per liter and averaged 1,050 milligrams per liter. (Woodard-USGS)

GROUND-WATER RESOURCES OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA

Crockett, M. G.

GEOL O GICAL SURVEY, BISMARCK, N. DAK.


Journal Announcement: SWRA0670

In Mercer and Oliver Counties, North Dakota, artesian aquifers consisting of fine- to medium-grained sandstone occur in the Fox Hills and Hell Creek formations of late Cretaceous age. The Tongue River formation of tertiary age, the water is suitable for livestock, domestic, and some industrial uses. The total withdrawal from the artesian aquifers is about 1 million gallons per day. Glacial and alluvial deposits of sand and gravel form potentially productive aquifers beneath the valleys of Goodman, Antelope, Square Butte, and Elm Creeks and the Knife and Missouri Rivers. The aquifers, which are relatively undeveloped, are 1 to 5 miles in breadth, have a maximum thickness of about 250 feet, and contain about 2,640,000 acre-feet of water. aquifer near Stanton has a transmissivity of 176,000 feet per day and a storage coefficient of 0.003. The Missouri River aquifer near Hensley has a transmissivity of 107,000 to 121,000 gallon per foot and a storage coefficient of 0.02. Approximately 137,000 acre-feet of water was used in Mercer and Oliver Counties in 1968, most of this water was taken from the Missouri River for cooling purposes in electric-generating plants and for irrigation. About 2,270 acre-feet was obtained from groundwater sources for industrial, livestock, and domestic use. (Woodard-USGS)

GROUNDWATER BASIC DATA, PART 2 OF GEOLOGY AND GROUNDWATER RESOURCES OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA

Crockett, M. G.

GEOL O GICAL SURVEY, BISMARCK, N. DAK. COMMISSION GROUNDWATER STUDIES 15, 1970. 268 p., 2 Figs, 1 Plate, 6 Tabs, 11 Ref.

Journal Announcement: SWRU322

DATA WERE COLLECTED TO BE USED TO: (1) DETERMINE THE
 resulting from mining (2) develop the capability of making reasonably accurate projections of hydrologic effects resulting from the various land-use changes caused by surface mining. Data collection has been underway since October 1976 for the West Branch Antelope Creek study area in western North Dakota and since March 1978 for the Hay Creek study area in eastern Montana. Data collected during the premining period are being analyzed using statistical methods for the evaluation of the premining conditions. A digital model with the capability of making hydrologic projections is being developed. Most of the model components have been tested during 1979 and 1980. (USGS)

Hydrologic Analysis of High Flow from Snowmelt on Small Basins in the Fort Union Coal Region. Emerson, Douglas G. U.S. Geological Survey

Data from the Surface-Water Hydrologic Investigations of the Hay Creek Study Areas, Montana, and the West Branch Antelope Creek Study Areas, North Dakota, October 1976 Through April 1982

Emerson, Douglas G., Horbeck, Steven W., and Borelfflug, Kelvin L.


Data are provided for the Hay Creek study area near Wibaux, Montana, and the West Branch Antelope Creek study area near Belalak, North Dakota. The report contains data for the following: Air temperature, relative humidity, wind direction, wind run, solar radiation, precipitation, soil temperature, snowpack temperature, snowpack density, and water content; streamflow; water quality; soil moisture; land use, and basin characteristics. Detailed descriptions of the location of the data-collection sites, instrumentation, and methods used to collect data are included.

Progress Report on the Effects of Surface Mining on the Water Use and Hydrology of Selected Basins in the Fort Union Coal Region, North Dakota and Montana

Emerson, O. G.


The purpose of the investigation is to provide a means to assess the impact of surface mining on the water use and hydroplogy of small representative drainage basins and provide historical data with which to compare the magnitude of changes
Hydrogeological Consequences of Strip Mining in the Fort Union Group of Southwestern North Dakota

Houghton, Robert L., U.S. Geological Survey

An increase in lignite production from 0.1 to 3.0 million tons annually from a strip mine near Gascoyne in south-western North Dakota was accompanied by significant degradation in quality and quantity of shallow ground water. Near Gascoyne, the 30-foot Harmon lignite bed of the Bullion Creek Formation of the Paleocene Fort Union Group (designated Fort Union Formation by the U.S. Geological Survey) is an important source of domestic water. The lignite aquifer is recharged principally by precipitation and discharges mainly through its underclay to the underlying slope-basal Bullion Creek sandstone aquifer and by lateral flow to local streams. As recharge to both aquifers is dominated by locally infiltrating precipitation, the quality of shallow ground water is controlled mainly by processes in the unsaturated zone. Laboratory experiments, field observations, and geochemical modeling indicate ground-water quality is controlled largely by dissolution of soil gases, oxidation of iron-sulfide minerals, dissolution of carbonate minerals, precipitation and dissolution of gypsum, cation exchange on clay minerals, cation exchange and adsorption on lignitic materials, and sulfate reduction. Isotopic data indicate organic compounds may control some redox processes.

Most of these chemical reactions occur naturally but are accelerated by mine disturbances. Resultant mine waters are enriched in sodium, sulfate, and bicarbonate with as much as a fivefold increase in dissolved solids.

Oxidation of reactive iron sulfides to sulfate salts proceeds to completion. This process is so rapid that the overburden stripping rate is not limited by this process. Dissolution of sulfate salts is the principal source of solutes to mine waters. As natural waters infiltrating below the root zone of vegetation become saturated with gypsum increased solute loads in mine waters can occur only where sulfate solubilities are increased by complementary reactions, principally involving organic compounds, where spoils materials are devoid of relict lignitic materials, and where mine waters are not significantly enriched in solutes.

Weathering of the lignite aquifer within the mine to facilitate stripping has produced large cones of depression centered on the mine in the lignite and sandstone aquifers. The cone of depression in the saturated aquifer exceeds 30 feet in depth at its center and extends 2 miles beyond mine boundaries. Parts of the lignite aquifer destroyed by mining are re-established in rubble zones at the base of the spoils pile. As compaction of the spoils occurs, its hydraulic conductivity is decreased, limiting aquifer flow and retarding recharge. Long-term deterioration of shallow aquifers mined in recharge areas may be expected.

Composition of Atmospheric Deposition in Western North Dakota

Houghton, Robert L., U.S. Geological Survey

Trace-Element Enrichments in Waters Associated with Strip Mining of Lignite in the Fort Union Group of Southwestern North Dakota

Houghton, Robert L., U.S. Geological Survey

Weathering of outcropping lignite and strip mining in the Fort Union Group near Gascoyne in southwestern North Dakota have resulted in enrichment of several trace elements in local ground and mining waters. The 30-Foot Harmon Lignite at the Bullion Creek Formation of the Paleocene Fort Union Group (as used by the North Dakota Geological Survey) crops out along an east-trending bench in the Gascoyne area and dips north toward the center of the Williston Basin at 30-35 feet per mile. At the Gascoyne mine, weathered lignite (Leonardite) along the outcrop and unoxidized lignite at depth are strip mined within an eight square mile area.

In the Gascoyne area, the shallow Harmon Lignite provides water for local domestic and livestock use. The lignite aquifer is recharged by local precipitation and discharges principally through a basal claystone bed to an underlying sandstone aquifer and by lateral flow to intermittent streams within the mine area. As these streams are also used for livestock water, deterioration of water quality by lignite spoil could force ranchers to develop deeper, more expensive, water sources.

Along the lignite outcrop line, oxidation of the organic components of lignite bed complexes by O2, H2O, and CO2 that are readily dissolved by infiltrating waters. Additionally, oxidation of Fe sulfide minerals makes a variety of chalcophile trace metals available for dissolution. Stripping the overburden during mining accelerates the oxidation of reactive Fe sulfides to completion in the poorly consolidated Fort Union strata, increasing the availability of trace metals like Cd, Cu, Fe, and Zn and their relict Fe sulfides. Additional reactions are solutions of primary Fe sulfides as Fe oxyhydroxides and by local precipitation of Fe oxyhydroxides. The precipitated Fe oxyhydroxides released during weathering of lignite have been converted to secondary Fe oxyhydroxides, including copiapite, melanterite, and jarosite. These Fe oxyhydroxides, as well as sulfates, are readily precipitated as complex sulfate salts, including copiapite, melanterite, and jarosite. Concentrations of these metals in infiltrating waters are controlled by sulfate-salt solubilities, where sulfate salts occur adjacent to relict lignite in the spoils. Solubilities are greatly enhanced by preferential adsorption of Ca and Mg. Five-fold trace-metal enrichments are observed in some parts of the lignite aquifer downstream from active mine pits and in surface waters at base flow. Cadmium, Cu, Pb, and Zn concentrations exceed recommended domestic water criteria.
in many parts of the lignite aquifer. Although concentrations of these trace elements currently do not exceed recommended levels for livestock use, expanded mining may alter this condition.

Weathering of Coal Scoria—A Source for Diagenetic Silica Cements?

Houghton, Robert L., U.S. Geological Survey

Coal scoria, clastic sedimentary rocks baked by the natural incinert combustion of coal, has long been considered relatively inert in most low-temperature geochemical systems. However, chemical weathering of scoria may be important in the early diagenesis of its surrounding strata.

During underground burning of coal, blocks of sediment overburden may fall into the resultant coal furnace and fuse to a glasslike slag. Thus, concentrations of slag usually underlie major coal bodies. Like all glass, this slag is chemically unstable and will hydrate and release silicic acid to the ground-water system, making silica available for other diagenetic processes.

Scoria slag in the Paleocene Fort Union Formation near Gascouyex, North Dakota, is extensively hydrated and associated with minor secondary zeolite. Two such scoria zones are overlain by siliceous sedimentary horizons. One silica-cemented horizon has been described as a silcrete and overlies deeply weathered strata. The second siliceous horizon is comprised of semicontinuous, silica-cemented concretions which formed at depth, perhaps delineating a paleo-water-table position. The similarity of trace-element ratios in slag and associated concretions indicates that hydration of fused scoria is the primary source of siliceous fluids responsible for diagenetic silica cementation of overlying Fort Union sediments. Similar silica cementation is absent in the underlying sediments and at the same stratigraphic level distant from scoria zones.

GROUND-WATER BASIC DATA FOR DUNN COUNTY, NORTH DAKOTA

Klausing, R. L.

GEOLICAL SURVEY, BISMARCK, N. D.

NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 68--PART II, AND NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 65--PART II, BISMARCK, N. D., 1976, 501 P., 3 FIG., 1 PLATE, 10 TAB., 20 REF. 2 APPENDIX.

Journal Announcement: SWRA074, COOPERATIVELY BY THE U.S. GEOLOGICAL SURVEY AND NORTH DAKOTA STATE WATER MANAGEMENT DISTRICT, THE RESULTS OF THE INVESTIGATION WILL BE PUBLISHED IN THREE SEPARATE PARTS, PART (1) IS AN INTERPRETIVE REPORT DESCRIBING THE GEOLOGY OF THE STUDY AREA; PART (2) IS A COMPILATION OF THE GROUND-WATER BASIC DATA; AND PART (3) IS AN INTERPRETIVE REPORT DESCRIBING THE GROUND-WATER RESOURCES. PART (2) THIS REPORT CONTAINS BASIC DATA FOR 7,276 WELLS AND TEST HOLES AND 154 SPRINGS. IT INCLUDES 652 LOSS OF TEST HOLES AND WELLS FOR CHEMICAL ANALYSES OF WATER SAMPLES AND WATER-LEVEL MEASUREMENTS.

IN 140 OBSERVATION WELLS, THE GEOLOGIC FORMATIONS PENETRATED BY DRILLING ARE UPPLI CRETACEOUS, TERTIARY, AND QUATERNARY IN AGE. (WOODARD-USGS)

GROUND-WATER RESOURCES OF MCKEAN COUNTY, NORTH DAKOTA

Klausing, R. L.

GEOLICAL SURVEY, BISMARCK, N. D.

NORTH DAKOTA GEOLOGICAL SURVEY BULLETIN 68, PART III, AND NORTH DAKOTA STATE WATER COMMISSION COUNTRY GROUND-WATER STUDIES 19, PART III, 1974, 73 P., 24 FIG., 1 PLATE, 7 TAB., 45 REF., APPENDIX.

Journal Announcement: SWRA074, GROUNDWATER IN MCKEAN COUNTY, NORTH DAKOTA, IS OBTAINABLE FROM AQUIFERS COMPRIZED OF SAND AND GRAVEL IN THE GLACIAL DEPOSITS AND SANDSTONE AND LIGNITE IN THE PREGLACIAL ROCKS. THE AQUIFERS HAVE GREATES POTENTIAL FOR DEVELOPMENT THAN TO THE GLACIAL DEPOSITS. MUST ARE ASSOCIATED WITH HURLED VALLEYS AND MELT-WATER CHANNELS. A LARGE INTERCONNECTED SYSTEM OF AQUIFERS IS ASSOCIATED WITH HURLED VALLEYS IN EAST-CENTRAL MCKEAN COUNTY. THE AQUIFERS CONTAIN ABOUT 940,000 ACRE-FOOT OF GROUNDWATER IN AVAILABLE STORAGE, WELL YIELDS OF AS MUCH AS 1,500 GALLONS PER MINUTE ARE POSSIBLE FROM THE LAKE NELLY AQUIFERS, OTHER GLACIAL AQUIFERS HAVE WELL YIELDS OF AS MUCH AS 1,500 GPM, WEL YIELDS OF AS MUCH AS 1,000 GPM SHOULD BE OBTAINABLE FROM MISSOURI RIVER IN WESTERN MCKEAN COUNTY. WATER FROM

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North Dakota

North Dakota
The aquifers in the glacial deposits is predominately a sodium bicarbonate or calcium bicarbonate type and is usually hard to very hard. Wells tapping the Fort Union group of Paleocene age generally yield from 5 to 75 gpm; however, in places yields as great as 200 gpm may be possible. The water type is predominately a sodium bicarbonate type. Wells tapping the Hells Creek and Fox Hills formations yield from 10 to 50 gpm. The water is predominately a sodium bicarbonate type. (KNAPP-USGS)


Geological survey hydrologic investigations Atlas HA-475, 1972. 1 sheet, 1 fig, 1 map, 1 tab, 6 ref.

Journal Announcement: SWAUS23

This one-sheet hydrologic atlas describes the occurrence and movement of groundwater in "Clean County," N. Dak., including the sources and areas of recharge and discharge, the potential yields of wells tapping the major aquifers, and the chemical quality of the groundwater. Important aquifers occur both in the glacial drift and in the underlying bedrock formations. The major glacial-drift aquifers generally will yield more than 50 gpm to individual wells and in places will yield more than 1,000 gpm. Three bedrock units—the Fort Union formation, Hells Creek formation, and Fox Hills Sandstone—supply water to wells. In McLean County, the most productive bedrock aquifers consist of sandstone and lignite beds. Wells from the bedrock aquifers is predominately soft and is a sodium bicarbonate type. Water from the glacial-drift aquifers is generally harder but less saline and of better quality than water from the bedrock aquifers. (WOODARD-USGS)


North Dakota Geological survey bulletin 50—part III, and North Dakota Water Commission county groundwater studies 11—part III, 1971. 100 p. 31 fig, 2 plate, 8 tabs, 68 ref.

Journal Announcement: SWAUS03

Two types of aquifers occur in Renville and Ward counties, North Dakota—those in the semiconsolidated and consolidated bedrock formations and those in the unconsolidated glacial deposits. The Fort Union Group contains the most productive bedrock aquifers. Generally, water from the Fort Union is a sodium bicarbonate type or a sodium chloride type. The water is unsuitable for irrigation and in many places is undesirable for domestic use. Deposits of Quaternary age comprise the major aquifers with yields of more than 500 gpm of good quality water. The most productive aquifers are in the valleys of the Souris and Des Lacs rivers. Well yields of more than 500 gpm are available from the Kenmare aquifer and locally from aquifers in the Souris River valley between Minot and Logan, northwest of Minot, and between Logan and Washburn. Cold water can be expected. Much of the water in the valley aquifers is suitable for domestic, municipal, and industrial uses. Substantial quantities of groundwater are stored in surficial sand and gravel deposits in ice-marginal channels. In most places the water had a specific conductance that is less than 1,000 micromhos. (WOODARD-USGS)


Journal Announcement: SWAS801

Thisbasic-data volume is part 2 of a series. Part 1 describes geology and part 3 describes the groundwater resources of the 2 counties located in north-central North Dakota. The basic data are useful for predicting geologic and groundwater conditions at a proposed well site. Tables list (1) descriptive data for 1,737 wells and test holes; (2) water-level measurements in 81 wells; (3) logs of 242 test holes and wells; and (4) chemical analyses of 476 water samples. Aquifers in the counties are consolidated bedrock units and glacial deposits.

Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming.

Open-File Report 75-631, December 1975. 31 p. 5 fig, 2 tabs, 43 ref. 77-03332. (duplicated see Wyoming).


Journal Announcement: SWAUS02 Chieflly between 1971 and 1974. The data includes: (1) geologic and measurements in 77 observation wells; (3) lithologic and geophysical logs of 257 test holes and wells; (4) 15 chemical analyses of groundwater; (5) 15 chemical analyses of water from streams during low flow.
Ground-Water Resources of Grant and Sioux Counties, North Dakota

Randle, P. G.

Journal Announcement: SWR1311

Ground water in Grant and Sioux Counties is obtainable from aquifers of Late Cretaceous Tertiary, Pleistocene, and Holocene age. The major bedrock aquifers in the counties are the Fox Hills and Hell Creek aquifers of Late Cretaceous age and the Cannonball and Tongue River aquifers of Tertiary age. Potential yields to individual wells range from about 5 to 150 gallons per minute. The water generally is soft and high in dissolved solids. Aquifers of Pleistocene age--the Shields, Elm Creek, St. James, Beaver Creek, and Battle Creek aquifers--underlie about 48 square miles in Grant and Sioux Counties. Well yields of as much as 1,000 gallons per minute are obtainable in a few places along the central axes of these aquifers. The major dissolved constituents in water from these aquifers are calcium, magnesium, sodium, bicarbonate, and sulfate. Aquifers of Holocene age are located in the alluvial deposits in the Cannonball River, Heart River, and Cedar Creek valleys. Potential well yields generally are less than 50 gallons per minute. (Kosco and USGS)

Ground-Water Data for McHenry County, North Dakota

Randle, P. G.

Journal Announcement: SWR1420

The purpose of the investigation in McHenry County, N. Dak., was to provide detailed geologic and hydrologic information needed for the orderly development of water supplies for municipal, domestic, livestock, irrigation, industrial, and similar uses. Specifically, the objectives were to: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of ground water; including the sources of recharge and discharge; (3) estimate the quantities of water stored in the glacial aquifers; (4) determine the yield of wells tapping the major

Summary of Appraisals of the Nation's Ground-Water Resources--Souls-Red-Rainy Region

Reeder, H. O.

Journal Announcement: SWR1122

A broad--perspective analysis of the ground-water resources and present and possible future water development and management in the Souls-Red-Rainy Region is presented. The region includes the basins of the Souris River within Montana and North Dakota; the Red River of the North in South Dakota, North Dakota, and Minnesota; and the Rainy River within Minnesota. The region includes 59,465 square miles, mostly in North Dakota and Minnesota. This report is one of a U.S. Geological Survey series that summarizes information on the Nation's ground-water for the guidance of planners. New data were not collected for the appraisal, but information has been utilized. In addition to summarizing the knowledge of ground-water resources of the region, the report points out deficiencies of knowledge. The primary objective of evaluating information deficiencies is to direct attention to types of studies and information that will lead to fuller understanding and description of ground-water reservoirs for future water supply planning and management of the region's management of all water resources, ground water can assume greater significance in the region's development. (Ward and USGS)

The Geochemistry of the Fox Hills-Hell Creek Aquifer in Southwestern North Dakota and Northwestern South Dakota

Thorstenson, D. C.; Fisher, D. W.; Crofts, M. G.
Water Resources Research, Vol. 11, No. 4, p. 1479-1488.
December 1979, 9 Fig., 5 Tab., 69 Ref., Journal Announcement: SWR1318

The Upper Cretaceous Fox Hills Formation and the basal part of the overlying Hell Creek Formation constitute an important aquifer in the Fort Union coal region. Throughout most of southwestern North Dakota and northwestern South Dakota the aquifer is at depths ranging from 1,000 to 2,000 feet, except for exposures along the Cedar Creek anticline, where water flows in the aquifer from southwest to northeast with flow rates of a few feet per year. The recharge and discharge areas of the aquifer are separated by a north-south trending transition zone in which significant changes in water chemistry occur. Computer modeling and carbon isotope data suggest the following reactions in the recharge area: Carbon dioxide derived from lignitic carbon reacts to dissolve carbonate minerals with cations, such as Ca²⁺, resulting in: (1) formation of Na⁺ and Mg²⁺; (2) Hydrogen-ion concentration is continuously buffered by the carbonate-ion exchange equilibria. These changes can be accounted for by reactions in the aquifer: (1) Sulfate is reduced by lignitic carbon with formation of pyrite; (2) Hydrogen-ion concentration is continuously buffered by the carbonate-ion exchange equilibria. Chemical and hydrologic data suggest that the increase in sodium chloride results from upward movement of small volumes of water into the Fox Hills aquifer from the transition zone eastward. Redox reactions in the aquifer are closely analogous to those observed in pore waters of reducing marine sediments. Reactions, approach but not achieve, true thermodynamic equilibrium. Measurements of redox potential suggest a down-gradient decrease in redox potential. The measurements are not amenable to quantitative interpretation. (Kosco-USGS)

GEOLOGY AND GROUND-WATER RESOURCES OF HETTINGER AND STARK COUNTIES, NORTH DAKOTA
TRAPP, H. J.; CROFT, M. G.
DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, BISMARCK, N. DAK.
NORTH DAKOTA STATE WATER COMMISSION, BISMARCK, N. DAK.
GROUND-WATER STUDIES, 16-1975, 51 P., 14 FIG., 6 PLATS, 4 TAPS. 52 REF.
Journal Announcement: SWR1315

The sedimentary rocks of Paleozoic, Mesozoic, and Cenozoic age in Hettinger and Stark counties, north dakota, are almost entirely thick, they are gently folded. The north-plunging anticlines and synclines, the Fox Hills and Black Hills Creek Aquifer System underlies the entire area at depths greater than 1,000 feet. The Water in this system is a Sodium bicarbonate type with a sentinele butte Aquifer System underlies all of Hettinger and Stark counties. The water contains a sodium bicarbonate type with a in the Basin. The sedimentary rock is generally a sodium bicarbonate type with a sentinele butte Aquifer System underlies most of Stark County. The water is generally of a Sodium sulfate type. Dissolved-solids concentration of the water was obtained from ground water and surface-water sources in 1969. Ground Water Sources Furnished about 40 percent of the total Water Supply. (Woodard-USGS)

GROUND WATER BASIC DATA, HETTINGER AND STARK COUNTIES, NORTH DAKOTA
TRAPP, HENRY JR
DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, BISMARCK, N. DAK.
GROUND-WATER STUDIES, 1974, 51 P., 7 FIG., 7 TAB., 19 REF.
Journal Announcement: SWR1416

Hydrologic investigations were made in Hettinger and Stark counties, N. DAK., TO DETERMINE THE QUANTITY AND QUALITY OF GROUNDWATER AVAILABLE FOR MUNICIPAL, DOMESTIC, LIVESTOCK, INDUSTRIAL, AND IRRIGATION USES. The information was collected between 1966 and 1969, and consists of the following: (1) Data on 3,000 Wells and Test Holes; (2) Data on 91 Springs; (3) Water-level Measurements in 61 Observation Wells; (4) Logs of 544 Test Holes and Wells; (5) Chemical Analyses of 261 Water Samples; (6) Color Values of 351 Water Samples; and (7) 59 Particle-Size Distribution Curves. The data are presented in Tables and Maps. (Wood-USGS)


Journal Announcement: SWR1505

Water-resources studies and investigations in North Dakota made by the U.S. Geological Survey in cooperation with State and Federal agencies are summarized. The investigations include data-collection projects, county ground-water studies, regional water-resource studies, aquifer evaluations, energy-related water-resource studies, and special investigations. The special investigations include snow survey research, ground-water quality sampling technique research and hydrologic response changes on a major stream. (USGS)
WATER RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF WYOMING, MONTANA, AND NORTH DAKOTA, 1975
GEOLOGICAL SURVEY, DENVER, COLO. WATER RESOURCES DIV.
OPEN-FILE REPORT: MAY 1975, 50 P., 27 FIG., 27 REF.,
Journal Announcement: SWRA0824
THE GEOLOGICAL SURVEY'S WATER RESOURCES DIVISION HAS FOR MANY YEARS MAINTAINED A PROGRAM OF WATER-RESOURCES INVESTIGATIONS THAT INCREASES THE COAL REGIONS OF WYOMING, MONTANA AND NORTH DAKOTA. THE RECENT INTEREST IN COAL HAS ADDED NEW DIMENSIONS AND GREATER INTENSITY TO THE INVESTIGATIONS. THE WORK HAS EXPANDED TO INCLUDE MONITORING THE ENVIRONMENTAL EFFECTS OF COAL MINING AND PROCESSING AND TO DETERMINE THE AVAILABLE AMOUNTS OF WATER SUPPLIES FOR COAL-CONVERSION PLANTS AND RELATED DEMANDS. THIS REPORT DESCRIBES THE WATER-RESOURCES INVESTIGATION PROGRAM THAT IS CURRENTLY IN OPERATION. LOCATIONS OF SAGING STATIONS AND WATER-QUALITY MEASURING SITES, FREQUENCIES AND PARAMETERS, AND AREAS OF GROUNDWATER STUDIES ARE INCLUDED. BRIEFS OF SELECTED STUDIES BY INVESTIGATORS WHO ARE HEADQUARTERED OUTSIDE THE NORTHERN GREAT PLAINS COAL REGIONS ARE ALSO INCLUDED. SUCH STUDIES ARE RESEARCH IN TOPICS RELATED TO COAL EXTRACTION, WATER SUPPLY, AND POST-MINING RECLAMATION. (WOODARD-USGS)

WATER-RESOURCES INVESTIGATIONS IN THE FORT UNION COAL REGION, NORTH DAKOTA, 1975-76
GEOLOGICAL SURVEY, BISMARK, N.DAK.
OPEN-FILE REPORT: JANUARY 1975, 23 P., 11 FIG.,
Journal Announcement: SWRA0910
Owing to the current emphasis on energy development, a rather large number of geologic and hydrologic studies either are underway or are proposed by a number of agencies and private companies working in the Fort Union coal region of North Dakota. The purpose of this report is to inform agencies, private companies, and the public in general of the on-going and completed work in the Fort Union coal region by the water resources division of the U.S. geological survey. The work done by the water resources division in North Dakota is listed by sequential project identification number. Some of the projects are primarily concerned with data collection. Others involve interpretation in addition to data collection. The results of all projects are made available to the public in various forms of publication. (WOODARD-USGS)

WATER-RESOURCES INVESTIGATIONS IN THE FORT UNION COAL REGION, NORTH DAKOTA, 1974-76
GEOLOGICAL SURVEY, BISMARK, N.DAK.
OPEN-FILE REPORT: JANUARY 1975, 42 P., 10 FIG.,
Journal Announcement: SWRA0819
Owing to the current emphasis on energy development, a rather large number of geologic and hydrologic studies either are underway or are proposed by a number of agencies and private companies working in the Fort Union coal region of North Dakota. The purpose of this report is to inform other agencies, private companies, and the public in general of the on-going and recently completed work by the water resources division of the U.S. Geological Survey in the Fort Union coal region. The work done by the water resources division in North Dakota is listed by sequential project identification number. Some of the projects are primarily concerned with data collection. Others involve interpretation in addition to data collection. A summary of each project includes objectives, cooperators, and availability of the report. (WOODARD-USGS)

Ground-Water Data for selected coal areas in Western North Dakota

Ground-water data are provided for the Sand Creek-Hanks, New England-Potts, Dickinson, and Howan-Gascoyne coal areas in western North Dakota. The report contains the following: (1) Maps showing the location of wells, springs, and test holes; the location of test holes; where drillers' logs are available; and the location of water with chemical analyses; and (2) tables showing well, spring, and test hole records; logs; and chemical analyses of water.
The 4.2 square mile Beulah Trench site in the Renners Cove Coalfield of the Williston Basin is characterized by rolling hills, bordered by flat miltwater channels on the east and south. Most of the site is drained by tributaries to ephemeral Antelope Creek. Annual precipitation is about 15 inches plus and evaporation is estimated to be 36 inches annually. The hills are underlain by bedrock. Till and alluvium cover the low lands. Nearly 110 million tons of coal are in beds more than 2.5 feet thick covered by less than 300 feet of overburden. Most of the coal is in the Beulah-Zap bed, part of the Sentinel Butte Member of the Paleocene Fort Union Formation. Small amounts of unconfined and semi-confined water occur in disconformable sandstone layers above the coal. Small amounts are also found confined in the coal. Dissolved solids ranged from 1,010 to 2,150 milligrams per liter. Larger quantities of more highly mineralized water undoubtedly occur in deeper aquifers. Moderate to large quantities of water are available in the buried valleys on the east and south borders of the site. Mining would dewater the coal and aquifers above. Recharge, of poorer quality, to the buried valley aquifers would be hastened.

Falkirk Coal Lease Application, central North Dakota
BLM, Miles City, Montana
EA, 1976

This document analyses the impacts of leasing 998.87 acres of Federal coal (19.2 million tons) in 8 scattered tracts (1/4 section or smaller) in McLean County, central North Dakota. Refusal to lease would leave the Federal coal isolated and economically unrecoverable. The tracts are in the prairie pothole region which is underlain by a veneer of glacial deposits. Relief is generally less than 25 feet. Precipitation is about 13 inches per year. Surface drainage is internal and most of the potholes contain brackish to briney water and many are ephemeral. Coal is in two seams totaling 11 feet thick, in the Sentinel Butte Formation at the top of the Upper Cretaceous Fort Union Group. Ground water occurs in the sandstones of the Fort Union Group below the coal, and in the underlying Hell Creek and Fox Hills Formations. Well yields range up to 75 gallons per minute, and dissolved solids range from 206 to 3,550 milligrams per liter. Wells in buried glacial channels in the vicinity yield as much as 200 gallons per minute of water containing from 277 to 1,360 milligrams per liter dissolved solids. Surface mining of these leases would have little influence on their hydrology.

Beulah Trench Study Site Coal Resource and Surface Mining Potential
Reclamation Evaluation in Mercer County, west-central North Dakota
BLM, Denver, Colorado
EMRIR Report No. 10-77

This analysis examines and records possible impacts of BLM leasing 480 acres of Federal coal in three separate parcels in Mercer County, west-central North Dakota. No leasing would bypass the coal and would leave it uneconomical to mine in the future. About 9.5 million tons of coal occur in the Tongue River Formation under 140 feet or less of overburden. The lease areas, on a broad, gently rolling dissected plateau, drain to intermittent Alderlin Creek. Much of the area is veneered with glacial till. Annual precipitation 10 miles south is 17.83 inches. Small quantities, less than 10 gallons per minute, of water occur in the coal, and as much as 150 gallons per minute have been obtained from basal Hell Creek-Fox Hills sandstones below the Tongue River. Water quality ranges between 1,070 and 2,000 milligrams per liter total dissolved solids. Mining of this coal would have little hydrologic impact in addition to that already taking place.

Glenharold Mine Coal Lease, west-central North Dakota
BLM, Miles City, Montana
DTEA, 1976

This analysis assesses impacts of leasing 1,668.08 acres of Federal coal in seven tracts scattered among ongoing mining of private and existing Federal leased coal in Mercer and Oliver Counties, southwest-central North Dakota. Failure to lease would leave Federal coal in uneconomically minable units. The 25-square-mile area is mostly a broad, gently rolling plateau dissected by Missouri River Valley ravines on the northeast. A thin glacial till veneers most of the Tongue River Formation’s glacial bedrock topography. The coal is in the Hazel bed (4 to 6 feet thick) and the lower Stanton bed (7 to 17 feet thick) of the Paleocene Tongue River Formation. Overburden, of clay and boulder till, siltstone, and claystone, averages 110 feet thick. Annual precipitation is 17.83 inches. Drainage is by ephemeral tributaries to the Knife River on the southwest and the Missouri River to the east. Runoff is about one inch per year. Ground water recharge is negligible. Mining would increase erosion and sedimentation until rehabilitation is complete, and would increase salinity of shallow ground water and dry up seeps.

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BLM, Miles City, Montana
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This document evaluates impacts of 3 levels of energy development (surface coal mines and electric generating and coal gasification plants) in seven counties (Burleigh, Dunn, McLean, Mercer, Morton, Oliver and Stark). The area is bisected by the Missouri River Trench, the Missouri River, and its Sakakawea and Oahe Reservoirs. About a third of the area, which is northeast of the river, is underlain by a dissected bedrock surface veneered by glacial deposits, physiographically a part of the Missouri Coteau and Coteau Slope. Maximum local relief is about 25 feet. Most of the area southwest of the river is a gently, northeast sloping plateau containing rolling prairie, isolated buttes, mesas and badlands. Precipitation is 16 to 18 inches per year. The area northeast of the river is poorly drained and contains many small lakes, ponds and sloughs. Most of the area southwest of the river is drained into the Missouri River by the Knife and Hart Rivers and smaller tributaries. About 5 billion tons of strippable coal is in the Sentinel Butte and Tongue River Formations, which gently dip westward to the center of the Williston Basin. Moderate quantities of confined water, generally less than 50 gallons per minute, but exceptionally more than 100 gallons per minute have been obtained in the coal and sandstone layers above the underlying Pierre Shale. Water quality ranges from suitable to marginal for domestic and stock use. Below the top of the Pierre Shale, about 2,000 feet deep, water is too mineralized for domestic and stock use. Buried glacial meltwater channels have produced as much as 1,500 gallons per minute of usable quality water. More than adequate, as much as 300,000 acre-feet per year from Sakakawea Reservoir, good quality water is available from the Missouri River system. Level 1 development, two electric generating plants, two gasification plants and 4 strip mines, would require about 52,000 acre-feet of water per year, mostly for cooling, a significant part of which would be returned to the river system. Level 2 development which would add one electric generating plant, 5 new surface mines and expand one existing surface mine, would require an additional 10,000 acre-feet of water per year, mostly for cooling. Level 3 would increase coal extraction by 4.6 million tons per year and would require relatively insignificant additional water. Surface mining would reduce local tributary stream flows less than one percent, lower water levels in wells within one mile of the mines, destroy existing wells and springs, modify shallow aquifers, lose small surface water bodies, and degrade water quality. Plant operations would increase Missouri River temperature by an measurably small increment and increase individual mineral constituents by less than 0.1 to 0.4 percent.
SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—OHIO REGION

BLODGE, R. M., JR.
GEOLOGICAL SURVEY, RESTON, VA.
AVAILABLE FROM SUPT. OF DOCUMENTS, GPO, WASHINGTON, D.C.
20402—$1.75 (PAPER COVER). PROFESSIONAL PAPER 813-A, 1974. 41 P., 22 FIG., 13 TAB., 25 REF.,
Journal Announcement: SWAUS21

GROUNDWATER IN THE OHIO REGION IS A LARGE, IMPORTANT, AND MANAGEABLE RESOURCE THAT SHOULD HAVE A SIGNIFICANT ROLE IN REGIONAL WATER DEVELOPMENT. ON THE BASIS OF A COMPARISON OF GROUNDWATER WITHDRAWALS WITH ESTIMATED GROUNDWATER RECHARGE, THE GROUNDWATER RESOURCES PROBABLY WILL NOT BE USED AT FULL POTENTIAL UNDER EXISTING DEVELOPMENT PLANS. ANNUAL GROUNDWATER USE (1960) MUNICIPALITIES AND RURAL RESIDENTS WAS ABOUT 1,000 MILLION GALLONS PER DAY. AVERAGE ANNUAL REGIONAL GROUNDWATER RECHARGE IS ABOUT 35,000 MGD. THEREFORE, BASE-YEAR (1960) MUNICIPAL AND RURAL GROUNDWATER USE IS ONLY ABOUT 3% OF RECHARGE. ANNUAL REGIONWIDE GROUNDWATER USE (1965) BY INDUSTRY ALSO IS ONLY ABOUT 3% OF RECHARGE. TOTAL POTABLE GROUNDWATER AVAILABLE FROM STORAGE IN THE OUTWASH AND ALLUVIAL AQUIFERS IN THE OHIO RIVER VALLEY AND THE SUBRASINS IS ABOUT 23,000 BILLION GALLONS. THIS IS ABOUT FOUR TIMES THE FLOOD-CONTROL STORAGE OF ALL OHIO REGION CORPS OF ENGINEERS RESEVOIRS CONSTRUCTED, UNDER CONSTRUCTION, OR IN ADVANCE PLANNING AS OF JULY 1965, APPROXIMATELY 85,000 BILLION GALLONS OF POTABLE GROUNDWATER IS AVAILABLE FROM STORAGE IN AQUIFERS OTHER THAN THE OUTWASH AND ALLUVIAL AQUIFERS. (WOODARD-USGS)

Hydrology of Area 7, Eastern Coal Province, Ohio
Engelke, M. J., Jr., Roth, D. K., and others, 1981

Ground-Water Hydrology of Strip-Mine Areas in Eastern Ohio
(Conditions During Mining of Two Watersheds in Coshocton and Muskingum Counties)
Geological Survey Open-File Report 81-913 (WRI), 1981. 25 P., 14 FIG., 2 TAB., 5 REF.,
Journal Announcement: SWAUS1512

Ground-water conditions during coal strip mining in two small watersheds are described as part of an ongoing study of effects of mining on hydrologic systems. Each watershed was underlain by stratified sedimentary rocks containing two perched aquifers above clays which underlaid the major coal seams. Mining involved removing the over-burden rocks, including the
top aquifers, striping the top coal seam, and recontouring the
overburden spoils to the approximate premining shape of the
watersheds, water-levels in the top aquifer declined as mining
near the watersheds, but destruction of observation wells
reduced a record of the decline during mining of the
watersheds, and completion of the top aquifer was reflected in stream
base flow, which was reduced and more highly mineralized
after mining. Initial saturated thickness of replaced overburden
soils was greater than that in the premining top aquifer. No immediate significant
effects of mining are evident on groundwater levels or quality
beneath the stripped coal. (USGS)

Surface Water Quality in Ohio's Coal Regions
Helsel, Dennis R., and Pfaff, Christine L.
U.S. Geological Survey Papers Presented Before the Abandoned
Mine Reclamation Symposium
Water quality at base flow for 150 streams located within the
coal producing areas of eastern Ohio was inventoried during 1975-76 in a two-phase study. Phase one, a reconnaissance to
relate water quality to land use, demonstrated significant
differences in levels of pH, total alkalinity, total aluminum,
specific conductance, and sulfate between unlined watersheds and
those containing abandoned coal mines. Reclaimed basin waters
produced waters similar to those from unlined watersheds for pH, total
iron, and total aluminum concentrations, whereas specific conductance
and sulfate concentrations were lower in the reclaimed basin. Alkalinity and pH varied not only with
type of mining operation but with the underlying geologic
formation.

In the second phase of this study, four watersheds were
selected from among the first-phase sampling sites. Types of
mining represented were abandoned drift mine, abandoned surface
mine, reclaimed surface mine, and reclaimed surface mine. Samples
from drainage upstream and downstream from the mine sites
were collected to describe any chemical changes within the
watershed associated with mining activity. The reclaimed surface
mine site did not significantly affect quality in the main stream
channels, whereas water quality was altered in the other three streams
because of mining activity.

Hydrology of Area 3, Eastern Coal Province, Pennsylvania
Herby, W. J., Shaw, L. C., Brown, D. E.,
Geological Survey Open-File Report 81-537 (U.S.), September
1981. 58 p. 65 Figs. 26 Tab. 29 Ref. Appendix.
Journal Announcement: SW81-1511
Hydrologic data are presented for area 3 of the Eastern Coal
Province, 4,077 square miles of the lower Allegheny River

bassin in western Pennsylvania. Seventy-three streams were
sampled three times during the 1979 and 1980 water years for
specific conductance, pH, total alkalinity, dissolved and total iron,
dissolved sulfate, total iron, total manganese, and dissolved sulfate indicative of
acid-mine drainage. These streams were most common in the
Redbank and Blacklick Creek basins and in the Conemaugh and
lower Kiskiminetas River basins. Benthic invertebrates were not
found in 11 of 64 streams sampled. An additional 13 streams
had low benthic invertebrate diversity indices. Low diversity
indices were most common in the southern part of area 3. Low
flow, mean flow, peak flow, and flow duration data are
presented for gaging stations in area 3. Data used in estimating these data for ungaged sites are presented and
referred. The functions of, and access to, the National
Water Data Exchange, National Water Data Storage and
Retrieval System, and Office of Water Data Coordination
are explained. (USGS)

Water Resources Data for Ohio Coal Areas, Water Year 1979-80
available from the National Technical Information Service
Springfield, VA 22161 as PB81-115405, in paper copy in
microfiche.
Herbert, L. R.
160 p. 2 fig. 3 tables.

Water Resources of the Black Hand Sandstone Member of the
Cuyahoga Formation and Associated Aquifers of Mississippian Age
in Southeastern Ohio
Norris, Stanley A., and Mayer, Gregory C.
The Black Hand Sandstone Member of the Cuyahoga Formation and
associated aquifers of Mississippian age, including the
Allensville Conglomerate, member of the Logan Formation,
were investigated in a 1,500-square-mile area, parts of five counties
in southeastern Ohio. The aquifers crop out in western Vinton,
western Jackson and southwestern Fairfield Counties. They dip
southwestward about 35 feet per mile, becoming progressively more
deeply buried until at Lake Hope, in northeastern Vinton County,
the aquifers are the deepest sources of potable ground water in
Ohio occurring at depths locally exceeding 200 feet.
These aquifers are the chief sources of water beneath the
coal-bearing rocks of the Pennsylvania System and are widely used for farm and home requirements. Specific capacities of wells are low, exceeding 1 gallon per minute per foot of drawdown only in scattered areas.

At Mayfield (in Vinton County, the aquifers yield about 100,000 gallons per day for municipal and industrial use but withdrawal has been accompanied by declining ground-water levels during the past 10 years in a 10-square-mile area. Transmissivity determined from wells open to both the Black Hand Sandstone Member and Attleboro Conglomerate Member at Mayfield's west municipal well field is about 115 square feet per day.

The ground water is predominantly of the sodium bicarbonate type in the central part of the area and changes as it moves down to a sodium chloride bicarbonate type. Along the eastern boundaries of Hocking and Vinton Counties, the aquifers are below the common depth of wells and are presumed to be potable but contain water too salty for ordinary use. Locally, the aquifers are contaminated by brine from oil and gas wells.

Assessment of Water Quality in Streams Draining Coal-Producing Areas in Ohio

Pfaff, C. L.; Helsel, D. R.; Johnson, D. P.; Angelov, C. G.

Geological Survey Water Resources Investigations Open-File Report 81-409; October 1981, 98 p, 17 Fig, 7 Tab, 45 Ref, Append.

Journal Announcement: SWRA1511

Water quality in the coal-producing areas of eastern Ohio was studied in a two-phase investigation between May 1975 and August 1976. Results of phase one, a reconnaissance of water quality at 150 sites, indicated that acid mine drainage generally occurs where abandoned drift or strip mines were located, whereas areas characterized by reclaimed or active strip mines showed few instances of acid drainage. Phase two was a detailed study of four small basins: One contained abandoned drift mines; the second, abandoned strip mines; the third, reclaimed strip mines; the last, active strip mines. Results of phase two were similar to those of phase one. (USGS)

Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and West Virginia

Roth, D. K.; Engelke, M. J., Jr


Journal Announcement: SWRA1511

Area 4 (one of the 24 hydrologic areas defining the Eastern Coal Province) is located at the northern end of the Eastern Coal Province in eastern Ohio, northern West Virginia, and western Pennsylvania. It is part of the upper Ohio River Basin, which includes the Beaver, Mahoning, and Shenango Rivers. The area is underlain by rocks of the Pottsville, Allegheny, Conemaugh, and Mazonia Groups (or Formations) and Dunkard Group. Area 4 has a temperate climate, with an annual average rainfall of 40 to 42 inches; most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-67, 152 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water quality, sediment, and biology. The data are available for computer storage through the National Water Data Exchange (NAWDEX) or the published annual Water Resources Data reports for Ohio, Pennsylvania, and West Virginia. Hydrologic problems related to mining are: (1) Erosion and increased sedimentation, and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage effluent in area 4 comes from underground mines. The rest seeps from abandoned surface mines. Usually in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that oxidation of acid-forming minerals, commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils. (USGS)

Water Resources Data for Ohio (published annually since 1975).


Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for Ohio consist of records of stage, discharge, and water-quality of streams, stages, contents, and water-quality of lakes and reservoirs; and water levels and water-quality of wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, Federal, and other governmental agencies in Ohio. (Woodard-USGS)
Rainfall-Runoff Hydrograph and Basin Characteristics Data for Small Streams in Oklahoma

Bergman, O. L.; Huntzinger, T. L.


Journal Announcement: SWRA1509

Rainfall with concordant runoff events recorded at 45 gages located in drainage basins of less than 30 square miles in Oklahoma are summarized. Selected basin characteristics which relate to storm runoff are described and tabulated for each gage site summarized. A tabulation is included which identifies drainage basins that produce atypical rainfall-runoff distribution as a result of regulation by upstream flood-retention structures. (USGS)

Geology and oil and gas resources of Craig County, Oklahoma


Geology and coal resources of the Henryetta mining district, Okmulgee County, Oklahoma

Dunham, R. J., and Trumbull, J. V. A., 1955


Groundwater in the Verdigris River basin, Kansas and Oklahoma

Fader, S. W., and Morton, R. H., 1975


Investigation of the coal reserves in the Ozarks section of Oklahoma and their potential users

Friedman, S. A., 1974


Map of eastern Oklahoma showing locations of active coal mines, 1977-79


Oklahoma Geological Survey Map 6R-24, 1 sheet, scale 1:500,000

Geology of the Greenwood quadrangle, Arkansas-Oklahoma


Geology of the Van Buren and Lavaca quadrangles, Arkansas and Oklahoma


The U.S. Geological Survey has collected data on Oklahoma's ground-water resources since 1934. This report makes available both published and unpublished water-quality records for approximately 1,740 wells, test holes, and springs in 39 counties in eastern Oklahoma. (Woodard-USGS)


This atlas of maps and cross sections describes geology and Earth Resources for Oklahoma. Rocks of every geologic period crop out in Oklahoma. Although most of these rocks are of sedimentary origin, consolidated from sediments deposited during the Precambrian era, the oldest are Precambrian. The younger rocks include the Phanerozoic, which form the surficial layer of the Earth. The western Panhandle to as much as 56 inches in the southeastern part of the state. Major groundwater aquifers are stream deposits, alluvium, terrace deposits, and the Ogallala Formation, limestone, sandstone, and gypsum. These aquifers are estimated to contain more than 300 million acre-feet of water. The entire state is drained by the Arkansas and Red rivers and their tributaries. Each year approximately 15 million acre-feet of water flows into the state through these streams, 22 million acre-feet is added by precipitation, and 35 million acre-feet flows out. The mineral content of groundwater from stream deposits, limestone, and sandstone is typically low to moderate, and the water is suitable for most purposes. Highly mineralized water is unfit for nearly any use; is present beneath freshwater in all parts of the state. (Woodard-USGS)


Statistical summaries of surface-water-quality data for 47 streams in Oklahoma have been compiled; data for the period of record through the 1975 water year. At each site we used to develop regression equations for specific conductance--constituent relationships for calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, silica, and dissolved solids. Tables include minimum, mean, and maximum values for selected constituents for the period of record through the 1975 water and for individual water years. (Woodard-USGS)


This 4-sheet atlas describes the water resources for the Tulsa, Oklahoma, area. Surface water is the major source of water used in the Tulsa quadrangle. The total amount of water used in 1968 is estimated at 25.4 million gallons. Approximately 25.4 million gallons of water is used annually.
Other rock types yield water usually highly mineralized. Particular quality maps, coal groundwater of parts of people; water from rocks weathered between springs and some of structure also affects Oklahoma ground water districts. Had been established by the end of 1967, these approximately 15,000 people; all the water was taken from surface-water sources. (Woodard-USGS)


The geology and water resources of the Fort Smith Quadrangle, Oklahoma are shown by a 4-sheets hydrologic atlas consisting of a geological map, a groundwater availability map, a groundwater quality map, a map showing distribution of precipitation, hydrographs, tabulated data, and descriptive text. In some parts of the quadrangle, wells readily yield several hundred gallons of water per minute suitable for most purposes, whereas in other parts, supplies of water sufficient for daily household use are difficult to obtain and much of this water is of poor quality. Differences in well yield and water quality are controlled mainly by the type of rock in which a well is completed. In general, alluvium is the most favorable type of rock or large well yields, followed by terrace deposits in local areas and then, in order of decreasing favorability, weathered chert, limestone, sandstone, and siltstone. With shale the least frequent. In addition to rock type, geologic structure also affects the occurrence of groundwater, particularly in the northeastern part of the area where springs and some of the wells of large yield apparently obtain water from rocks broken by faulting. Minor streams in the area go dry or nearly dry almost every year. Alluvium yields ground water of the best quality and shale to poorest, whereas other rock types yield water with a quality somewhere between. Groundwater that has been in contact with coal beds is usually highly mineralized and, in some places, unfit to drink. Coal mining and gas-field development may adversely affect the water quality locally. (KNAPP-USGS)

Statistical summaries of streamflow records, Oklahoma, through 1974

Mize, L. D. 1975

Ground water in the Grand (Neosho) River basin, Kansas and Oklahoma
Horton, R. B., and Fader, S. W., 1975

Geology and mineral resources of Washington County, Oklahoma
Oakes, M. C., 1940

Geology and mineral resources of Tulsa County, Oklahoma
Oakes, M. C., 1952
Oklahoma Geological Survey Bulletin 69, 234 p

Flood characteristics of Oklahoma streams
Sauer, V. B., 1974

Mineral resources of northeastern Oklahoma
Stiebenhal, C. E., 1978

Water type and suitability of Oklahoma surface waters for public supply and irrigation. Part 1: Arkansas River mainstem and Verdigris, Neosho, and Illinois River basins through 1978

Water-quality data in the Arkansas River mainstem and the Verdigris, Neosho, and Illinois River basins within Oklahoma were examined for water type and suitability for public water supply and irrigation use. The classification of water type was based on the relation of the major ions; each other within the range of measured specific conductance. The judgment of suitability for public supply use was based on the concentration levels and distributions of selected constituents. The Wilcox irrigation classification scheme was used, to relate sodium concentrations and the salinity distribution to the use of the water for irrigation. The possibility of phytotoxic effects from boron was discussed where data were available. (USGS)

Index of published surface-water-quality data for Oklahoma
GEOLoGICAL SURVEY REPORT Of
Oklahoma, Oklahoma City, OKLA.

Alluvium is the principal aquifer along the Verdigris River between Muskogee and Catoosa, Oklahoma. Yields of 1 to 10 gallons of water per minute, adequate for most domestic and stock uses, are available in almost all areas underlain by alluvium, in places where the proportion of gravel to fine material is high. Yields ranging from 10 to 30 gpm are possible from large-diameter wells. Terrace deposits yield small amounts of water (1 to 10) to fluctuations. In response to seasonal changes in recharge and discharge, range from 1 to 5 feet. Long-term fluctuations are about 10 feet in the alluvium and less than 5 feet in the terrace deposits. Recharge to the alluvium is mainly by precipitation. Recharge maintains groundwater levels above the level of the Verdigris River. Discharge from the alluvium is by seepage into the river and its tributaries and by evapotranspiration. Generally, the quality of the water in the alluvium and terrace deposits is suitable for domestic, stock, and irrigation uses. (Knapp-USGS)


Annual peak discharges and basin and climatic characteristics are summarized for 103 small-stream sites in Oklahoma. The U.S. Geological Survey rainfall-runoff model was calibrated for 20 small watersheds. The rainfall-runoff model can be used to extend the length of flood records for small watersheds. Records from four small watersheds were extended by the model. And synthetic frequency curves were computed for these sites to show applicability of the model. (Knapp-USGS)


Water resources data for Oklahoma consist of records of stage, discharge, and water quality of streams; stage contents, and water quality data of reservoirs. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (Kosco-USGS)


Water resources studies and investigations of the U.S. Geological Survey in Oklahoma are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydraulic data network consists of 160 primary, secondary, and water management streamflow stations; 254 groundwater observation wells; and 35 water quality observing sites. Small state maps show principal sources of groundwater, average annual


Water resources investigations 77-54.
PRECIPITATION, AVERAGE ANNUAL RUNOFF, DISCHARGE OF THE PRINCIPAL RIVERS, AND THE CHEMICAL QUALITY OF THE RIVERS. A MAP, SCALE 35 MI TO THE INCH, SHOWS BY SYMBOLS, NUMBERS, AND COLORED OUTLINE THE HYDROLOGIC DATA NETWORK AND INVESTIGATIONS IN OKLAHOMA IN JULY 1966. (WOODARD-USGS)


Oklahoma District reports January 1973. 91 p., 6 fig., 2 tab., 114 ref.

Journal Announcement: SWRA0923

This report is a summary of the 1978 program of the U.S. Geological Survey. Geologic descriptions of all active projects and the current status of each. A list of all published reports related to the water resources of Oklahoma is given. It contains listings of all streamflow gaging stations, water quality stations, and reservoir stations which the Geological Survey operates or publishes through cooperation with other State, local, and federal agencies. Included are discontinued surface water and water quality stations for which the Geological Survey has published records. Stations are listed by type and by cooperators and the number of stations funded by each cooperators is summarized. Maps show the locations of various types of stations, the locations of selected ground-water projects, and an index of the two-degree sheets in Oklahoma for which hydrologic reconnaissance studies have been made. (Woodard-USGS)

PRELIMINARY REPORT

Pennsylvania

Variations in the chemical character of the Susquehanna River at Harrisburg, Pennsylvania

Anderson, P. W., 1965


Field Investigation of Nine Waters in the Northern Anthracite Field, Pennsylvania

Barnes, Ivan; Stuart, W. T., and Fisher, D. W., 1964


GUIDE TO THE AVAILABILITY OF HYDROLOGIC DATA, GREATER PITTSBURGH REGION, PENNSYLVANIA

Beall, R. M.

GEOLOGICAL SURVEY, HARRISBURG, PA.

OPEN-FILE REPORT 76-152, MAY 1976. 12 P., 1 PLATE, 33 REF.

Journal Announcement: SWRA0923

ACTIVE PRIMARY-COLLECTION SITES FOR HYDROLOGIC DATA ARE SHOWN ON A MAP OF THE GREATER PITTSBURGH REGION (ALLEGHENY, ARMSTRONG, BEAVER, BUTLER, WASHINGTON, AND WESTMORELAND COUNTIES IN SOUTHWESTERN PENNSYLVANIA). THE SOURCES OF DATA—BY PUBLICATION OR RESPONSIBLE AGENCY—are DESCRIBED. SECONDARY DATA COLLECTION SITES HAVE NOT BEEN SHOWN ON THE MAP, BUT SEVERAL AGENCIES INVOLVED IN THIS ACTIVITY HAVE BEEN LISTED. HYDROLOGIC DATA ARE COLLECTED AT THE FOLLOWING NUMBERS OF IDENTIFIED SITES UNDER THE AUSPICES OF FEDERAL, STATE, AND INTERSTATE ORGANIZATIONS: PRECIPITATION OR TEMPERATURE MILES, SURFACE-WATER STAGE OR DISCHARGE MILES, SURFACE-WATER QUALITY MILES, AND GROUND-WATER LEVELS. (WOODARD-USGS)

STREAM RECONNAISSANCE FOR NUTRIENTS AND OTHER WATER QUALITY PARAMETERS, GREATER PITTSBURGH REGION, PENNSYLVANIA

Beall, R. M.

GEOLOGICAL SURVEY, CARNEGIE, PA.

AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA 22161 AS PB-241 495, 52.75 IN PAPER COPY, $2.25 IN MICROFICHE. WATER-RESOURCES INVESTIGATIONS 50-74, FEBRUARY 1975. 47 P., 7 FIG., 2 PLATE, 4 TAB., 30 REF.

Journal Announcement: SWRA0923

EIGHTY-FIVE STREAM SITES IN AND NEAR THE SIX-COUNTY GREATER PITTSBURGH REGION WERE SAMPLED IN MID-JUNE 1971 AND AGAIN IN MID-OCTOBER 1972. DATA ARE REPORTED FOR 89 SITES (INCLUDING 4 SUBSTITUTE SITES SAMPLED IN THE SECOND PERIOD). DRAINAGE AREAS OF THE BASINS SAMPLED RANGED FROM 4.1 TO 19,500 SQUARE MILES (10.6 TO 50,500 SQUARE KILOMETERS). THE CHEMICAL ANALYSES INCLUDE CONSTITUENTS OF THREE GENERAL CLASSES: (1) NUTRIENTS, (2) ACTIVITY INDICATORS, AND (3) DOMINANT ANIONS. NUTRIENT CONCENTRATIONS WERE HIGH ENOUGH TO INDICATE POTENTIAL PROBLEMS AT ABOUT A QUARTER OF THE SAMPLING SITES. TEMPERATURE, DISSOLVED OXYGEN, AND PH VALUES INDICATED A
Pennsylvania

Generally favorable capacity for regeneration or recovery from degradation, although a number of streams east of the Allegheny and Monongahela rivers are marginal or lacking in that capacity. Regionally, sulfate is the dominant ion and was observed in concentrations of 40 milligrams per litre or more at 90% of the sites. Bicarbonate exceeded 100 milligrams per litre at 22 sites. A moderate to high degree of mineralization, as indicated by conductance readings of more than 500 micromhos per centimeter at half of the sampling sites, is a characteristic of the region's surface waters. (Woodard-USGS)

Groundwater in Pennsylvania
Becher, A. E.

Journal Announcement: SWR40411

The existing knowledge of the groundwater resources of Pennsylvania is summarized. It was written to provide industrial and civil planners, developers, managers, and the public with sufficient information about statewide water resources to make intelligent, fundamental decisions about the future use, development, and protection of the groundwater. Pennsylvanians used about 6.6 BGD (billion gallons per day) of water in 1966, excluding electric power plant use. Although only 11% of the water was taken directly from groundwater sources, 25 to 35% of the people depend on groundwater for their personal needs. In addition, 55% of water companies obtain all their water, and another 13% obtain part of their water from groundwater sources. Twenty-one of the 67 Pennsylvania counties obtain more than half their total water supplies from groundwater. Both regional and local problems of water quality exist in Pennsylvania. Many of these problems are the result of activities undertaken in the past without adequately protecting water resources. Waters that flow from coal mines and contain high concentrations of sulfuric acid and iron in solution are the major problem of water quality both in the volume of water involved and the total area affected. Second to acid mine waters in areal extent, but equally serious, is the pollution of Pennsylvania's stream and groundwater by sewage and industrial wastes. Another type of groundwater pollution is caused by crude oil and saline waters moving upward into fresh water aquifers either through natural openings or through oil and gas wells abandoned prior to the well plugging law of 1951. (Woodard-USGS)

Stream quality in Appalachia as related to coal-mine drainage, 1965 (Duplicated see Alabama and W. Virginia).
Biesecker, J. E., and George, J. R., 1966

284
Selected Water Resources Data. Clarion River and Red Bank Creek Basins, Northwestern Pennsylvania—Part 2


This report presents selected basic data collected during a study of the water resources of the Clarion River and Red Bank Creek basins in northwestern Pennsylvania. Hydrologic information including data on aquifers, water levels, and yields is presented for 1,500 wells. Records for 51 springs are also given. The report contains 83 chemical analyses of water samples collected from 30 stream sites and 300 analyses of water from 196 wells and 43 springs. Also included are 103 trace-element analyses. Monthly and annual means of ground-water levels for six observation wells are tabulated. Benthic invertebrate data from 136 stream sites are listed. Locations of data-collection sites are shown on 50-page-size reductions of 7.5-minute topographic quadrangle maps. (Kosco-USGS)

Water Resources of the Clarion River and Red Bank Creek basins

Buckwalters, T. J., and others, 1983

U.S. Geological Survey Water-Resources Investigations

Chemical quality of surface waters in Pennsylvania

Dorfer, C. N., and Anderson, P. W., 1965

Sediment discharge from Highway Construction Near Port Carbon, Pennsylvania

Helm, R. E.


Journal Announcement: SWRA1120

The effects of highway construction on suspended-sediment loads were studied in the upper reaches of the Schuylkill River basin, Schuylkill County, Pennsylvania, from April 1975 to March 1977. In December 1975, part of State Route 209 was relocated through the upper reaches of the basin, a mountainous watershed with a drainage area of 27.1 square miles. About 24,750 tons of suspended-sediment was discharged from the basin during the construction. The highway construction produced about 8,100 tons or 50 percent of the total sediment discharge. Steep slopes, the availability of fine coal wash water, and land-clearing operations, and other land uses in the valley were responsible for most of the remaining sediment discharge. Seventy percent of the total suspended-sediment discharge occurred during eight storms. (Woodard-USGS)

Hydrology of Area 3, Eastern Coal Province, Pennsylvania, Maryland, and West Virginia

Herb, W. J.; Shaw, L. J.; Brown, D. E.


Journal Announcement: SWRA1511

Hydrologic data are presented for area 3 of the Eastern Coal Province, 3,077 square miles of the lower Allegheny river basin in western Pennsylvania. Seventy-three streams were sampled three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate, and dissolved solids. Benthic invertebrate populations were determined and botom material samples were analyzed for metals. Sixteen streams had pH, acidity, alkalinity, total iron, total manganese, and dissolved sulfate indicative of acid-mine drainage. These streams were most common in the Redbank and Blacklick Creek basins and in the Conemaugh and lower Kiskiminetas River basins. Benthic invertebrates were not found in 13 of 64 streams sampled. An additional 13 streams had low benthic invertebrate diversity indices. Low diversity indices were most common in the southern part of area 3. Low flows, mean flow, peak flow, and flow duration data are presented for gaging stations in area 3. Techniques for estimating these data for ungaaged sites are presented and referenced. The functions of and access to the National Water Information System, National Water Data Storage and Retrieval System, and Office of Water Data Coordination are explained. (USGS)

Hydrology of Area 5, Eastern Coal Province, Pennsylvania, Maryland, and West Virginia

Herb, W. J.; Shaw, L. J.; Brown, D. E.


Journal Announcement: SWRA1511

Hydrologic data are presented for area 5 of the Eastern Coal Province, the 7,384 square-mile Monongahela River basin in western Pennsylvania, western Maryland, and western Maryland, and West Virginia. One hundred thirty-four streams were sampled about three times during the 1979 and 1980 water years for specific conductance, pH, acidity, alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate, dissolved solids. Benthic invertebrate populations were determined and bottom material samples were analyzed for metals. Eleven streams had pH, acidity, and dissolved total iron, total manganese, and dissolved-sulfate levels indicative of acid-mine drainage. These streams were most...
Pennsylvania

common in the Tygart Valley River basins, although indicators of acid-mine drainage were found throughout the Monongahela basin. No benthic invertebrates were found in 25 of 129 streams sampled. Such streams were most common in the Cheat and Tygart Valley River basins. Low flow, mean flow, peak flow, and flow duration data are presented for gaging stations in the area. Techniques for estimating these data for ungauged sites are presented and referenced. The function of, and access to, the National Water Data Exchange, WATSTORE, and indexes to water-data activities in coal provinces are presented. (USGS)

HYDROLOGY OF THE PLEISTOCENE SEDIMENTS IN THE WYOMING VALLEY, LUZERNE COUNTY, PENNSYLVANIA

HOLLOWELL, J. R.

GEOLOGICAL SURVEY

HARRISBURG, PA.

PENNSYLVANIA GEOLOGICAL SURVEY WATER RESOURCE REPORT 28-
4TH SERIES, 1971. 77 P. 16 FIG. 7 TAB. 27 REF. APPEND.,

Journal Announcement: SWA905


Hydrology of the abandoned coal mines in the Wyoming Valley, Pennsylvania

HOLLOWELL, J. R., 1976

Open-File Report 74-237, 1974. 47 P. 6 FIG. 3 TABS. 5 REF.,

Append. 75-02128.

GROUND-WATER RESOURCES OF LACKAWANNA COUNTY, PENNSYLVANIA

HOLLOWELL, J. R.; KOESTER, H. E.; SUSQUEHANNA RIVER BASIN COMMISSION; HARRISBURG, PA.; AND PENNSYLVANIA STATE GEOLOGICAL SURVEY, HARRISBURG, PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES.

HarriSburg water resources report 47, 1975, 106 P. 26 FIG. 3 PLATE, 20 TAB. 28 REF.,

Journal Announcement: SWA905

LACKAWANNA COUNTY COMPRIS ES AN AREA OF ABOUT 450 SQ MI IN NORTHEASTERN PENNSYLVANIA. THE COUNTY IS BISECTED BY THE SUSQUEHANNA VALLEY, PART OF A STRUCTURAL BASIN. ITS NORTHERN ANTHRACITE FIELD, SINCE 1967, SUBURBAN DEVELOPMENT HAS CREATED A DEMAND FOR GROUNDWATER SUPPLIES. THE PRINCIPAL AQUIFER IS THE CATSKILL FORMATION. OTHER AQUIFERS ARE UTILIZED, BUT BECAUSE OF THEIR SMALL AREAL EXTENT THEY ARE RELATIVELY UNIMPORTANT. GROUNDWATER OCCURS MAINLY IN BEDDING PLANES, JOINTS, FAULTS, AND OTHER FRACTURES IN THE ROCKS. WELLS DRILLED INTO THE FRACTURED ROCK AQUIFER HAVE YIELDS THAT RANGE FROM A HALF GALLON TO 500 GPM. WELLS DRILLED IN VALLEYS HAVE A MEDIAN YIELD OF 50 GPM, WHICH IS ABOUT 40 TIMES THAT OF HILLTOP AND HILLSIDE WELLS. WATER FROM MOST WELLS TAPPING THE CATSKILL FORMATION IS OF GOOD QUALITY. IT IS LOW IN DISSOLVED SOLIDS AND IS PRIMARILY A BICARBONATE-TYPE WATER. MINE DRAINAGE IN VALLEYS THE LACKAWANNA RIVER AT NUMEROUS POINTS ALONG ITS COURSE IN LACKAWANNA COUNTY. DISSOLVED-SOLIDS

Ground-water quality and data on wells and springs in Pennsylvania. Volume II—Susquehanna and Potomac River Basins

Koester, H. E.; Miller, D. R.


Available from OFS-USGS. Box 25425, Fed. Ctr., Denver, CO 80225.


Journal Announcement: SWA1604

Volume II of the Ground-Water Quality and Data on Wells and Springs in Pennsylvania presents ground-water quality and physical data on about 1,400 wells and springs in the Susquehanna and Potomac River basins in Pennsylvania. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
showing the geologic age and aquifer are provided. (USGS)


Wells drilled in the county indicate that the highest ground-water yields are obtained from aquifers in the Pocono Group and in the alluvium. Water in the sandstone and limestone aquifers of the consolidated rocks occurs in pore spaces and in secondary openings such as fractures and solution channels. Yields from sandstone in the Pocono Group vary widely, depending on the amount of shale interbedded. Yields of less than 10 gpm to over 500 gpm have been reported. In the Poitsville Group, the average yield is 28 gpm, but if the wells penetrate the upper and lower sandstone, the yields may be much higher. The sandstone and limestone members of the Allegheny Group are reliable sources of small to moderate amounts of ground water and well yields adequate amounts for domestic use at almost any location drilled. Excessive iron is the main water quality problem in ground water of Clarion County. Ground water in the deeper aquifers is generally highly mineralized, in some (Woodward-USGS).


The Lehigh River, 700 miles long, is the second largest tributary to the Delaware River. It drains 1,364 sq mi in 4 physiographic provinces. The Lehigh River basin includes mountainous and forested areas, broad agricultural valleys and basins, urban and industrial development. In the headwaters the water is of good quality and has a low concentration of solutes. Downstream, some tributaries receive coal-mine drainage and other drain areas underlain by limestone and acquire alkaline characteristics. The alkaline streams neutralize and dilute the acid mine water where they mix. The dissolved-oxygen content of river water, which is high in the upper reaches of the stream, is reduced in the lower reaches because of lower turbulence, higher temperature, and the respiration of organisms. Most of the river water requires only gerate treatment for industrial use and public distribution throughout the Lehigh River Valley. At times, however, some segments of the Main River and its tributaries transport industrial wastes and acid coal-mine drainage. Since May 1966 an instrument installed by the U.S. Geological Survey at Easton, PA, has conductance, temperature, and dissolved oxygen content. Streamflow and water quality data are tabulated. (Knap-USGS).


The geologic units in Clarion County include the unconsolidated Quaternary deposits; the Pennsylvania Llewellyn and Poitsville formations; the Mississippian Mauch Chunk and Pottsville formations; the Carboniferous marine beds, and Hamilton Group. Ground water occurs largely in the sponge, secondary openings, and solution channels in the unconsolidated deposits, and in the alluvium along the Susquehanna River. Yields of over 1,000 gpm have been reported from wells. The Llewellyn formation, marine beds, and Hamilton Group are the poorest of the bedrock aquifers, well yields range from 2 to 325 gpm, and most wells produce soft water of good quality. In- and water samples collected outside of the mined areas were of acceptable quality. Ground water in the vicinity of the coal mines is generally high in iron and sulfate. There is no known overdraft of ground water anywhere in the county except in the vicinity of active mines, where the water table is being lowered to facilitate mining. The locations of sources of pollution, such as sanitary landfills and septic tanks, are a major factor in the selection of well sites. The discharge from abandoned strip and deep mines is a major source of Pennsylvania
SUMMARY: SMALL TO MODERATE SUPPLIES OF PENNSYLVANIAN CONEMAUGH FORMATION WATER ARE AVAILABLE IN WESTMORELAND COUNTY, PENNSYLVANIA, FROM ROCKS OF THE PENNSYLVANIAN MONONGAHELA AND CONEMAUGH GROUPS. THE PENNSYLVANIAN-PENNOSYLVANIAN WASHINGTON FORMATION, THE PENNSYLVANIAN CONEMAUGH GROUP, FROM ROCKS OF CENTRAL CHESTER COUNTY, PENNSYLVANIA, AND THE PENNSYLVANIAN GREENE GROUP, ALL FORMATIONS FROM ROCKS RANGING IN AGE FROM THE MISSISSIPPIAN-POCONO GROUP TO QUATERNARY ALLUVIUM, YIELD MODERATE TO LARGE SUPPLIES OF WATER IN SOME AREAS. THE YIELDS DEPEND UPON THE DEGREE OF CONSOLIDATION OF THE ALLUVIUM. GROUNDWATER USED FOR MOST PURPOSES HAS PROBABLY DECREASED DUE TO IMPROVED PLANT DESIGN AND TO THE USE OF MORE EFFICIENT MANUFACTURING TECHNIQUES. SINCE THERE IS RELATIVELY LITTLE USE OF GROUNDWATER IN THE COUNTY, THERE IS NO KNOWN OVERDRAFT. THE GREATEST WATER PROBLEM IN THE COUNTY IS THE CONTAMINATION OF WATER RESOURCES BY DRAINAGE FROM COAL-MINING OPERATIONS. OTHER SOURCES OF POLLUTION ARE THE NUMEROUS OIL AND GAS WELLS THAT WERE ABANDONED BUT NOT PROPERLY PLUGGED.

GROUNDWATER RESOURCES INVESTIGATIONS IN THE SUSQUEHANNA RIVER BASIN UNIVERSITY OF PENNSYLVANIA DEPARTMENT OF FORESTS AND WATERS TECHNICAL BULLETIN 52, 1970, 1 SHEET, 2 TAB, 1 MAP.

SUMMARY: WATER RESOURCES INVESTIGATIONS IN THE SUSQUEHANNA RIVER BASIN OPERATED BY THE U.S. GEOLOGICAL SURVEY (USGS) IN COOPERATION WITH OTHER AGENCIES ARE SHOWN ON THIS HYDROLOGIC ATLAS AS FOLLOWS: (A) HYDROLOGY AND SEDIMENTATION OF THE COREY CREEK AND ELK RUN WATERSHEDS; (B) SURFACE-WATER QUALITY OF THE WEST BRANCH SUSQUEHANNA RIVER BASIN; (C) ACIDITY OF BEECH CREEK; (D) SURFACE-WATER QUALITY OF THE WEST BRANCH SUSQUEHANNA BASIN IN THE VICINITY OF DANVILLE, PENNSYLVANIA; (E) HYDROLOGY AND SEDIMENTATION OF THE UXLIER RUN WATERSHED; (F) WATER RESOURCES OF THE SATARA CREEK BASIN; (G) GEOLOGY AND HYDROLOGY OF THE MARTINSBURG SHALE IN THE LEBANON VALLEY; (H) GEOLOGY AND METAMORPHIC AND JUKEBOOM RAVINES IN THE LEBANON VALLEY; (I) HYDROLOGY OF LIMESTONES IN THE LEBANON VALLEY; (J) HYDROLOGY OF THE NEW OXFORD FORMATION IN ADAMS AND YORK COUNTIES, PENNSYLVANIA; (K) HYDROLOGY OF THE LITTLE COACH RIVER AT MARTINSBURG, PENNSYLVANIA; (L) HYDROLOGY OF THE NEW OXFORD FORMATION IN LANCASTER COUNTY, PENNSYLVANIA; (M) HYDROLOGY OF THE CARBONATE ROCKS OF THE LANCASTER COUNTY, PENNSYLVANIA; (N) HYDROLOGY OF THE IRON CREEK AT HARRISBURG, PENNSYLVANIA; (O) HYDROLOGY OF THE SUSQUEHANNA RIVER AT HARRISBURG, PENNSYLVANIA; AND (P) HYDROLOGY OF THE CARBONATE ROCKS OF THE LANCaster COUNTY, PENNSYLVANIA. LISTED ARE 150 SELECTED REPORTS DEVOTED EXCLUSIVELY TO THE CONTAINING DATA ON WATER IN THE SUSQUEHANNA RIVER BASIN.
Journal Announcement: SWK724
GROUNDWATER OCCURS IN ARMSTRONG COUNTY, PENNSYLVANIA IN UNCONSOLIDATED DEPOSITS ALONG THE STREAM VALLEYS. ESPECIALLY THE ALLEGHENY RIVER AND IN WATERSHEDS OF THE BEDROCK. YIELDS OF WELLS IN THE UNCONSOLIDATED DEPOSITS AVERAGE ABOUT 400 GPM AND YIELDS AS HIGH AS 1,400 GPM HAVE BEEN REPORTED. CALCULATED BEDROCK YIELD IS CONSIDERABLY LESS THAN THOSE IN THOSE IN THE UNCONSOLIDATED MATERIAL. THE AVERAGE YIELD OF WELLS IN THE 25 GPM, ALTHOUGH SOME WELLS YIELD LESS THAN 100 GPM AND SOME AS MUCH AS 500 GPM. THE WATER IS GENERALLY HARD AND HIGH IN CALCIUM, MAGNESIUM, SULFATE, AND SODIUM. WATER FROM DEEPLY BURIED ROCKS IS ALSO HIGH IN CHLORIDE. THERE IS NO KNOWN OVERDRAFT OF GROUNDWATER, BUT OVERDRAFT IS POSSIBLE IN THE FUTURE. IN THE LOCATIONS OF SOURCES OF POLLUTION SUCH AS SANITARY LANDFILLS AND SEPTIC TANKS, ARE A MAJOR FACTOR IN THE SELECTION OF WELLS SITES. THE CHIEF WATER PROBLEM IS CONTAMINATION FROM COAL-MINING OPERATIONS. OTHER SOURCES OF CONTAMINATION ARE THE HUNDREDS OF OIL AND GAS WELLS THAT WERE ABANDONED BUT NOT PROPERLY PLUGGED. THE CASTINGS HAVE BEEN REMOVED OR ARE SEVERELY CORRODED, ALLOWING SALTWATER TO RISE IN THE BOREHOLES AND CONTAMINATE SHALLOW FRESHWATER AQUIFERS. (KNAPP-USGS)

SUMMARY GROUNDWATER RESOURCES OF BEAVER COUNTY, PENNSYLVANIA
POTH, C. W.
GEOLOGICAL SURVEY, HARRISBURG, PA.
GEOLOGICAL SURVEY GEOLOGICAL SURVEY FOURTH SERIES, WATER RESOURCES REPORT 39, 1973, 39 P., 4 FIG., 1 PLATE, 7 TAB. 22 REF.
Journal Announcement: SWK724
GROUNDWATER IS AVAILABLE IN BEAVER COUNTY, PENNSYLVANIA, FROM ROCKS OF THE PENNSYLVANIAN MONONGAH, CONEUMAH, ALLEGHENY, AND POTTSVILLE GROUPS AND FROM UNCONSOLIDATED QUATERNARY DEPOSITS. GROUNDWATER OCCURS LARGELY IN THE UNCONSOLIDATED QUATERNARY DEPOSITS THAT ARE PRESENT IN THE HUNTER DRIFT BASIN AND MODERN FLOOD PLAINS ALONG THE MAJOR STREAMS OF THE COUNTY. YIELDS OF OVER 100 GPM HAVE BEEN REPORTED FROM WELLS DRILLED IN THESE ALLUVIAL DEPOSITS. SOME SALTWATER IS ALSO AVAILABLE IN THE BEDROCK, BUT THE WATER IS GENERALLY OF POOR QUALITY. MUST OF THE WATER IS OF ACCEPTABLE QUALITY. THE WATER IS GENERALLY HIGH IN IRON, AND MUCH OF THE IRON IN THE BEDROCK BELOW SEVERAL HUNDRED FEET MAY CONTAIN SALTWATER. THERE IS NO KNOWN OVERDRAFT OF GROUNDWATER ANYWHERE IN THE COUNTY, THE LOCATIONS OF SOURCES OF POLLUTION, SUCH AS SANITARY LANDFILLS AND SEPTIC TANKS, ARE A MAJOR FACTOR IN THE SELECTION OF WELLS SITES. THE DISCHARGE FROM ABANDONED STRIP AND DEEP MINES IS A MAJOR SOURCE OF POLLUTION. OIL AND GAS WELLS THAT WERE ABANDONED AND NOT PROPERLY PLUGGED ARE ANOTHER SOURCE OF POLLUTION. (KNAPP-USGS)

SUMMARY GROUNDWATER RESOURCES OF BUTLER COUNTY, PENNSYLVANIA
POTH, C. W.
GEOLOGICAL SURVEY, HARRISBURG, PA.

Effects of Strip Mining the Abandoned Deep Anna S Mine on the Hydrology of Wab Creek, Tioga County, Pennsylvania
Reed, L. A.
Available from the National Technical Information Service, Springfield, Virginia 22151 as PB-171537, 11 p., 16 Figs, 7 Ref., 1 Fig. 13-7
Journal Announcement: SWK724
DAYLIGHTING (STRIP MINING OF COAL SEAMS PREVIOUSLY DEEP MINED) OPERATIONS ARE BEING CONDUCTED ON THE ANNA S MINE, THAT UNDERLIES ABOUT 850 ACRES THAT ARE DRAINED BY THREE MAJOR DISCHARGES. THE HUNTER RIVER DRAINS AN UNDERGROUND AQUIFERS ACROSS THE ANNA S 1 MAIN ENTRY, AN AREA OF 330 ACRES, AND MITCHELL 1 DISCHARGE AN AREA OF ABOUT 120 ACRES. AS OF AUGUST 1, 1975, 53 ACRES (15%) HAD BEEN SHARED NEAR THE DRIFT BASIN, ABOUT 15 ACRES (5%) IN THE ANNA S MAIN ENTRY BASIN AND ABOUT 30 ACRES (25%) IN THE MITCHELL BASIN. THE AQUIFERS

Pennsylvania geological survey. Fourth series, water resources report 36, 1973. 49 P.; 4 FIG., 1 PLATE, 7 TAB. 27 REF.
of the Mitchell 2 discharge changed the most, from 176 milligrams per liter (as CaCO$_3$) in 1975-76 to 1,190 in 1978-79, an increase of 580%. The acidity of the Hunter Drift discharge increased from 348 milligrams per liter during 1975-76 to 710 milligrams per liter during 1978-79, an increase of 100%. The acidity of Anna S 1 increased about 45%. (USGS)

WATER RESOURCES INVESTIGATIONS IN THE UPPER OHIO RIVER BASIN

Rossow, C. J., Jr., Coll, M. D., Jr.

GEOLOGICAL SURVEY, HARRISBURG, PA.

Pennsylvania DEPARTMENT OF FORESTS AND WATERS


1 SHEET, 2 TAB. 1 MAP.

Journal Announcement: SWRA402

ACTIVE AREAL PROJECTS IN THE UPPER OHIO RIVER BASIN OPERATED BY THE U. S. GEOLOGICAL SURVEY (WRD). LARGELY IN COOPERATION WITH OTHER AGENCIES, ARE SHOWN ON THESE HYDROLOGIC ATLAS AS FOLLOWS: (A) GROUND-WATER RESOURCES, ALLEGHENY RIVER BASIN AND PART OF THE LAKE ERIE BASIN, NEW YORK; (B) SURFACE-WATER RESOURCES OF THE ALLEGHENY RIVER BASIN AND PART OF THE LAKE ERIE BASIN, NEW YORK; (C) CHEMICAL QUALITY OF STREAMS, ALLEGHENY RIVER BASIN, NEW YORK; (D) GEOLOGY AND GROUND-WATER RESOURCES OF WESTERN CRANDON COUNTY; (E) GEOLOGY AND GROUND-WATER RESOURCES OF THE SHENANDO AND STONEBORO QUADRANGLES; (F) INVESTIGATION OF PRINCIPAL AQUIFERS IN NORTHEASTERN OHIO; AND (G) ROARING CREEK-GRASSY Run A C I D M I N E DRAINAGE INVESTIGATIONS—AREA CONTAINING DATA ON WATER IN THE OHIO RIVER BASIN AND 45 SELECTED REFERENCES ON HYDROLOGY. (WOODARD-USGS)

Hydrology of Area 4, Eastern Coal Province, Pennsylvania, Ohio, and western Virginia

Roth, D. K.; Engelke, M. J., Jr.

GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.


62 P. 41 REF. 3 APPEND.

Journal Announcement: SWRA1151

Area 4 (one of the 24 hydrologic areas defining the Eastern Coal Province) is located at the northern end of the Eastern Coal Province in eastern Ohio, northern West Virginia, and western Pennsylvania. It is part of the upper Ohio River basin, which includes the Beaver, Mahoning, and Shenango rivers. The area is underlain by rocks of the Pottsville, Allegheny, Conemaugh, Monongahela groups (or formations) and Dunkard group. Area 4 has a temperate climate with an annual average rainfall of 38 to 42 inches, most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-87, 132 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water quality, sediment, and biology. The data are available from computer storage through the National Water Data Exchange (NAWDEX) or the

published annual Water Resources Data reports for Ohio, Pennsylvania, and West Virginia. Hydrologic problems related to mining areas: (1) Erosion and increased sedimentation, and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive coal soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage effluent in area 4 comes from underground mines. The rest seeps from abandoned surface mines. Usually in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that oxidation of acid-forming minerals, commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils. (USGS)
bedrock is mapped in detail and consists of rocks of Devonian, Mississippian, and Pennsylvanian age. The rocks of Devonian age are not exposed in the area but are present beneath the glacial deposits in deep bedrock valleys. The Mississippian rocks are found along valley sides and some valley bottoms, and the Pennsylvanian rocks generally underlie the uplands. Maximum yields of bedrock wells seldom exceed 100 gpm (gallons per minute), but a yield of 300 gpm is reported from one well in the lower member of the Shenango Formation. Potable water can be obtained everywhere in the area.

(Woodard-USGS)

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA

SEABER, PAUL R.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

PREPARED IN COOPERATION WITH ATOMIC ENERGY COMM. GEOL.

SURV INTERIM GROUNDWATER REP., AUGUST 1968.

Ref.:

Journal Announcement: SWRA1209

THE AVALIABILITY, QUANTITY, QUALITY, VARIABILITY, AND COST OF DEVELOPMENT OF THE GROUNDWATER RESOURCES IN THE UPPER SUSQUEHANNA RIVER BASIN IN PENNSYLVANIA ARE DESCRIBED AND APPRAISED BY GEOLOGICAL FORMATIONS AND BY AREAS OF THE STATE. WATER MOVES FROM THE GROUND INTO MOST OF THE STREAMS OF THE AREA WITH A CONSEQUENTLY LARGE EFFECT ON SURFACE WATER QUANTITY AND QUALITY. IN MOST OF THE AREA, DEVELOPMENT OF GROUNDWATER SUPPLIES IS FAR BELOW THE POTENTIAL MAXIMUM DEVELOPMENT. TABLES SHOW ESTIMATED SPECIFIC CAPACITIES AND YIELDS, WELL DESIGNS, AND COSTS OF HYPOTHETICAL WELLS IN THE GEOLOGIC UNITS OF THE AREA. WATER CHEMICAL ANALYSES FROM WELLS IN ALL THE GEOLOGIC UNITS ARE ALSO TABULATED. (KNAPP-USGS)

Bituminous coal fields of Pennsylvania. Part II

SISLER, J. D., 1961


Quality of Surface Water in the Coal-Mining Areas of Western Maryland and Adjacent Areas of Pennsylvania and West Virginia from April 1979 to June 1980. (duplicated see Maryland).

STABITZ, W. W.

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.


Journal Announcement: SWRA1510

Water Resources of Greene County, Pennsylvania—Appalachian Coal Basin

Pennsylvania


PADER Water resources report.

GEOHYDROLOGIC RECONNAISSANCE OF THE UPPER POTOMAC RIVER BASIN

TAINER, F. W.; WATKINS, F. A. JR.

GEOLOGICAL SURVEY, RESTON, VA.

AVAILABLE FROM SUPT. OF DOCUMENTS, GPO, WASHINGTON, DC 20402.

PRICE $1.95. WATER-SUPPLY PAPER 2035. 1975. 68 p; 16 Fig; 1 Plate; 10 Tab; 53 Ref.

Journal Announcement: SWRA1423

THE UPPER POTOMAC RIVER BASIN, IN THE CENTRAL APPALACHIAN REGION IN PENNSYLVANIA, MARYLAND, VIRGINIA, AND WEST VIRGINIA, IS A HUMID TEMPERATE REGION OF DIVERSE FRACURED ROCKS, THREE GEOHYDROLOGIC TERRAINAS, WHICH UNDERLIE LARGE PARTS OF THE BASIN, ARE DISTINGUISHED IN TERMS OF THEIR AQUIFER CHARACTERISTICS AND OF THE MAGNITUDE AND DURATION OF THEIR BASE RUNOFF: (1) FRACURED ROCK HAVING A THIN REGOLITH, (2) FRACURED ROCK HAVING A THICK REGOLITH, AND (3) CARBONATE ROCK, CRYSrALLINE ROCK, AND MOUNTAINOUS PART OF THE BLUE RIDGE PROVINCE AND SHALE WITH TIGHT SANDSTONE IN THE FOLDED APPALACHANS ARE COVERED WITH THIN REGOLITH. WATER IS STORED IN AND MOVES THROUGH FAIRLY UNMODIFIED FRACURED ROCKS. AVERAGE TRANSMISSIVITY (T) IS ESTIMATED TO BE 150 SQ FEET PER DAY, AND AVERAGE STORAGE COEFFICIENT (S) 0.005. CRYSrALLINE AND SEDIMENTARY ROCKS IN THE PIEMON'TPROVINCE AND IN THE LOWLAND PART OF THE BLUE RIDGE PROVINCE ARE COVERED WITH THICK REGOLITH, ESTIMATED AVERAGE VALUES FOR AQUIFER CHARACTERISTICS AR T, 200 SQ FEET PER DAY, AND S, 0.03-0.04. CARBONATE ROCK, IN WHICH FRACTURES HAVE BEEN WIDENED SELECTIVELY BY SOLUTION AND STRONGLY LIMESTONE, HAS ESTIMATED AVERAGE AQUIFER CHARACTERISTICS OF T, 500 SQ FEET PER DAY, AND S, 0.03-0.04. THIS ROCK IS THE MOST EFFECTIVE IN THE BASIN IN TERMS OF WATeR SUPPLY AND BASE RUNOFF. ACIDIC MINE-DRAINAGE WATER, LOCAL HIGHLY MINERALIZED GROUNDWATER, AND THE HIGH NITRATE CONTENT OF GROUNDWATER IN SOME AREAS WOULD PROBABLY HAVE A LITTLE ADVERSE AFFECT ON THE USE OF GROUNDWATER FOR LOW-FLOW AUGMENTATION. (WOODARD-USGS)


WARD, J. R.

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.


Journal Announcement: SWRA1423

Acid-drime drainage entering the Tioqa River above Blossburg, PA, degrades water quality for most of its length by increasing levels of sulfate, trace elements and specific
sedimentation, and decreasing alkalinity and pH. Mill creek near Tioga and Crooked Creek are alkaline tributaries that help to neutralize acid-mine drainage in the Tioga River. The Cowanesque River is also alkaline, but slightly affected by industrial effluents near Westfield and has high chloride levels but nutrient levels in the basin are generally low but high enough to support biological activity. Field measurements indicate that mine drainage has repressed biological activity in the Tioga River. Most of the phytoplankton samples have low diversity indices. Concentrations of many of the water-quality parameter were related to discharge using regression techniques. Annual suspended-sediment yields averaged 575 tons per square mile above the downstream limit of the study. Mill creek near Tioga and the Cowanesque River upstream from Nelson were the lowest contributors of suspended sediment. (USGS)

Preliminary Results of Preimpoundment Water-Quality Studies in the Tioga River Basin, Pennsylvania and New York

Ward, J. R.


The impoundments have been proposed for the Tioga study area in Pennsylvania and New York. Two of the reservoirs, Tioga and Hammond Lakes, are presently under construction and will be completed in 1977. Cowanesque Lake in the planning stages and will be started in the near future. The Tioga River and its major tributaries were sampled monthly from September 1975 to July 1976. Water quality in the Tioga River is degraded by acid-drainage entering the stream near Blossburg from both strip- and deep-mined areas. The stream supports few species of aquatic life from Blossburg to its confluence with Crooked Creek. The water of tributaries Mill Creek, Crooked Creek, and the Cowanesque River counteract the acidity carried downstream from Blossburg, and the water quality of the Tioga River gradually improves, supporting a more diversified population of fish and aquatic life. All of the streams in the Tioga River basin carry nutrients sufficient for algae blooms. Dissolved solids range from very high to moderately high throughout the basin. The Tioga River has high concentrations of sulfate and heavy metals, particularly iron and manganese. Dissolved oxygen was usually above 80 percent saturation and never dropped below 70 milligrams per liter throughout the basin. Relationships between selected water-quality parameters have been developed for the sampling stations throughout the basin. Downstream trends were also examined. (Woodard-USGS)

Sedimentation in the East Branch Mahoning Creek Basin, Clarion and Jefferson Counties, Pennsylvania, June 1979 to June 1980

Wetzler, Kim


Preimpoundment Water-Quality Data of the Raystown Branch Juniata River and Six Tributary Streams, South-Central Pennsylvania

Williams, D. R.


The Raystown Branch Juniata River Watershed, which is the main water source for Raystown Lake, is a 900-square-mile drainage basin in collected on the Raystown Branch and Six Tributary Streams in the basin. Specific conductance values varied inversely with water discharge, the PH values were extremely low only at the shoup run site. Dissolved oxygen concentrations observed at all sites indicated a relatively high oxygen saturation level throughout the year. Seasonal variations in nitrate-N and orthophosphate-P levels were measured at the main inflow station, Sartow, PA. The highest concentrations of nitrate-N and orthophosphate-P occurred in the winter and spring months and the lowest concentrations were measured during the summer and fall. Water-ecological data indicate that all streams except the Juniata River are suitable for recreational use. soil samples collected at four sites in the impoundment area were predominantly of the Barbour, Philo, and Bashe series. Soils are considered to be highly fertile. Soils with silty sand and sandy-loam textures. Morphological features of the lake basin and low nutrient levels at the inflows should prevent excessive weed growth around the lake perimeter. (Woodard-USGS)

Appraisal of Stream Sedimentation in the Susquehanna River Basin


The Susquehanna River transports about 3.0 million tons of sediment annually (110 tons per square mile). Only about 1.8 million tons of sediment enters the head of Chesapeake Bay annually because some sediment is trapped behind the power dams on the lower Susquehanna. Measured annual sediment yields from subbasins in Susquehanna range from 40 to 440 tons per square mile. The highest yields are from parts of the glaciated
Summary Groundwater Resources of Centre County, Pennsylvania

The northwest third of Centre County, Pa., lies in the Appalachian Plateaus physiographic province. The principal aquifers are the Allegheny Group, Pottsville Group, and the Sandstone. The average yield of Allegheny and Pottsville Groups is commonly high in iron. The southeast two-thirds of the county lies in the Appalachian Mountain section of the Valley and Ridge physiographic province. The average yield of nondomestic from the Old Port, Keyser, Tonoloway, Wills Creek, Nittany, and Gatesburg Formations. The water occurs in fractures, solution-eroded in carbonate rocks. Thus, the noncarbonate rocks are susceptible to over-pumping, and the carbonate-rock aquifers are easily contaminated. At least 10 springs have generally have much higher yields than those observed in valleys generally have higher yields than those on hillsides and hilltops. (USGS)

GREATR PITTSBURGH REGIONAL STUDIES, REPORTS AND MAPS, APRIL 1976


Available from the National Technical Information Service, Springfield, VA 22151.

Water resources data for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements.


Journal Announcement: SWRA1501

A requirement of Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, is the understanding of the hydrology in actual and proposed surface-mined areas. Surface-water data for small specific-sites and for larger areas such as adjacent and general areas are needed also to satisfy the hydrologic requirements of the Act. The Act specifies that surface-water modeling techniques may be used to generate the data and information. The purpose of this report is to describe how this can be achieved for smaller watersheds. This report also characterizes 12 "state-of-the-art" strip-mining assessment models that are to be tested with data from small, extensive studies involving small watersheds in watersheds with specific-site data. Extending the use of modeling techniques to larger watersheds remains relatively untested, and to date the upper limits for application have not been established. The U.S. Geological Survey is currently collecting regional hydrologic data in the major coal provinces of the United States and this data will be used to help satisfy the "general-area" data requirements of the Act. This program is reviewed and described in this report. (USGS)

Hydrology of Area 20, Eastern Coal Province, Tennessee, Georgia, and Alabama

Holliday, E. F., and others, 1982

U.S. Geological Survey Water-Resources Investigations 82-440

Improving estimates of streamflow characteristics in the Cumberland Plateau of Tennessee by using digital land-cover data from Landsat satellite


The primary objective is to improve upon the regression equations used to estimate streamflow in areas affected by coal mining in the Cumberland Plateau by using land-cover information derived from digitally processed Landsat data as well as maps. The digital data will update the land-cover data base for the New River basin project "Hydrologic Effects of Coal Mining." The usefulness of the digital land-cover data base developed from Landsat tapes and available map data will be tested by an experiment designed to compare two sets of regression equations—one containing the most up-to-date but routinely-derived basin characteristics derived from Landsat tapes.


Water-Resources Investigations 76-106 (open-file report), September 1976. 14 p. 13 Fig., 1 tab., 3 ref.

Journal Announcement: SWRA1006

Land-cover information is needed to select subbasins within the New River basin, Tennessee, for the study of hydrologic processes and is also needed to transfer study results to other sites affected by coal mining. This study demonstrates that digital processing of Landsat tapes can produce maps and tables of the areal extent of selected land-cover categories. The relative area of each category within the basin is agriculture, 5 percent; evergreens, 7 percent; bare earth, 6 percent; three categories of hardwoods, 81 percent; and water, rock, and unclassified areas, each less than 1 percent. (Woodard-USGS)

Hydrology of area 16, eastern coal province, Virginia, Tennessee

Hufschmidt, P. W., and others, 1981


Hydrology of Area 18, Eastern Coal Province, Tennessee


Journal Announcement: SWRA1511
The Eastern Coal Province is divided into 24 hydrologic reporting areas. This report describes the hydrology of area 18, which is located in the Cumberland River basin in central Tennessee near the southern end of the Province. Hydrologic information and services are presented as text, tables, maps, and other illustrations designed to be useful to mine owners and consulting engineers in implementing permit applications that comply with the environmental requirements of the Surface Mining Control and Reclamation Act of 1977. Area 18 encompasses parts of three physiographic regions: from east to west the Cumberland Plateau, Highland Rim, and Central basin. The Plateau is underlain by sandstones and shales, with thin interbedded coal beds, of Pennsylvanian age. The Highland Rim and Central basin are underlain by limestone and dolomite of Mississippian age. Field and laboratory analyses of chemical and physical water-quality parameters of streamflow samples show widespread problems. Some streams, however, in the heavily mined areas have concentrations of sulfate, iron, manganese, and sediment above natural levels, and pH values below natural levels. Mine seepage and direct mine drainage were not sampled. Ground water occurs in and moves through fractures in the sandstones and shales and solution openings in the limestones and dolomites. Depth to water is variable, ranging from about 5 to 70 feet below land-surface in the limestones and dolomites, and 15 to 40 feet in the coal-bearing rocks. The quality of ground water is generally good, locally in coal-bearing rocks, acidic water and high concentrations of manganese, chloride, and iron have been detected.

The quality of water discharging from the New River and Clinch Fork basins in Tennessee is characterized by neutral pH, low dissolved solids (less than 300 milligrams per liter) and high concentration of suspended sediment. Approximately 59,000,000 tons of suspended sediment were discharged from the New River basin in 1977, as compared to an estimated 20,000,000 tons from the relatively undismined Clinch Fork basin. More than 90 percent of the suspended sediment is silt and clay. In association with these fine-grained suspended sediments are sorbed trace metals. In 1977 the New River basin discharged an estimated 17,000 tons of suspended solids from Clinch Fork only, and discharged an estimated 600 tons.

Suspended-sediment concentration was found to be highly correlated with both suspended and total trace-metal concentrations. This correlation coupled with the nearly neutral pH of water indicates that trace metals are transported primarily in the suspended phase. The most promising indicator of the presence of coal mining was found to be dissolved sulfate. All unmined basins sampled in this study showed dissolved-sulfate concentrations less than 20 milligrams per liter, whereas all mined basins had dissolved-sulfate concentrations in excess of 20 milligrams per liter regardless of basin size or discharge.

Appraisal of Hydrologic Information Needed in Anticipation of Lignite Mining in Lauderdale County, Tennessee

Park, W. S.


Lignite in western Tennessee occurs as lenses or beds in various stratigraphic horizons in the Coastal Plain sediments of Late Cretaceous and Tertiary age. The occurrence of this lignite has been known for many decades, but not until the energy crisis was it considered an important energy resource. In recent years, several energy companies have conducted extensive exploration programs in western Tennessee, and tremendous reserves of lignite have been found. Lauderdale County was selected as one of the counties where strip-mining of lignite will most likely occur. Lignite in this county occurs in the Jackson and Cockfield Formations, undivided, of Tertiary age. The hydrology of the county is known only from regional studies and the collection of some specific data. Therefore, in anticipation of the future mining of lignite, a plan is needed for obtaining hydrologic and geologic information to adequately define the hydrologic system before mining begins and to monitor the effects of strip-mining once it is begun. For this planning effort, available hydrologic, geologic, land-use, and associated data were located and compiled; a summary description of the surface and shallow subsurface hydrologic system was prepared; the need for additional baseline hydrologic information was outlined; and plans to monitor the effects of strip-mining were proposed.

Benthic populations of thirty-three stream locations draining coal reserves of Tennessee; Tennessee Technological University, Cookeville

Pennington, W. R., 1980
Final report to U.S. Geological Survey, Nashville

Water pollution occurs from the mining of coal when dissolved, suspended, or other solid mineral waste enters the receiving streams. This can occur from water flowing from surface or underground mines. The pollution that occurs may be physical or chemical and is usually harmful to aquatic life. Because of the increase in mining activity, the U.S. Geological Survey has initiated a monitoring program to determine the benthic macroinvertebrate populations of selected areas draining coal reserves to coincide with their current water-quality monitoring programs. This information will be used to make projections of changes that may occur and to provide baseline information for many of the areas that may be affected by future mining. This report summarizes some of that benthic macroinvertebrate information. (From author's introduction.)

Synthetic fuels development, earth science considerations

Rickert, O. A., Ulman, M. J., Jr., and Hampton, E. R., editors, 1979

Ground-water resources in the Cumberland River basin, Kentucky-Tennessee


Hydrology of Area 4, Eastern Coal province, Pennsylvania, Ohio, and West Virginia

Roth, R. K., Engleke, M. J., Jr., and others, 1981

The Cumberland Plateau overthrust and geology of the Crab Orchard Mountains area, Tennessee

Stearns, B. G., 1956
Tennessee Division of Geology Bulletin 60, 47 p.

Water Resources of the Appalachian Region, Pennsylvania to Alabama

Mark, J. W., 1965; 4 Schneiders, M. J., Jr., and others

Summary Appraisals of the Nation's Ground-Water Resources--Tennessee Region

Zurawski, A.

Journal Announcement: SWA1122

Ground water is an abundant but underdeveloped resource in the water-rich Tennessee Region. The estimated recharge to aquifers in the region is one-fifth to one-third of the precipitation, or about 8 trillion gallons per year. Less than one percent of this amount of ground water was used in 1970. The aquifers of the Tennessee Region are composed of carbonate rocks, unconsolidated granular materials, and fractured noncarbonate rocks. Because of their great areal extent the carbonate aquifers have the greatest potential for ground-water development. Although ground water has been a little used resource in the Tennessee Region, it could play a significant role in regional water supply. However, optimum development would require a degree of knowledge of ground-water occurrence, movement and interaction with surface water that is unavailable in most of the region. Because it is an integral part of the region's water resources, ground water deserves further study and consideration in regional development planning. (Woodard-USGS)

Water Resources Data for Tennessee, Published annually since 1970

Water resources data for Tennessee consist of records of stage, discharge, and water quality of streams and springs; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Tennessee. (USGS)
milligrams per liter of dissolved solids, which is shown on the sections, serves as an index of water availability of this quality. (Woodard-USGS)

Descriptors: *Groundwater availability; *Water quality; *Aquifer characteristics; *Texas; *Gulf Coastal Plain; *Stratigraphy; Hydrogeology; Geologic mapping; Catahoula Sandstone; Evangeline aquifer; Chicot aquifer

Section Heading Codes: 2F (Water Cycle--Groundwater); 6B (Water Quantity Management and Control--Groundwater Management)

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--TEXAS-GULF REGION

Baker, E. T. JR; Wall, J. H.

GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C., 20402, $2.45 IN PAPER COPY. PROFESSIONAL PAPER 813-F, 1971. 66 P, 12 FIG, 9 TAB, 29 REF., 100 REF.,

Journal Announcement: SWRA01915

GROUNDWATER IN THE TEXAS-GULF REGION IS A LARGE AND IMPORTANT RESOURCE THAT CAN PROVIDE A MORE SIGNIFICANT PERCENTAGE OF THE TOTAL WATER SUPPLY OF THE REGION, TOTAL WATER REQUIREMENTS WITHIN THE REGION ARE PROJECTED TO RISE SHARPLY FROM 14 MILLION ACRE-FT (17 CUBIC KILOMETRES) IN 1970 TO NEARLY 26 MILLION ACRE-FT (32 CUBIC KILOMETRES) IN 2020. ABOUT HALF OF THE WATER USED IN 1970 WAS GROUNDWATER. AN ESTIMATED TOTAL OF 1.04 BILLION ACRE-FT (1,280 CUBIC KILOMETRES) OF RECOVERABLE WATER CONTAINERS LESS THAN 2 METRES) IN THE AQUIFERS OF THE REGION. IN ADDITION, PART OF AN ESTIMATED 3.28 BILLION ACRE-FT (4,040 CUBIC KILOMETRES) OF WATER IN STORAGE BELOW 400 FT (122 METRES) IS RECOVERABLE. THROUGH NOT ALL OF THE GROUNDWATER IS RECOVERABLE, A SIGNIFICANT AMOUNT IS AVAILABLE FOR DEVELOPMENT; AND AN ENORMOUS QUANTITY IS ACCESSIBLE SHOULD OCCASIONS PROMPT ITS USE ON A TIME-LIMITED BASIS. (WOODARD-USGS)

Descriptores: *Groundwater resources; *Available water; *Water quality; *Regional analysis; *Hydrologic data; Water supply; Water yield; Water storage; Aquifer characteristics; Water utilization; Water demand; Conjunctive use; Water resources development; Water rights

Section Heading Codes: 2F (Water Cycle--Groundwater); 6B (Water Cycle--Chemical Processes); 4B (Water Quantity Management and Control--Groundwater Management)

GROUND-WATER RESOURCES OF CASS AND MARION COUNTIES, TEXAS

U.S. GEOLOGICAL SURVEY, AUSTIN, TEX.

TExAS WATER DEVELOPMENT BOARD; 12, 1970, 104 P, 1 FIG, 1 TABLE, 5 REF.,

Journal Announcement: SWRA01210

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes and interrelationship of these units statewide across much of the Coastal Plain of Texas. These units, and 1 strike section, which extend from the land surface to 7,600 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000

Stratigraphic and Hydrogeologic Framework of the Coastal Plain of Texas

Baker, E. T. JR


Open-file report 77-712, March 1978. 32 p, 15 FIG, 1 TAB, 34 REF.,

Journal Announcement: SWRA1202

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes and interrelationship of these units statewide across much of the Coastal Plain of Texas. These units, and 1 strike section, which extend from the land surface to 7,600 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000

ANNUAL COMPILATION AND ANALYSES OF HYDROLOGIC DATA FOR CALAVERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1969

Alexander, J. M.


Geological Survey Data Report 1970, 56 p, 2 FIG, 3 TAB,

Journal Announcement: SWRA0183

The report contains the rainfall, runoff, and storage data collected during the 1969 water year for the 77.2-square-mile area above the stream-gaging station Calaveras Creek near Elmendorf, Texas. The seven floodwater-retarding structures in the Calaveras Creek watershed. These structures have a capacity for temporary storage of 8,640 acre-feet of flood runoff from 28.6 of the 77.2-square-mile study area. All but one of the structures are upstream from Calaveras lake. The mean rainfall for the 1969 water year was 30.91 inches, or 112% of the 14-year (1955-68) weighted-mean average. The average monthly rainfall totals ranged from 0.42 inch in July to 6.02 inches in November. Mean daily discharge at the stream-gaging station, Calaveras Creek near Elmendorf, was 1.16 cfs. This shows the effect of Calaveras Dam on the basin as the average discharge for the preceding 14 years was 10.7 cfs. Annual runoff at the stream-gaging station was 859 acre-feet, or 0.20 inch. Three storms were selected for detailed computations including detailed time breakdown of rainfall and discharge. Hydrograph and mass curves are drawn for illustrations.

(Woodard-USGS)

Descriptors: *Surfaceflow; *Rainfall-runoff relationships; *Hydrologic data; *Data collections; *Texas average flow; Small watersheds; Flow measurement; Stream gages; Runoff; Flow rates; Flow characteristics; Storms; Watershed management; Hydrographs; Mass curves; Reservoirs; Flood control; Water storage; Water yield

Section Heading Codes: 7C (Resources Data--Evaluation, processing, and publication); 2F (Water Cycle--Streamflow and runoff)
GROUN-D WATER RESOURCES OF WOOD COUNTY, TEXAS.

U. S. GEOLOGICAL SURVEY.

TEXAS WATER DEVELOPMENT BOARD REP 79. 84 P. AUG 1968. 19 FIG. 11 TAB. 35 REF.

JOURNAL ANNOUCEMENT: SWRA004 COUNTY IN NORTHEASTERN TEXAS, ARE DESCRIBED. THE PRINCIPAL SOURCES ARE THE TERTIARY CARRIZO-WILCOX AND SPARTA-QUEEN CITY AQUIFERS. THE SAFE PECENIAL YIELD IS ABOUT 55,000 ACRE-FEET PER YR. OF WHICH ABOUT 50,000 ACRE-FEET PER YR. IS IN THE SPARTA-QUEEN CITY AQUIFER: THE 1965 PUMPING RATE WAS ONLY ABOUT 3,500 ACRE-FEET PER YR. ABOUT 34 MILLION ACRE-FEET OF FRESH WATER IS STORED IN THE UPPER 400 FT OF THE CARRIZO GROUP. THE AREA'S LOW PH AND HIGH IRON CONTENT OF THE WATER MAY LIMIT LARGE-SCALE GROUNDWATER DEVELOPMENT. THE OCCURRENCE OF IRON IS PREDICTABLE, SO THAT WITH CAREFUL WELL CONSTRUCTION AND PUMPING, RELIABLE IRON-FREE WATER CAN BE RECOVERED FROM BOTH AQUIFERS. GROUNDWATER BASIC DATA TABLES INCLUDE WELL DESCRIPTION, CHEMICAL DATA, DEPTH TO WATER, AND DRILLER'S NAMES. HYDROGRAPHIC AND FLOW-DETERMINATION CURVES FOR THE CARRIZO WILCOX GROUP ARE ALSO PRESENTED. A GEOLOGIC MAP AND CROSS SECTIONS, MAPS SHOWING DEPTH TO THE AQUIFERS, A MAP OF WATER LEVELS, GRAPHS SHOWING DRAWDOWN-DISTANCE-TIME, DIAGRAMS SHOWING HYDROGRAPHIC ZONES, AND MAPS SHOWING AQUIFER THICKNESS ARE INCLUDED. (KNAPP-USGS)

GROUN-D WATER RESOURCES OF GREGG AND UPSHUR COUNTIES, TEXAS.


WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED.

TEXAS. OCTOBER 1974-SEPTEMBER 1976

DAVIDSON, H. J. GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.

OPEN-FILE REPORT 78-98, JANUARY 1978. 46 P. 2 FIG. 10 TAB 8 REF.

JOURNAL ANNOUNCEMENT: SWRA1123


WATER-QUALITY RECORDS FOR THE HUBBARD CREEK WATERSHED.

TEXAS. OCTOBER 1967-SEPTEMBER 1969

DAVIDSON, H. J. GEOLOGICAL SURVEY, AUSTIN, TX.

GEOLOGICAL SURVEY OPEN-FILE REPORT (TEXAS DISTRICT), 1972. 78 P. 2 FIG. 11 TAB 5 REF.

JOURNAL ANNOUNCEMENT: SWRAS15


GROUN-D WATER RESOURCES OF BASTROP COUNTY, TEXAS.

FOILLET, C. R.

REPORT PUBLISHED AND DISTRIBUTED BY TEXAS WATER DEVELOPMENT BOARD, PO BOX 12386, AUSTIN, TEX 78711. TEXAS WATER DEVELOPMENT BOARD REPORT 101., OCT 1969. 76 P. 16 FIG. 9 TAB 41 REF.

JOURNAL ANNOUNCEMENT: SWRA031

GREGG AND UPSHUR COUNTIES, IN NORTHEAST TEXAS, ARE UNDERLAIN BY TWO AQUIFERS THAT ARE CAPABLE OF SUSTAINING...
GROUNDWATER RESOURCES OF BRAZOS AND BURLESON COUNTIES, TEXAS

The principal formations in Bastrop County, Texas, that yield large quantities of water to wells are the Wilcox Group, Carrizo Sand, Queen City Sand, and Sparta Sand. The Carrizo Sand and the underlying Wilcox Group are connected hydrologically and function as a single aquifer. The use of groundwater is gradually increasing, but the total of 3.7 mgd or 4,100 acre-feet per year used in 1966 is small compared to the quantity available. About 100 million acre-feet of fresh to slightly saline water is in transient storage in the principal aquifers, but only a fraction of this water is economically recoverable. 

The yields of wells in Bastrop County range from a few gallons a minute to about 1,800 gpm. Yields of at least 2,000 gpm are possible from properly constructed and screened wells in the Carrizo-Wilcox aquifer. The dissolved-solids content of selected water samples ranged from 10 to 4,020 mg/l.

Editorial note: The underwater storage data collected during 1964-65 is not included. Additional development of ground water in westernmost Texas will be accompanied by further declines in water levels, and will probably induce local migration of slightly saline ground water into fresh water aquifers. Land surface subsidence could occur in local areas where water-level declines are large and the basin fill contains large amounts of compressible clay.


HAMPTON, B. H. 

GEOLoGICAL SURVEY, AUSTIN, TX. WATeR RESOuRces DIV. 


Journal Announcement: SWRA0075

The U.S. Soil Conservation Service is actively engaged in the installation of flood- and soil-erosion reducing measures in Texas. Hydrologic investigations of small watersheds were begun by the U.S. Geological Survey in 1951 and are now being made in 12 study areas. This report contains the rainfall, runoff, and storage data collected during the 1971 water year for the 46.1-square-mi area above the stream-gaging station on Green Creek, near W同期on. The eight floodwater-retarding structures in the Green Creek study area contain a total combined capacity of 7,500 acre-feet below
HYDROLOGIC STUDIES OF SMALL WATERSHEDS, GREEN CREEK, BRAZOS RIVER BASIN, TEXAS, 1955-66

HAMPTON, H. D.

GEOLOGICAL SURVEY, AUSTIN, TEX.

WATER DEVELOPMENT BOARD, AUSTIN, REPORT 159, NOVEMBER 1972.

Journal Announcement: SWRAUS17

ANNUAL COMPIILATION AND ANALYSIS OF HYDROLOGIC DATA AND MUKWATER CREEK, COLORADO RIVER BASIN, TEXAS, 1969

HEIJL, H. H. JR

GEOLOGICAL SURVEY, AUSTIN, TEX.

WATER RESOURCES DIV.

GEOLOGICAL SURVEY DATA REPORT, 1970. 94 P. 2 FIG. 3 TAB.

Journal Announcement: SWRAUS17


ANNUAL COMPIILATION AND ANALYSIS OF HYDROLOGIC DATA FOR DEEP CREEK, COLORADO RIVER BASIN, TEXAS, 1970

HEIJL, H. R. JR

GEOLOGICAL SURVEY, AUSTIN, TEX.

GEOLOGICAL SURVEY OPEN-FILE REPORT (TEXAS DISTRICT), APRIL 1972. 35 P. 2 FIG. 3 TAB.

Journal Announcement: SWRAUS58

RECONNAISSANCE INVESTIGATION OF GROUND WATER IN THE RIO GRANDE DRAINAGE BASIN--WITH SPECIAL EMPHASIS ON SALINE GROUND-WATER RESOURCES

KELLY, T. E.

GEOLOGICAL SURVEY, RESTON, VA.

WATER RESOURCES DATA.

GEOLOGICAL SURVEY INVESTIGATIONS ATLAS HA-510, 1974. 4 SHEETS, 14 MAPS, 47 REF.

Journal Announcement: SWRAUS05

THE SURFACE-WATER RESOURCES OF THE RIO GRANDE DRAINAGE BASIN, COLORADO, NEW MEXICO, AND TEXAS, ARE INSUFFICIENT TO MEET PRESENT NEEDS IN MOST OF THE BASIN. GROUNDWATER SUPPLIES HAVE BEEN EXTENSIVELY DEVELOPED FOR IRRIGATION AND FOR MUNICIPAL USES. IN AREAS OF HEAVY GROUNDWATER USE THEY OFTEN SUBSTANTIALLY EXCEED ANNUAL RECHARGE; THEREFORE THE GROUNDWATER IN STORAGE IS BEING DEPLETED STEADILY, WITH...
ACCOMPANYING DETERIORATION IN QUALITY, GROUNDWATER IN THE RIO GRANDE BASIN CAN BE DIVIDED INTO TWO MAJOR QUALITY TYPES: FRESHWATER WHICH GENERALLY IS NEAR THE SURFACE, AND THE MORE DEEP SEATED SALTIER WATER. FRESHWATER IS PRESENT IN INSUFFICIENT QUANTITIES IN MOST OF THE RIO GRANDE BASIN IN COLORADO AND NEW MEXICO, AND IN PARTS OF WEST TEXAS, THE GREATEST THICKNESS OF THE FRESHWATER AQUIFER IS PRESENT IN THE SAN LUIS STRUCTURAL BASIN OF COLORADO. THROUGHOUT THIS ENTIRE BASIN THE WATER TABLE GENERALLY IS LESS THAN 12 FEET BELOW THE LAND SURFACE. THE MIDDLE BASIN AREA IS CHARACTERIZED BY WELL LITHIFIED PALEOZOIC ROCKS. LIMESTONE IS THE MAJOR LITHOLOGY. THROUGHOUT MOST OF THIS AREA FRESHWATER IS PRESENT IN THE THIN ALLUVIAL DEPOSITS OF THE RIVER VALLEYS; IN OTHER AQUIFERS THE WATER RANKS IN QUALITY FROM SLIGHTLY SALINE TO ARID. THE LOWER BASIN REGION IS SIMILAR TO THE MIDDLE BASINS, BUT THE ROCKS GENERALLY ARE MESOZOIC IN AGE AND THE GROUNDWATER IS LESS HIGHLY MINERALIZED. MAJOR AQUIFERS IN THE REGION ARE LIMESTONE AND PAREL OF CRETACEOUS AGE WHICH GENERALLY YIELD FRESHWATER TO WELLS AT SHALLOW (KNAPP-USGS).

Hydrologic Data for North Creek Trinity River Basin, Texas, 1979

Kidwelly, C. C.


Journal Announcement: SWRA910

This report contains rainfall and runoff data collected during the 1979 water year for the 21.6-square mile area above the stream-gaging station North Creek near Jacksboro, Texas. Continuous water-stage recording gage was installed on one representative floodwater-retarding structure (site 28-A) on October 1, 1972. The data are collected to compute the contents, surface area, inflow, and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations are included for one storm during the 1979 water year at the stream-gaging station. (USGS)

Hydrologic Data for North Creek Trinity River Basin, Texas, 1975

Kidwelly, C. C.


Open-file report 76-724. April 1977. 50 p, 2 Figs, 3 Tabs.

Journal Announcement: SWRA1023

This report contains the rainfall, runoff, and storage data collected during the 1975 water year for the 21.6-square-mile area above the stream-gaging station North Creek near Jacksboro, Texas. The weighted-mean rainfall in the study area during the water year was 39.01 inches which is greater than the 18-year average of 30.21 inches for the period 1958-75. Monthly rainfall totals ranged from 1.04 inches in November to 7.94 inches in May. The mean discharge for 1975 at the stream-gaging station was 5.98 cfs, compared with the 14-year (1957-70) average of 5.75 cfs. The annual runoff from the basin above the stream-gaging station was 4,230 acre-feet or 3.76 inches. Three storms were selected for detailed computations for the 1975 water year. The storms occurred on Oct. 30-31, 1974, May 27, 1975, and Aug. 26, 1975. Rainfall and discharge were computed on the basis of a refined time breakown. Patterns of the storms are illustrated by hydrographs and mass curves. A summary of rainfall-runoff data is tabulated. There are five floodwater-retarding structures in the study area. A total capacity of 4425 acre-feet below flood-spillway crests and regulate streamflow from 16.3 square miles or 75 percent of the study area. A summary of the physical data at each of the floodwater-retarding structures is included. (Woodard-USGS)

HYDROLOGIC DATA FOR NORTH CREEK TRINITY RIVER BASIN, TEXAS, 1976

Kidwelly, C. C.

GEOLOGICAL SURVEY, AUSTIN, TEX.

OPEN-FILE REPORT, MAY 1976. 40 P, 2 FIG, 3 TAB.

Journal Announcement: SWRA910

This report contains the rainfall, runoff, and storage data collected during the 1976 water year for the 21.6 square mile area above the stream-gaging station North Creek near Jacksboro, Texas. The annual rainfall was 47.94 inches for the period 1958-75. Monthly rainfall totals ranged from 0.00 inches in December to 7.07 inches in August. The yearly mean discharge at the stream-gaging station was 1,13 cfs, compared with the 14-year (1957-70) average of 5.75 cfs. Prior to the notable effect caused by the floodwater-retarding structures, the annual runoff from the basin above the stream-gaging station was 521 acre-ft. Two storms were selected for detailed computations for the 1976 water years. The storms selected occurred on Oct. 1, 1975 and Aug. 29, 1974. Rainfall and discharge were computed on the basis of a refined time breakown. Patterns of the storms are illustrated by hydrographs and mass curves. (Woodard-USGS)
Kidwell, C. C. 
Available from U.S. GSS Box 25625, Fed. Ctr., Denver, CO 80222. Prices: $5.50 in paper copy, $3.50 in microfiche. 

Journal Announcement: SWRA 1415 
This report contains rainfall and runoff data collected during the 1978 water year for the 21.6-square mile area above the stream-gaging station North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are collected to compute the contents, surface area, inflow, and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations are included for two storm periods during the 1978 water year at the stream-gaging station. (USGS)

Kidwell, C. C. 

Journal Announcement: SWRA 1216 
This report contains rainfall and runoff data collected during the 1976 water year for a 21.6-square mile area above the stream-gaging station North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are used to compute the contents, surface area, inflow, and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations, including hydrographs and mass curves, are included for two storm periods during the 1976 water year at the stream-gaging station. (Woodard-USGS)

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE SULPHUR RIVER AND CYPRESS CREEK BASINS, TEXAS. 
LEIFESTE, DONALD K. 
GEOLaOGICAL SURVEY, AUSTIN, TEX. 
TEXAS WATER DEVELOPMENT BOARD REPORT 87, DEC. 1968. pp. 13 figs. 6 tabs. 29 ref. 

The sulphur river and Cypress Creek basins are free of serious water-quality problems, continued municipal and industrial growth will increase the waste-disposal burdens of the streams, and planned impoundments will cause a reduction in the streamflow which now aids in waste assimilation. Average annual precipitation ranges from 45 in. in the north to 55 in. in the south, and streamflow rates range from high to low. The Precipitation, Flow Rates, and Chemical Quality of Surface Waters of the Sulphur River and Cypress Creek Basins in Texas. 

ROCKS IN THE SULPHUR RIVER BASIN IS GENERALLY OF A MIXED TYPE CONTAINING LESS THAN 250 PPM DISSOLVED SOLIDS, EXCEPT IN THE WHITE OAK CREEK SUB BASIN WHERE OIL-FIELD DRAINAGE INTERMITTENTLY DEGRADERS THE QUALITY OF THE WATER. IN THE CYPRESS CREEK BASIN, THE CRETACEOUS ROCKS CONTRIBUTE A SODIUM CHLORIDE TYPE WATER THAT GENERALLY CONTAINS LESS THAN 250 PPM DISSOLVED SOLIDS. THE CHLORIDE CONTENT OF THE SURFACE WATERS IS GENERALLY LESS THAN 25 PPM, EXCEPT WHERE OIL-FIELD DRAINAGE IS AFFECTING THE QUALITY OF THE WATER. ALL THE RESERVOIRS IN THE BASINS CONTAIN WATER OF VERY GOOD QUALITY. THE DISSOLVED-SOLIDS CONCENTRATION IS USUALLY LESS THAN 150 PPM. WATER THAT WILL BE STORED IN ROBERT LEE RESERVOIR, NOW SALINE WATER. SMALL-SCALE MAPS SHOW THE RANGE IN PRECIPITATION AND RUNOFF; LOCATIONS OF RESERVOIRS, OIL FIELDS, GAGING STATIONS, AND CHEMICAL-QUALITY SAMPLING SITES; AND GEOLOGY. IMPORTANT TABLES GIVE THE SOURCE, SIGNIFICANCE, AND INDUSTRIAL TOLERANCES FOR VARIOUS MINERAL CONSTITUENTS; AN INDEX TO SURFACE-WATER RECORDS; SUMMARY OF CHEMICAL QUALITY ANALYSES AT DAILY STATIONS; AND CHEMICAL ANALYSES OF WATER FROM OTHER STATIONS.


The Edwards aquifer, which is one of the most productive aquifers in the southwestern military installations, and 17 communities in South Texas, San Antonio, which has a population of about 750,000, obtains its entire water supply from the Edwards. The primary purpose of this progress report is to describe the geology and porosity of the rocks of the Edwards aquifer in the San Antonio area and to present preliminary interpretations of borehole geophysical and laboratory data. The data were obtained from geophysical and geologic studies of nine cored test holes, from laboratory analyses of samples of aquifer materials, and from recent stratigraphic studies by Rose (1972). The aquifer is areally divided into a fresh-water zone and a saline zone at the "bad-water" line. The bad-water line forms the southern boundary of the fresh-water zone.
and its position is determined by the Rock characteristics and water chemistry. In the fresh-water one differs markedly from those of the saline zone. The high permeability of the aquifer within the fresh-water zone results from open fractures and selectively dissolved facies. (Woodard-USGS)

ANNUAL COMPIILATION AND ANALYSIS OF HYDROLOGIC DATA FOR GREEN CREEK, BRAZOS RIVER BASIN, TEXAS--1969

MASEY, B. C.

GEOLOGICAL SURVEY, AUSTIN, TEX.

GEOLOGICAL SURVEY DATA REPORT, 1970, 44 p., 2 FIGS. 3 TABLES.
Journal Announcement: SWRA716

This report, which is the tenth in a series of detailed analysis reports published annually for the Green Creek study area, contains the rainfall-runoff, and storage data collected during the 1969 water year (Oct. 1968-Sept. 1969), soil-porous area above the stream-gaging station Green Creek near Alexander, Texas. The locations of the floodwater-retarding structures and hydrologic instruments in the area are shown. The weighted-mean rainfall was 31.07 inches, or 98 percent of the 31.67 inches in Dublin, Texas. The mean daily discharge at the stream-gaging station Green Creek near Alexander was 12.7 CFS compared with the 11-year (1958-69) average of 6.14 CFS. Three storm periods were selected for detailed analysis and computation. These computations include detailed time break down of rainfall and discharge, hydrographs, and mass curves. The storms selected occurred on April 12, 1969; July 27, 1969, and July 28, 1969. A summary of rainfall-runoff data for these storms is tabulated. Computations along the hydrographs and mass curves for the storms are shown in the compilation and analysis of data. (Woodard-USGS)

RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATERS OF THE RIO GRANDE BASIN, TEXAS

MENDIETA, M.

GEOLOGICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 180, MARCH 1974, 109 P.
10 FIGS., 11 TABS., 46 REF.
Journal Announcement: SWRA716

The kinds and quantities of minerals dissolved in surface waters of the Rio Grande basin are related principally to the geology of the area and return flow from irrigation. During periods when the flow consists principally of seepage from the quaternary deposits and return flow from irrigation, water in the upper reach of the Rio Grande usually is slightly saline and very hard. Water in the upper reach of the Pecos River and most of its tributaries that traverse the quaternary deposits is slightly hard, that traverse the tertiary deposits in the Mexican side of the basin is fresh and very hard. Much of the middle reach of the Rio Grande basin is underlain by rocks of cretaceous age. Water in streams that traverse these deposits usually is fresh and hard. Inflow from the Rio Conchos and other tributaries and from springs more than compensates for the saline inflow from the Pecos River, and results in a decrease in dissolved constituents in the middle reach of the Rio Grande. Water in the international Falcon reservoir on the lower Rio Grande is used for municipal supply, industry, and irrigation. Return flow from irrigation causes an increase in dissolved constituents downstream from the reservoir. The concentrations of dissolved solids and sulfate in the Rio Grande upstream from the Rio Conchos usually exceed the limits recommended by the U.S. Public Health Service for drinking water. Water in the Pecos River and some of its tributaries is undesirable for domestic or industrial use because the water usually contains excessive concentrations of dissolved solids, sulfate, and chloride. Water in most of the other streams usually is suitable for domestic supply and many industrial uses. The sodium hazard of water in the Rio Grande usually ranges from low to medium. That of the Pecos River usually is very high. The salinity hazard of water in the Rio Grande and Pecos River usually is high or very high. (Knapp-USGS)

TRAVEL TIME FOR SOLUTES, UPPER SABINE RIVER BASIN, TEXAS

MILLS, W. U.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

GEOLOGICAL SURVEY OPEN-FILE REPORT 1972, 2 SHEETS, 2 FIGS. 2 TABLES.
Journal Announcement: SWRA610

The U.S. GEOLOGICAL SURVEY, IN COOPERATION WITH THE SABINE

APPLICATION OF A RAINFALL-RUNOFF MODEL IN ESTIMATING FLOOD PEAKS FOR SELECTED SMALL NATURAL DRAINAGE BASINS IN TEXAS

MASEY, B. C.; SCHROEDER, E. E.


Green-file report 77-792, December 1977, 23 p., 2 FIGS., 1 TABLE, 13 REFERENCES.
Journal Announcement: SWRA1114

A parametric rainfall-runoff simulation model was used to synthesize long-term records of annual peak discharges for small natural drainage basins in Texas. Optimum model-parameter values were determined for each of the 40 basins studied by using short-term rainfall-evaporation and discharge data. The calibrated model was used in conjunction with long-term records of rainfall and evaporation to synthesize a record of annual peaks for each site. Because the frequency curves of the simulated peaks had flatter slopes than those of the observed peaks, the synthetic frequency curves were adjusted for the loss of variance inherent in the modeling process. (Woodard-USGS)
RIVER COMPACT ADMINISTRATION, CONDUCTED TIME-OF-TRAVEL STUDIES USING RHODAMINE WT DYE IN THE SABINE RIVER BASIN, TEXAS, ON APRIL 16-20, 1972. ONE STUDY WAS MADE ON THE MAIN STEM OF THE SABINE RIVER IN FOUR REACHES FROM LAKE TAWAKONI TO TOLEDO BEND RESERVOIR, A DISTANCE OF 219 MILES. TWO OTHER STUDIES WERE MADE ON REACHES FROM LAKE FORK CREEK AND BIG SANDY CREEK. THE PURPOSE WAS TO PROVIDE TRAVEL-RATE DATA TO BE USED BY THE SABINE RIVER AUTHORITY OF TEXAS IN CONSTRUCTING A HYDROLOGIC MODEL OF THE BASIN. THE AVERAGE VELOCITY IN THE SABINE RIVER SHOWED AN OVERALL INCREASE FROM 0.33 FPS IN THE UPSTREAM REACH TO 0.81 FPS AT THE DOWNSTREAM END, EVEN THOUGH THE VELOCITY FLUCTUATED BETWEEN ADJOINING REACHES. AVERAGE VELOCITIES IN THE TRIBUTARY STREAMS RANGED FROM 0.08 FPS TO 0.30 FPS. THE HIGHER VELOCITIES OCCURRED AFTER RUNOFF FROM THE STORM ON APRIL 27 ENTERED THE STREAMS. MAPS, TABLES, AND HYDROGRAPHS SUMMARIZE THE DATA ON TWO SHEETS (APPROXIMATELY 1 X 2.25 TIMES THE LOCATION OF SAMPLING SITES, WATER QUALITY, PROFILES AND AVERAGE VELOCITY OF DYE PEAKS, AND SHAPE OF THE DYE CLOUD AT EACH MEASURING POINT. (WOODARD-USGS)

WATER BUDGET AND QUALITY OF WATER STUDIES OF HUBBARD CREEK RESERVOIR, TEXAS, 1963-67 WATER YEARS

WYERS, B. A.

GEOLGICAL SURVEY. AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 151, JUNE 1972. 9 P., 1 FIG., 2 TAB. 15 REF.

Journal Announcement: SWRA0520

THE RESULTS OF A WATER BUDGET AND CHEMICAL QUALITY OF WATER STUDY OF HUBBARD CREEK RESERVOIR (TEXAS) ARE PRESENTED. DATA COLLECTED INCLUDED COMPUTATION OF WATERSHED PRECIPITATION, INFLOW AND OUTFLOW OF THE RESERVOIR, EVAPORATION, AND CHEMICAL ANALYSIS OF WATER. SMALL WATER LOSSES WERE ATTACHED TO SATURATION OF ALLUVIAL SEDIMENT IN THE RESERVOIR BASIN DURING THE INITIAL FILLING OF THE RESERVOIR, BECAUSE THERE ARE NO GROUNDWATER AQUIFERS OF IMPORTANCE IN THE WATERSHED. AND BECAUSE THE SEDIMENTS WITHIN THE DRAINAGE BASIN ARE RELATIVELY IMPERMEABLE, NO LARGE AMOUNTS OF WATER ARE LOST BY INFILTRATION. DURING THE PERIOD 1963-67, APPROXIMATELY 110,000 ACRE-FeET OF WATER WAS LOST BY EVAPORATION. THIS AMOUNT REPRESENTS ABOUT 50% OF THE CAPACITY OF THE RESERVOIR AT NORMAL OPERATING LEVEL. WATER-SAMPLE ANALYSES FROM TRIBUTARIES PASSING THROUGH OIL FIELDS INDICATE THAT INDUSTRIAL WASTE CONTRIBUTES TO MINERALIZATION OF THE RESERVOIR WATER. (WOODARD-USGS)

TIME-OF-TRAVEL OF SOLUTES IN THE TRINITY RIVER BASIN, TEXAS, SEPTEMBER 1973 AND JULY-AUGUST 1974

OLLMAN, R. H.

GEOLGICAL SURVEY, FORT WORTH, TEX.

OPEN-FILE REPORT 75-536, NOVEMBER 1975. 3 SHEETS, 2 FIG., 2 TAB.

Journal Announcement: SWRA0911


GEODYNAMIC SIGNIFICANCE OF LITHOCARPS OF THE COCKFIELD FORMATION OF LOUISIANA AND MISSISSIPPI AND OF THE YEGUA FORMATION OF TEXAS

PAYNE, J. N.

GEOLGICAL SURVEY, WASHINGTON, D.C.

AVAILABLE FROM SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D.C. 20402 - $0.25 (INCLUDING PLATES IN SEPARATE CASE). GEOLOGICAL SURVEY PROFESSIONAL PAPER 1104, 14 P., 2 FIG., 8 PLATES, 1 TAB. 63 REF. (PLATES UNDER SEPARATE COVER). JOURNAL ANNOUNCEMENT: SWRA0615

WATER IN AND NEAR OUTCROPS CONTAINS APPRECIABLE AMOUNTS OF CALCIUM AND MAGNESIUM. DIFFERENCES IN LITHOFACIES DISTRIBUTION AND OF ALTITUDE OF THE PIEZOMETRIC SURFACES ARE VIVIDLY REFLECTED IN THE REGIONAL DISTRIBUTION OF THE DISSOLVED-SOLIDS CONTENT OF WATER. (KNAPP-USGS)

GEHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI

PAYNE, J. N.

GEOLOGICAL SURVEY, BATON ROUGE, LA.

AVAILABLE FROM SUP. OF DOCUMENTS, GPO WASH., D.C. 20402 - PRICE $11.00. GEOLOGICAL SURVEY PROFESSIONAL PAPER 569-D, 1973, 11 P, 2 FIG., 9 PLATES, 1 TAB., 60 REF.

Journal Announcement: SWRA0151


HYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CANE RIVER FORMATION OR EQUIVALENTS OF ARKANSAS, LOUISIANA, MISSISSIPPI, AND TEXAS

PAYNE, J. N.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

AVAILABLE FROM GPO, WASHINGTON, D.C. 20402 - PRICE $10.00. GEOLOGICAL SURVEY PROFESSIONAL PAPER 569-C, 1972, 17 P, 4 Fig., 16 Plate (BOUND SEPARATELY), 1 Tab., 61 REF.

Journal Announcement: SWRA0151


RECONNAISSANCE OF THE OXYGEN BALANCE AND THE VARIATION OF SELECTED NUTRIENTS IN THE SAN ANTONIO RIVER DURING LOW FLOW

Rayburn, J.; Goss, R. L.; Kathburn, J. G.

GEOLOGICAL SURVEY, AUSTIN, TEX. TEXAS WATER DEVELOPMENT BOARD REPORT 142, FEBRUARY 1972. 11 P, 8 FIG., 2 TAB., 1 REF.

Journal Announcement: SWRA0151

A WATER-QUALITY RECONNAISSANCE OF THE SAN ANTONIO RIVER IN TEXAS WAS MADE TO DETERMINE THE PROGRESS OF WASTE ASSIMILATION TO DELINEATE THE CRITICAL RACH OF THE RIVER IN WHICH THE MINIMUM DISSOLVED-OXYGEN CONCENTRATION OCCURS AND TO DETERMINE THE CONCENTRATIONS OF SELECTED NUTRIENTS IN THE RIVER DURING THE LOW-FLOW PERIOD JUNE 16-19, 1969. WATER-QUALITY AND DISCHARGE DATA WERE OBTAINED AT SEVEN SITES IN THE 136.5-MILE REACH OF THE RIVER BETWEEN FARM ROAD 1518 NEAR ELMENDORF AND GULFAD. THE MEAN DISCHARGE RANGED FROM 128 CFS NEAR ELMENDORF TO 446 CFS AT SITE NEAR ELMENDORF CONSISTED OF TREATED SEWAGE EFFLUENT. THE QUANTITY OF TREATED EFFLUENT RELEASED INTO THE SAN ANTONIO RIVER ABOUT 18 MILES UPSTREAM FROM THE SITE NEAR ELMENDORF RANGED FROM 66 TO 136 CFS AND AVERAGED ABOUT 100 CFS. THE TIME-WEIGHTED CONCENTRATION OF DISSOLVED OXYGEN AND THE DISSOLVED-OXYGEN DEFICIT, DURING THE PERIOD FROM 1200 HOURS ON JUNE 17 TO 1400 HOURS ON JUNE 19, SHOW THAT THE CRITICAL PART OF THE REACH EXTENDED FROM SITE 1 (MILE 205.0) TO SITE 2 (MILE 175.3). THE DISSOLVED-OXYGEN CONTENT OF WATER IN THIS 27.5-MILE REACH

Effects of the Rate of Releases From Sam Rayburn Reservoir on the Aeration Capacity of the Angelina River, Eastern Texas

Rayburn, J.; Goss, R. L.; Kathburn, J. G.

GEOLOGICAL SURVEY, AUSTIN, TEX. WATER RESOURCES DIV., AQUATIC AND TERRESTRIAL CONSULTANTS, SPRINGFIELD, VA 22151 as AD-A094 303, Price codes: A03 in paper
A three-phase study was conducted during July and August 1970 to determine the effects of varying release rates through the power outlet works at Sam Rayburn Reservoir in eastern Texas on aeration capacity of a 14-mile reach of the Angelina River below Sam Rayburn Dam. The dominant factors that affected the aeration capacity during the study time were time of travel and the dissolved-oxygen deficit of the releases. Aeration was low throughout the study but increased in response to increases in the dissolved-oxygen deficit and the duration of time that the releases were exposed to the atmosphere (time of travel). The average concentration of dissolved oxygen sustained by release of 8,600 cubic feet per second from a power outlet 4.8 miles downstream; the time of travel averaged about 8 hours. The average concentration of dissolved oxygen in flow sustained by releases of 2,200 cubic feet per second increased from 5.2 to 5.5 milligrams per liter; the time of travel averaged about 20 hours. (USGS)

CONSIDERABLY BY POLLUTION.

CONSTITUENTS DISSOLVED SOLIDS USUALLY IS MODERATELY DEGRADED TO INDUSTRIAL POLLUTION.

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RAWSON, JACK

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AnnouncPMPnt: S.RA0219

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p. 4 Flg. 6

TAB.,

25 Ref.,

Journal Announcement: SWRAU219


RECONNAISSANCE OF WATER TEMPERATURE OF SELECTED STREAMS IN SOUTHEASTERN TEXAS

RAWSON, JACK

GEOLoaICAL SURVEY, AUSTIN, TEX.

TEXAS WATER DEVELOPMENT BOARD REPORT 105, JANUARY 1970. 13 P., 4 FIG. 2 TAB., 5 REF.,

Journal Announcement: SWRAU316

TEMPERATURE-PROFILE MEASUREMENTS WERE MADE AT 61 CROSS SECTIONS OF 7 MAJOR STREAMS IN TEXAS. NO CROSS-SECTIONAL VARIATIONS OF TEMPERATURE WERE ENCOUNTERED. ONLY 34 MEASUREMENTS SHOWED A TEMPERATURE DIFFERENCE OF MORE THAN 0.5 DEG C WITHIN A CROSS SECTION; THE MAXIMUM DIFFERENCE ENCOUNTERED WAS 1.5 DEG C. THE FLOW-TEMPERATURE RECORDS REPORTED BY THE U.S. GEOLOGICAL SURVEY IN TEXAS ARE USUALLY REPRESENTATIVE OF THE AVERAGE TEMPERATURE OF WATER WITHIN THE STREAM CROSS SECTION. AIR TEMPERATURE IS A REASONABLE INDEX OF THE TEMPERATURE OF THE MAJOR STREAMS IN THE STATE—PROVIDED THAT TEMPERATURE IS NOT AFFECTED BY SUCH ARTIFICIAL INFLUENCES AS ADDITION OF TREATED WASTES OR PRESENCE OF IMPoundMENTS. AT 8 SITES WHERE ARTIFICIAL INFLUENCE WAS NOT SIGNIFICANT, THE MEAN MONTHLY WATER TEMPERATURES, AS COMPUTED FROM ONCE-DAILY OBSERVATIONS, Seldom differed from corresponding mean monthly air temperatures by more than 2 DEG C and often differed by not more than 1 DEG C. THE TEMPERATURES OF TEXAS STREAMS VARY WIDELY FROM MONTH TO MONTH. THE SPREAD BETWEEN OBSERVED MONTHLY MAXIMUM AND MINIMUM TEMPERATURES AVERAGES 3-6 DEG C. (KNAPP-USGS)

ANNUAL COMPIlATION AND ANALYSIS OF HYDROLOGIC DATA FOR CALAVERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1970

REDY, D. R.

GEOLoaICAL SURVEY, AUSTIN, TEX. WATER RESOURCES DIV.

GEOLoaICAL SURVEY DATA REPORT, NOVEMBER 1971. 65 P., 2 FIG., 3 TAB.

Journal Announcement: SWRAU510

RAINFALL, RUNOFF, AND STORAGE DATA COLLECTED DURING THE 1970 WATER YEAR ARE PRESENTED FOR THE 77.2-SQUARE-MILE AREA ABOVE THE SOUTHEASTERN TERMINATION OF THE BASIN NEAR ELMENDORF, TEXAS. THERE ARE 7 FLOODWATER-RETARDING STRUCTURES IN THE WATERSHED. THESE STRUCTURES HAVE A CAPACITY FOR TEMPORARY STORAGE OF 8,640 ACRES-FOOT. THE FLOOD RUNOFF FROM THE 77.2-SQUARE-MILE STUDY AREA, THE MEAN RAINFALL IN THE STUDY AREA FOR THE 1970 WATER YEAR WAS 29.64 INCHES. THE AVERAGE MONTHLY RAINFALL TOTALS RANGED FROM 0.42 INCH IN JUNE TO 7.74 INCHES IN MAY. YEARLY MEAN DISCHARGE AT THE STREAM-GAGING STATION, CALAVERAS CREEK NEAR ELMENDORF, WAS 0.59 CFS. THIS
SABINE RIVER
8,500 ACRE-FEET
PER
AVAILABLE FOR DEVELOPMENT FROM
OUTCROPS OF THESE UNITS. ABOUT 30,700 ACRE-FEET
YEAR OF
TYPES OF USES OR CAN BE MADE
THE
THE
ALLUVIUM OF
3.2
TRANSMITTED THROUGH
DEPT H S
1972.
SAND TO
ONE, DIRECTION THROUGHOUT
MILES UPSTREAM FROM
A
FROM NO FLOW AT ABOUT
STREAM-GAGING STATION
OF RAINFALL AND DISCHARGE. HYDROGRAPHS
AVERAGE DISCHARGE FOR THE 14 YEARS (1957-68) WAS 10.7 CFS. FOR
THE 1970 WATER YEAR, 6 STORMS WERE SELECTED FOR DETAILED
COMPUTATIONS. THE COMPUTATIONS INCLUDE DETAILED TIME BREAKDOWN
OF RAINFALL AND DISCHARGE. HYDROGRAPHS AND MASS CURVES ARE
INCLUDED. (WOODARD-USGS)

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN CIBOLO CREEK,
TEXAS, MARCH 4-8, 1968
REEVES, WILLIAM E.; KUNZE, HARVEY L.
GEOLOGICAL SURVEY, AUSTIN, TEX.
TEXAS WATER DEVELOPMENT BOARD REPORT 112, APRIL 1970, 16 P. 3
FIG. 3 TAB, 4 REF., JOURNAL ANNOUNCEMENT: SWRA0320

THE CHANGES IN QUANTITY AND INORGANIC CHEMICAL QUALITY OF BASE
FLOW OF CIBOLO CREEK, TEXAS, IN THE REACH FROM THE
STREAM-GAGING STATION AT MILE 89.9, DOWNSTREAM TO A POINT 2.5
MILES UPSTREAM FROM THE MOUTH ARE EVAPOTRANSPIRATION WAS AT
A MINIMUM, DISCHARGE INCREASED IN A DOWNSTREAM DIRECTION,
FROM NO FLOW AT ABOUT MILE 88 TO 67.4 CFS AT MILE 2.5.
DISSOLVED-SOLIDS CONCENTRATIONS ALSO INCREASED IN A DOWNSTREAM
DIRECTION THROUGHOUT THE REACH. (KNAPP-USGS)

GROUNDWATER RESOURCES OF WASHINGTON COUNTY, TEXAS
SANDEEN, W. M.
GEOLOGICAL SURVEY, AUSTIN, TEX.
TEXAS WATER DEVELOPMENT BOARD, AUSTIN, REPORT 162, NOVEMBER
1972, 105 P. 21 FIG. 9 TAB, 52 REF., JOURNAL ANNOUNCEMENT: SWRA0614

LARGE QUANTITIES OF UNDEVELOPED FRESH WATER, EXTENDING TO
DEPTHS OF 1,000 FEET BELOW SEA LEVEL OCCUR IN THE CATAHOUA
SANDSTONE, SPARLING IN THE JASPAR AQUIFER, THE ALLUVIUM OF THE BRAZOS RIVER IN
TEXAS. IN 1968, AN ESTIMATED 5,2 MGD WAS PUMPED FROM THE GROUNDWATER RESERVOIR, AT LEAST
8,500 ACRE-FEET PER YEAR OF FRESH GROUNDWATER IS BEING
TRANSMITTED THROUGH THE CATAHOUA SANDSTONE, THE JASPAR
AQUIFER, AND THE EVANGELINE AQUIFER, AND ABOUT 14,700 ACRE- FEET PER
YEAR OF FRESH GROUNDWATER IS BEING REJECTED FROM THE
OUTCROPS OF THESE UNITS. ABOUT 30,700 ACRE- FEET PER YEAR OF
FRESH GROUNDWATER PROBABLY COULD BE WITHDRAWN CONTINUOUSLY FROM
THE AQUIFERS. ABOUT 118,000 ACRE- FEET PER YEAR IS
AVAILABLE FOR DEVELOPMENT FROM THE ALLUVIUM OF THE BRAZOS RIVER.
THE CHEMICAL QUALITY OF THE GROUNDWATER IS SUITABLE FOR MOST
TYPES OF USES OR CAN BE MADE SUITABLE WITH A MINIMUM OF
TREATMENT, LESS THAN 10 PERCENT OF THE SAMPLES ANALYZED FOR
DISSOLVED (WOODARD-USGS)

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR ELM
FORK TRINITY RIVER, TRINITY RIVER BASIN, TEXAS, 1970
SANSOR, J. N.

GEOLOGICAL SURVEY, AUSTIN, TEX.
GEOLOGICAL SURVEY OPEN-FILE REPORT (TEXAS DISTRICT), MARCH
1972, 47 P. 2 FIG. 3 TAB, APPEND., JOURNAL ANNOUNCEMENT: SWRA0518
THIS IS THE ELEVENTH IN A SERIES OF BASIC-DATA REPORTS
PUBLISHED ANNUALLY FOR THE ELM FORK TRINITY RIVER STUDY
AREA, AND CONTAINS THE RAINFALL, RUNOFF, AND STORAGE DATA
COLLECTED DURING THE 1970 WATER YEAR FOR THE
46,500 SQUARE-MILE AREA ABOVE THE STREAM-GAGING STATION ELM
FORK TRINITY RIVER NEAR MUNSTER, TEXAS. FOURTEEN FLOODWATER
RETAINING STRUCTURES PROVIDE CAPACITY FOR FLOOD-DETECTION
STORAGE OF 10,500 ACRE- FEET OF FLOOD RUNOFF FROM 55.5 SQUARE
MILES OF THE 46,500 SQUARE-MILE DRAINAGE AREA. THE AVERAGE
RAINFALL FOR THE 1970 WATER YEAR WAS 35.16 INCHES, OR 103% OF
THE 14-YEAR (1957-70) AVERAGE. THE MONTHLY RAINFALL TOTALS RANGED
FROM A LOW OF 0.31 INCHES IN JANUARY TO A HIGH OF 4.43 INCHES
IN SEPTEMBER. YEARLY MEAN DISCHARGE AT THE STREAM-GAGING
STATION WAS 20.5 CFS, COMPARED WITH THE 14-YEAR (1957-70)
AVERAGE OF 20.1 CFS. TOTAL RUNOFF DURING THE YEAR WAS 14,860
ACRE- FEET (6.06 INCHES), WHICH IS 17% OF THE TOTAL RAINFALL.
FOUR STORM PERIODS WERE SELECTED FOR DETAILED RAINFALL
AND DISCHARGE COMPUTATIONS. (WOODARD-USGS)

SELECTED HYDROLOGIC CHARACTERISTICS OF THE SABINE RIVER AND
BAYOU ANACOCO, LOUISIANA AND TEXAS
SHAMPINE, WILLIAM J.
GEOLOGICAL SURVEY, BATON ROUGE, LA.
GEOLOGICAL SURVEY - SABINE RIVER COMPACT ADMINISTRATION
COMPILED JOURNAL ANNOUNCEMENT: SWRA0419, 105 P. 21 FIG. 18 TAB, APPEND., JOURNAL ANNOUNCEMENT: SWRA0419

CREATION OF TOLEDO BEND RESERVOIR (TEXAS-Louisiana) HAS CAUSED
SIGNIFICANT CHANGES IN THE CHARACTERISTICS OF SABINE RIVER FLOODS IN THE VICINITY OF THE RESERVOIR. A FLOOD WITH A 20-YEAR RECURRENCE INTERVAL WILL NECESSITATE A CONSTANT RELEASE OF 50,000 CFS FOR 4 DAYS TO MAINTAIN A LAKE LEVEL ELEVATION LESS THAN 173.5 FEET WHEN THE INITIAL
ELEVATION IS 170 FEET. OXYGEN DEPLETION IN THE HYPOXIA
DURING THE SUMMER CAUSES SEVERAL WATER-QUALITY PROBLEMS IN TOLEDO
BEND RESERVOIR. THE CONCENTRATIONS OF SOME SOLUBLE CONTAMINANT
SPOILED INTO BAYOU ANACOCO FROM ROSEpine, LA. TO THE MOUTH CAN
BE CALCULATED. IF 1,000 POUNDS OF A CONTAMINANT WERE
DUMPED INTO BAYOU ANACOCO AT MILE 20 WHEN THE DISCHARGE AT THE
POIN'T WERE 150 CFS, THE MAXIMUM CONCENTRATION THAT WOULD REACH THE
MOUTH (WOODARD-USGS)

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER
RESOURCES - RlU GRAND REGION
WEST, S. W., BROADHURST, W. L
GEOLOGICAL SURVEY, RESTON, VA.
AVAILABLE FROM SUP., OF DOCUMENTS, GPO, WASHINGTON, D.C.

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<td>20402 - PRICE $1.75, PROFESSIONAL PAPER 813-D, 1975, 39 P. 21 FIG, 2 TAB, 154 REF.</td>
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<td>Journal Announcement: SWRA0821</td>
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<td>THE RIO GRANDE IS AN INTERSTATE AND INTERNATIONAL STREAM WHICH BEGINS IN HIGH MOUNTAINS OF COLORADO, FLOWS ACROSS NEW MEXICO, AND FORMS THE BOUNDARY BETWEEN TEXAS AND MEXICO. ANNUAL PRECIPITATION ON THE REGION IS ABOUT 86 MILLION ACRE-FEET; HOWEVER, ALL BUT 4 MILLION ACRE-FeET IS RETURNED TO THE ATMOSPHERE BY EVAPOTRANSPIRATION. THE GROUNDWATER RESERVOIRS CONTAIN AN AGGREGATE OF 5,600 MILLION ACRE-FeET OF FRESH AND SLIGHTLY SALINE WATER IN STORAGE, WHICH COULD BE WITHDRAWN THROUGH WELLS. IN CONTRAST, THE SURFACE RESERVOIRS HAVE A COMBINED STORAGE CAPACITY OF ONLY 18 MILLION ACRE-FeET. WITHDRAWAL OF GROUNDWATER IN 1970 WAS 2.7 MILLION ACRE-FeET, OF WHICH 88% WAS USED FOR IRRIGATION. THE REGION APPEARS TO OFFER SEVERAL POSSIBILITIES FOR UTILIZING UNDERGROUND SPACE FOR PURPOSES OTHER THAN THE WITHDRAWAL OF WATER SUCH AS WASTE DISPOSAL, ARTIFICIAL RECHARGE, WATER-QUALITY CONTROL, AND DEVELOPMENT OF GEOTHERMAL ENERGY. (WOOLARD-USGS)</td>
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GROUNDWATER RESOURCES OF RAINS AND VAN ZANDT COUNTIES, TEXAS

WHITE, O. E.

GEOLOGICAL SURVEY, AUSTIN, TX.

TEXAS WATER DEVELOPMENT BOARD REPORT 169, APRIL 1973, 81 P., 26 FIG, 6 TAB, 35 REF.

Journal Announcement: SWRA0619

RAINS AND VAN ZANDT COUNTIES IN NORTHEAST TEXAS HAVE ABUNDANT GROUNDWATER RESOURCES AND COMPARETIVELY LITTLE WATER DEMAND. THE WATER IS DERIVED FROM THE HEAVY PRECIPITATION (ABOUT 43 INCHES ANNUALLY) WHICH FILLS THE NUMEROUS LAKES AND RESERVOIRS AND RECHARGES THE FRESHWATER AQUIFERS. ONE OF THE AQUIFERS IN THE AREA, THE CARRIZO-WILCOX, HAS BEEN APPRECIABLY DEVELOPED. DURING 1969, THIS AQUIFER SUPPLIED A REPORTED 1,500 ACRE-FeET OF WATER FOR MUNICIPAL SUPPLY, INDUSTRIAL USE, AND RURAL WATER SYSTEMS IN THE TWO COUNTIES. THE CARRIZO-WILCOX AQUIFER CONTAINS AN ESTIMATED 50 MILLION ACRE-FeET OF FRESH TO SLIGHTLY SALINE WATER IN STORAGE, ABOUT 10% OF THIS AMOUNT, OR 5 MILLION ACRE-FeET, IS AVAILABLE TO WELLS. IN ADDITION TO THE WATER IN STORAGE, THE CARRIZO-WILCOX AQUIFER ANNUALLY RECEIVES AN ESTIMATED 5,000 ACRE-FeET OF EFFECTIVE RECHARGE FROM PRECIPITATION. YIELDS OF WELLS TAPPING THE CARRIZO-WILCOX AQUIFER RANGE FROM LESS THAN 5 TO AS MUCH AS 000 GPM. MOST OF THE MUNICIPAL AND INDUSTRIAL WELLS ARE EQUIPPED TO PUMP AT RATES OF 100 TO 250 GPM. A SECOND AQUIFER, THE QUEEN CITY SAND, IN SOUTHEASTERN VAN ZANDT COUNTY, WHICH IS CURRENTLY TAPPED SOLELY FOR RURAL DOMESTIC AND LIVESTOCK SUPPLY, IS PROBABLY CAPABLE OF YIELDING AS MUCH AS 150 GPM OF FRESHWATER TO PROPERLY CONSTRUCTED WELLS. (WOOLARD-USGS) |  |


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The proposed action is to lease 6,600 acres for surface coal mining in Bastrop County, southeast-central Texas. Underlying the area are 80-100 million tons of surface minable coal in the Calvert Bluff Formation of the Wilcox Group. The area is drained by intermittent McLaughlin and Dogwood Creeks, tributary to Big Sandy Creek adjacent on the northwest. The Calvert Bluff Formation overlies the Simsboro Formation, also Wilcox Group, and underlies the Carrizo Formation, both being significant aquifers. Highwall seepage from lensatic sandstones in the Calvert Bluff Formation is estimated to be about 150 gallons per minute (worst case). Dewatering of the underlying Simsboro Formation by wells at 10,600 gallons per minute (also worst case) would be required for hydrostatic pressure relief. Discharge of this water into Big Sandy Creek would increase base flow by 23 times, and median flow 4.5 times. Erosion of the streambed would be significant during mining, but the creek would gradually return to premining conditions. Dewatering would cause a drawdown of 81 feet at the nearest well, 2 miles down gradient, and increase its pumping lift.
RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE UPPER FREMONT RIVER VALLEY, WAYNE COUNTY, UTAH

Bjorklund, L. J.

GEOLoGICAL SURVEY, LOGAN, UTAH.

COPIES Of REPORT AVAILABLE AT UTAH DEPT OF NATURAL RESOURCES, DIV. OF WATER RIGHTS, 444 STATE CAPITOL, SALT LAKE CITY, UTAH. TECHNICAL PUBLICATION NO 22, 1969. 54 P, 11 FIG, 6 TAB, 21 REF.

Journal Announcement: SWRA0915

THE UPPER FREMONT RIVER VALLEY, A DEPRESSION CAUSED BY FAULTING ALTERED BY EROSION, AND PARTLY FILLED BY ALLUvIUM ERoded FROM SURROUNDING HIGHLANDS, INCLUDES ABOUT 40 SQUARE MILES IN SOUTH-CENTRAL UTAH. THE DRAINAGE BASIN WHICH CONTRIBUTES WATER TO THE VALLEY INCLUDES ABOUT 700 SQUARE MILES. WATER COLLECTS IN THE VALLEY FROM SEVERAL HIGH PLATEAUS. SEDIMENTARY ROCKS OF TRIASSIC, JURASSIC, TERTIARY, AND QUATERNARY AGE AND VOLCANIC ROCKS OF TERTIARY AGE ARE EXPOSED IN THE AREA. THE TERTIARY VOLCANIC ROCKS YIELD WATER TO SEVERAL LARGE SPRINGS AND FLOWING WELLS; THIS UNIT IS THE PRINCIPAL SOURCE OF GROUNDWATER IN THE VALLEY. THE VALLEY FILL OF QUATERNARY AGE, WHICH IS MORE THAN 500 FEET THICK IN PLACES, IS ALSO AN IMPORTANT SOURCE, YIELDING WATER TO MANY WELLS. THE AVERAGE ANNUAL INFLOW TO THE VALLEY VIA THE FREMONT RIVER DURING 1950-57 WAS 29,120 ACRE-FOOT AND THE AVERAGE ANNUAL OUTFLOW DURING 1909-57 WAS 64,840 ACRE-FOOT. ABOUT 60,000 ACRE-FOOT OF WATER IS DISCHARGED BY SPRINGS AND SEEPS IN THE VALLEY DURING MOST YEARS. APPROXIMATELY 3,500 ACRE-FOOT OF WATER IS DISCHARGED FROM FLOWING WELLS AND ABOUT 700 ACRE-FOOT FROM SPRINGS AND SEEPS. IRRIGATION IS THE PRINCIPAL USE OF BOTH SURFACE AND GROUNDWATER IN THE VALLEY. GROUNDWATER IS USED ALSO FOR THE PUBLIC SUPPLIES OF FREMONT, LOA, LYMAn, AND RICKNELL, FOR DOMESTIC AND STOCK USE, AND FOR FISH CULTURE. THE GROUNDWATER IN THE VALLEY IS SUITABLE FOR MOST USES. (KNAPP-USGS)

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISCO, UTAH: PART 2, BASIC DATA. (DUPiCATED SEE COLORADO).

Brennan, R. J.; Grozier, R. U.

GEOLOGICAL SURVEY, DENVER, COLO.

OPEN-FILE REPORT, 1976. 222 P, 54 FIG, 12 TAB.

Journal Announcement: SWRA0919

SALT-LOAD COMPUTATIONS--COLORADO RIVER: CAMEO, COLORADO TO CISCO, UTAH: PART 1, DATA SUMMARY. (DUPiCATED SEE COLORADO).

Brennan, R. J.; Grozier, R. U.

GEOLOGICAL SURVEY, DENVER, COLO.

OPEN-FILE REPORT, 1976. 15 P, 3 FIG, 6 TAB.
aquifers by infiltration of precipitation and seepage from streams in the headwaters of the Virgin River and Kanab Creek. Post-glacial isopachic and isopycnal surface data indicated that water moved from areas of recharge generally southward toward areas of natural discharge in the lower reaches of major streams. Chemical quality of ground water was found to vary both annually and by geologic source. The hydrologic impacts of possible increased ground-water withdrawals for the development of coal are evaluated.

Ground-Water Conditions in the Upper Virgin River and Kanab Creek Basins Area, Utah, with Emphasis on the Navajo Sandstone


Available from Utah Dept. of Natural Res., Div. of Water Res., 235 E. 400 S., South Salt Lake City, UT 84111. Utah Department of Natural Resources Technical Publication No. 70, 1981. 87 p. 18 Fg., 3 Plates, 23 Tab., 30 Ref., Journal Announcement: SWA0811

The upper Virgin River and Kanab Creek basins area in south-central Utah includes about 1,300 square miles in the upper Virgin River basin and about 650 square miles in the upper Kanab Creek basin. The sparsely populated area contains large coal reserves. Water occurs in both the unconsolidated and consolidated rocks. Principal aquifers in the unconsolidated rocks include older stream-channel deposits, lower parts of alluvial fans, and stream-valley alluvium. The most important consolidated-rock aquifer is the Navajo Sandstone of Triassic and Jurassic age. Other consolidated-rock aquifers of note include the Chinle Member of the Chinle Formation of Triassic age, sandstone strata of Cretaceous age, and the Wasatch Formation of Tertiary age. Ground-water recharge is derived chiefly from precipitation on the area. Water yields an average of 60,000 acre-feet per year. Discharge occurs chiefly as seepage to lower stream reaches and evapotranspiration. Natural discharge is estimated to total at least 9,400 acre-feet per year. In addition, about 5,000 acre-feet per year discharges as underflow into Arizona; and in 1977, at least 3,300 acre-feet was withdrawn by wells. Chemical composition of ground water varies considerably with geologic source. Water in the Navajo Sandstone and Wasatch formation most places, water in the Chinle and Moenkopi formations of Triassic age and the Carmel Formation of Jurassic age is generally saline containing 1,000 to 3,000 mg/l of dissolved solids in most places. (USGS)

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1968

Huntington and Cottonwood Creeks, central Utah.

Danielson, T. W., Illard, M. D., and Fuller, R. H., 1980b


The hydrologic system in this important coal-resource area of the wasatch Plateau is described. Data were collected from about 140 springs that issue from several water-bearing zones in rocks of Cretaceous and/or Tertiary age. Most springs that discharged more than about 50 gallon/minute were associated with faulting. During 1979, water entered underground coal mines mainly through joints, faults, and holes in mine roofs. Discharge from mines ranged from zero to about 1,100 gallon/minute.

Large differences in surface runoff in the study area are described. Chemical quality of surface water, as well as quality of water from springs and mines, is described. Possible effects of underground coal mining and associated mine dewatering on the hydrologic system are evaluated. It was concluded that discharge-recession curves for springs showed promise as a method of detecting changes in the ground-water system caused by mining.

Hydrology of coal-resource areas in the southern Wasatch Plateau, central Utah.

Danielson, T. W., and Syler, D. A., 1982


Summary Appraisals of the Nation's Ground-Water Resources—Lower Colorado River Region


Journal Announcement: SWA9821

This report is the twelfth in a series of annual reports that describe ground-water conditions in Utah. The report includes individual discussions of the most important areas of ground-water withdrawal in the state for the calendar year 1974. Water-level fluctuations, however, are described for the period spring 1974 to spring 1975. The estimated total withdrawal from wells in 1974 was about 879,000 acre-foot which was about 165,000 acre-foot more than in 1973 and 195,000 acre-foot greater than the average annual withdrawal for the period 1964-73. Both the levels were higher in 1973 and the increase over the 10-year average were due primarily to changes in withdrawals for irrigation. Estimated total withdrawals for irrigation in 1974 were about 611,000 acre-foot, which was about 273 more than the 480,000 acre-foot withdrawn in 1973. Changes in ground-water levels from spring 1974 to spring 1975 reflected the decreased availability of surface water and increased ground-water withdrawals. Water levels fell in most major ground-water basins in the state. Pavant Valley, in central Utah, was the only major ground-water basin in which water levels were higher in March 1975 than in March 1974.

Ground-Water Conditions in Utah, Spring of 1975


Journal Announcement: SWA9821

This report is the twelfth in a series of annual reports that describe ground-water conditions in Utah. The estimated total withdrawal of water from wells in Utah in 1977 was about 94,700,000 acre-feet, which was about 86,000 acre-feet more than in 1976 and 210,000 acre-feet greater than the average annual withdrawal for the period 1967-76. Both the increases in...
Ground-water reconnaissance in the Morgan Valley, Heber Valley, Coalville area, Morgan and Summit Counties, Utah, Gates, J. S., and Steiger, J. I.


Availability and quality of water are assessed. It was concluded that the Navajo Sandstone was the most probable source of large quantities of water. It was estimated that the Navajo contained about 50,000 acre-feet of ground water per square mile and that each year 26,000 to 30,000 acre-feet could be withdrawn from the Navajo in the study area with properly spaced wells. Sources of smaller quantities of water are also identified. Records of wells and springs and chemical analyses of water are listed in tables.


A generalized hydrologic description of this undeveloped coal resource area is presented. Preliminary data indicated several of the ephemeral streams. It was concluded that most ground water in North Horn Mountain probably was stored in perched aquifers underlying the coal. Numerous springs and seeps issued from the perched aquifers, but the spring waters usually were consumed by evapotranspiration short distances from the sources. It was also concluded that a regional aquifer exists in the Star Point Sandstone below the coal and sometimes in the coal-bearing Blackhawk Formation, both of Cretaceous age. Dissolved-solids concentrations of ground water ranged from less than 500 to about 1,000 mg/L. Potential impacts of coal development on the water resources are evaluated.

Ground-water conditions in Utah, Spring of 1980
Herbert L. R.
Journal Announcement: SWRA1424

This is the eighteenth in a series of annual reports that describe groundwater conditions in Utah. The estimated total withdrawal of water from wells in Utah in 1980 was about 762,000 acre-feet—about 98,000 acre-feet less than in 1979 and 44,000 acre-feet less than the average annual withdrawal during 1970-79. The decrease in withdrawal was due primarily to decreases in withdrawal for irrigation. Total withdrawal for irrigation in 1980 was about 494,000 acre-feet, which was 75,000 acre-feet less than reported for 1979. Withdrawal for public supply was 163,000 acre-feet, a decrease of 19,000 acre-feet. The quantities of water withdrawn from wells are closely related to local climatic conditions. Precipitation in 1980 was above average in most of Utah (National Oceanic and Atmospheric Administration, 1981). Of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 1 had below-average precipitation in 1980. This contributed most significantly to decreased withdrawals from wells during 1980. The above-average precipitation in most parts of the State during 1980 resulted in increased water supplies, recharge of ground water, and water for reservoirs as well as decreased withdrawals from wells. This in turn resulted in a general rise of groundwater levels in many parts of the State from spring of 1980 to spring of 1981. Notable exceptions were declines observed in areas where local above-average runoff contributed greatly to the recharge of the ground-water reservoir in the spring of 1980 but was not a factor in the spring of 1981. Also, declines occurred in some areas of late season withdrawals. The total number of wells drilled during 1980, as indicated by well-drillers reports filed with the Utah Division of Water Rights, was about 2 percent more than reported for 1979. The number of those wells 6 inches or more in diameter drilled for public supply, irrigation, and industrial use was about 18 percent less than reported for 1979.
about 561,000 acre-feet--about 31,000 acre-feet more than in 1978 and 23,000 acre-feet more than the average annual withdrawal during 1969-78. The increase in withdrawal from the amount reported for 1978 was due primarily to increases in withdrawal for public supply. Total withdrawal for public supply in 1979 was 162,000 acre-feet, which is 33,000 acre-feet more than reported for 1978. Withdrawal for irrigation was 567,000 acre-feet, an increase of 37,000 acre-feet. The quantities closely related to local climatic conditions. Precipitation in 1979 was below average in most of Utah (ratio of water withdrawn from wells are now Oceanic and Atmospheric Administration, 1980). Of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 27 had below-average precipitation in 1979. This contributed most significantly to increased withdrawals from wells. The below-average precipitation in most parts of the State during 1979 resulted in local reduction in ground-water recharge as well as increases in withdrawals from wells. This in turn resulted in a general decline of ground-water levels in many parts of the State from spring of 1979 to spring of 1980. Notable exceptions where rises occurred were in areas where local above-average runoff contributed greatly to the recharge of the ground-water reservoir. The total number of wells drilled during 1979, as indicated by well-drillers' reports filed with the Utah Division of Water Rights, was about 35 percent less than reported for 1978. The number of those wells 6 inches or more in diameter drilled for public supply irrigation, and industrial use was about 28 percent less than reported for 1978. (USGS)

Ground-water conditions in Utah, Spring of 1982

Holmes, C. L., and Others, 1982

Utah Division of Water Resources Cooperative Investigations Report No. 22

Hydrologic Evaluation of Ashley Valley, Northern Uinta Basin Area, Utah

Hood, J. W.


Journal Announcement: SWRA1023

The upper Duchesne River valley was studied during 1971-74 as part of an investigation of the northern Uinta Basin areas, Utah and Colorado. This report describes the relation of ground water to surface water in the upper Duchesne River valley, estimates the quantity of ground water moved to the Duchesne River, and evaluates the probable effect of increased ground-water withdrawals on the stream regime. The primary source of water is precipitation on the highlands adjacent to and north of the area and on the valley itself. Discharge is mainly by flow in the Duchesne River, Adjacent to and within the valley, ground-water and surface water are intimately related. Other water can interchange with surface water due to both natural and manmade conditions. The valley fill, which is composed mainly of outwash and related glacial debris, constitutes the main-ground-water reservoir in the valley. The ground water in the fill is unconfined. The volume of ground water stored in the fill, and theoretically available by gravity drainage, is a minimum of 40,000 acre-feet. The volume fluctuates by a maximum of 10 percent annually. The discharge from wells and springs used for domestic, stock, public, and irrigation purposes in 1974 was about 2 cubic feet per second. Most ground-water, except in parts of the Uinta Mountains, is from recharge. The surface water sampled in the study area was fresh. (Woodard-USGS)

Bedrock Aquifers in the Lower Dirty Devil River Basin Area, Utah, with Special Emphasis on the Navajo Sandstone

Hood, J. W.; Danielson, T. W.

AQUIFERS TO ANNUALLY IN THIS UTILITY. The annual water supply averages 1.6 billion acre-feet. The water sources of the Northern Uinta Basin Area, Utah and Colorado, with special emphasis on ground-water storage, (Duplicated see Colorado).


Selected Hydrologic Data, Uinta Basin Area, Utah and Colorado. (Duplicated see Colorado).


QUALITY OF GROUND WATER IN THE LOWER COLORADO RIVER REGION. ARIZONA, NEVADA, NEW MEXICO, AND UTAH. KISTLER, L. W.

GEOLOGICAL SURVEY, WASHINGTON, D. C. FOR SALE BY USGS, WASHINGTON, D. C. 20242, PRICE $1.00 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-478, 2 SHEETS, 1975. 5 FIGS, 2 MAPS, 17 REF.

Journal Announcement: SWRA0173. DATA ARE PRESENTED ON THE AREAL AND VERTICAL


BIBLIOGRAPHY OF U.S. GEOLOGICAL SURVEY WATER-RESOURCES REPORTS FOR UTAH. LAPRAY, B. A.

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH. UTAH DEPARTMENT OF NATURAL RESOURCES, SALT LAKE CITY INFORMATION BULLETIN NO. 23, 1975, 58 P, 4 TAB. Journal Announcement: SWRA0819. THE BIBLIOGRAPHY CONTAINS A COMPLETE LISTING TO DECEMBER 31, 1974, OF REPORTS RELATING TO THE WATER RESOURCES OF UTAH PREPARED BY PERSONNEL OF THE U.S. GEOLOGICAL SURVEY. DISCUSSIONS OF THE RELATED SUBJECTS OF GEOLOGY, HYDROLOGY, AND CHEMICAL QUALITY OF THE WATER ARE INCLUDED IN MANY OF THE REPORTS. THE REPORTS WERE PREPARED BY PERSONNEL ASSIGNED TO THE WATER RESOURCES DIVISION, UTAH DISTRICT, IN COLLABORATION WITH STATE AND LOCAL AGENCIES. THE BIBLIOGRAPHY IS DIVIDED INTO FOUR MAJOR PARTS: (1) PUBLICATIONS OF THE GEOLOGICAL SURVEY; (2) PUBLICATIONS BY AGENCIES OF THE STATE OF UTAH; (3) OTHER PUBLICATIONS—REPORTS PREPARED BY SURVEY PERSONNEL, BUT PUBLISHED BY OTHER AGENCIES OR BY PROFESSIONAL ORGANIZATIONS IN THEIR JOURNALS; AND (4) OPEN-FILE REPORTS OF THE GEOLOGICAL SURVEY. (WOODARD-USGS)
Hydrologic studies of the U.S. Geological Survey in major coal-resource areas of Utah through 1980
Lines, G. C., 1980

Hydrologic Monitoring in the Coal Fields of Central Utah, August 1978-September 1979
Lines, G. C.; Plantz, G. G.
30 Figs, 1 Plate, 13 Tab, 17 Ref.
Journal Announcement: SWRA422

Lab experiments that simulated leaching of overburden.

MAJOR THERMAL SPRINGS OF UTAH
MUNDOFF, J. C.
GEOL O GICAL SURVEY, SALT LAKE CITY, UTAH.
AVAILABLE FROM UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, 103 UTAH GEOLOGICAL SURVEY BLDG., UNIV. OF. UTAH, SALT LAKE CITY, 84112—PRICE $5.00.

AUGUST—SEPTEMBER 1979, August
Laboratory experiments that simulated leaching of overburden.
Reconnaissance of Chemical Quality of Surface Water and Fluvial Sediment in the Dirty Devil River Basin, Utah
Mundorff, J. C.
Utah Department of Natural Resources Technical Publication No 65, 1979. 132 p, 4 Figs, 3 Plates, 7 Tabs 21 Refs.
Journal Announcement: SWRA1404

This water-quality reconnaissance in the Dirty Devil River Basin, Utah, covers an area of about 48,350 square miles. Data were obtained by the U.S. Geological Survey one or more times at 104 sites during the period from July 1975 to September 1976. The change in pronounced characteristics of water in streams in the Dirty Devil River Basin occurs in a 15-mile reach of Muddy Creek between the major diversions of 4 miles north of Emery and the point at which Highway 1-70 crosses Muddy Creek. Dissolved-solids concentrations at the diversions are generally less than 300 milligrams per liter and at the lower end of the reach are consistently less than 2,000 milligrams per liter. The Dirty Devil River, which is formed by the confluence of Muddy Creek and the Fremont River, has no perennial tributaries. Except during short periods of the thunderstorm runoff in tributaries, the flow is simply a composite of flow from Muddy Creek and the Fremont River. A few data on total coliform, fecal coliform, and fecal streptococci bacteria suggest a general absence of major biological pollution in the basin. Sediment discharge from the upper 1,000 square miles of the Fremont River basin and from the upper 400 square miles of Muddy Creek Basin is a very small part of sediment discharge of the Dirty Devil River. Therefore, the upper drainage area of the Dirty Devil River probably contributes most of the sediment that is discharged by the streams during a very small part of the time each year. (USGS)

Reconnaissance of Chemical Quality of Surface Water and Fluvial Sediment in the Price River Basin, Utah
Mundorff, J. C.
Geological Survey, Salt Lake City, UT.

Utah Department of Natural Resources, Salt Lake City, Technical Publication No 59, 1972. 55 p, 15 Figs, 3 Plates, 5 Tabs, 22 Refs.
Journal Announcement: SWRA0617

The Price River Basin is mainly in Carbon and Emery Counties in East-Central Utah, and the total drainage area is about 1,900 square miles. Normal annual precipitation (1931-60) is more than 50 inches in headwater areas and is less than 8 inches in the downstream part of the basin. Surface rocks in the basin range in age from Jurassic to Quaternary, but the rocks having predominant influence on water quality are marine shales of Cretaceous age. The general chemical characteristics of the main stem of the Price River as determined by a reconnaissance during 1969-70 changed markedly between the headwaters and the mouth. The dissolved-solids content on the Price River is a rough estimate of the suspended-discharge of Price River at Woodsidc at least 1,400,000 tons during the 1970 water year. (USGS)
Reconnaissance of the quality of surface water in the San Rafael River basin, Utah

Mundorff, J. C. and Thompson, K. A., 1980

U.S. Geological Survey Open-File Report 80-574, 54 p. (to be duplicated as a Utah Department of Natural Resources Technical Publication)

Water in mountain streams in the study area during 1977-78 nearly always contained less than 500 mg/L of dissolved solids. The chemical quality of surface water deteriorated downstream from the mountains where the streams crossed a belt of land 10 to 15 miles wide where the gypsum-bearing Bancro Shale crops out. This same area contained nearly all the intensive irrigation in the San Rafael River basin. Numerous chemical analyses of surface water from sites throughout the basin are listed in tables.

Selected Biological Characteristics of Streams in the Southeastern Uinta Basin, Utah and Colorado

Matenz, R. W.; Fuller, R. H.


Journal Announcement: SWRA 1512

Biological sampling was carried out during 1976-78 in five streams in the southeastern Uinta Basin, Utah and Colorado, in order to provide baseline water-quality data for an area of potential oil-shale development. The biological activity in the streams sampled generally is limited by physical factors more than by chemical constituents and plant nutrients. Characteristics of streamflow, such as high turbidity, fluctuating water levels, and moderate to high salinity, limit production of flora and fauna biomass. Samples were collected for the determination of bacterial and periphyton concentrations and benthic-invertebrate communities. Bacterial concentrations were generally small, with some peaks in contaminable sites, especially from livestock and wildlife. Members of the order Chlorophyta (green algae) were the major periphytic algae present in three of the streams sampled. Glitter Creek was dominated by members of the order Cyanophyta (blue-green algae), and perennated diatoms were the predominant algae in Willow Creek. The benthic-invertebrate communities generally reflect a nonpolluted environment. Shannon-Weiner diversity indices ranged from 1.14 to 3.08. (USGS)

Developing a State Water Plan, Ground-Water Conditions in Utah, Spring of 1979

Price, D.


Journal Announcement: SWRA 1301

The estimated total withdrawal of water from wells in Utah in 1978 was about 829,000 acre-feet, which was about 118,000 acre-feet less than in 1977 and 62,000 acre-feet greater than the average annual withdrawal for the period 1968-77. The decrease from 1977 was due primarily to decreases in withdrawals for irrigation. Precipitation in 1978 was above average in most of Utah. This made more surface water available, reducing dependence on ground water for irrigation. Relatively small ground-water declines were recorded in some of the more heavily developed areas. The above-average precipitation combined with increased runoff and reduced ground-water withdrawals, however, resulted in significant rises of ground-water levels in many parts of the State. (Woodard-USGS)

Map Showing General Availability of Ground Water in the Kaiparowits Coal-Basin Area, Utah

Price, D.


Journal Announcement: SWRA 1216

This is one of a series of maps that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. The map is based partly on records of water wells, springs, and coal and petroleum-exploration holes, partly on unpublished reports of field evaluations of prospective stock-water well sites by personnel of the U.S. Geological Survey, and partly on a 6-day field reconnaissance by the writer. Rocks ranging in age from Permian to Holocene are exposed in the Kaiparowits coal-basin area. They consist chiefly of sedimentary rocks--mostly interbedded sandstone, siltstone, shale, conglomerate, and limestone--trapped in an area of more than 300,000 square miles. The minimum expected yields of individual wells shown on the map assume that the wells are at least 6 inches in diameter, 3,000 feet deep, fully penetrate the aquifers, and are equipped with optimal pumping equipment. The yields shown are those that could be sustained indefinitely by pumping: The ranges of expected depth to ground water on the map are based on measured and reported depths of water in wells. Yields of most springs range from less than 1 to about 20 gallons per minute, but several springs discharge more than 100 gallons per minute. Much of the ground water (including springflow) may be too saline to drink. (Woodard-USGS)

Map Showing General Chemical Quality of Ground Water in the Richfield Quadrangle, Utah

Price, D.


Journal Announcement: SWRA 1216

This is one of a series of maps that describe the geology and related natural resources of the Richfield Quadrangle, Utah. The map is based partly on records of water wells, springs, and coal and petroleum-exploration holes, partly on unpublished reports of field evaluations of prospective stock-water well sites by personnel of the U.S. Geological Survey, and partly on a 6-day field reconnaissance by the writer. Rocks ranging in age from Permian to Holocene are exposed in the Richfield Quadrangle, Utah. They consist chiefly of sedimentary rocks--mostly interbedded sandstone, siltstone, shale, conglomerate, and limestone--trapped in an area of more than 300,000 square miles. The minimum expected yields of individual wells shown on the map assume that the wells are at least 6 inches in diameter, 3,000 feet deep, fully penetrate the aquifers, and are equipped with optimal pumping equipment. The yields shown are those that could be sustained indefinitely by pumping: The ranges of expected depth to ground water on the map are based on measured and reported depths of water in wells. Yields of most springs range from less than 1 to about 20 gallons per minute, but several springs discharge more than 100 gallons per minute. Much of the ground water (including springflow) may be too saline to drink. (Woodard-USGS)
This is one of a series of maps that describe the geology and related natural resources of the Richfield Quadrangle, Utah. It shows known and inferred ranges of dissolved-solids concentrations in the ground water. Concentrations generally range from about 100 to 1,000 milligrams per liter throughout most of the area. They are less than 100 milligrams per liter locally in some higher mountain areas and more than 10,000 milligrams per liter locally beneath the Sevier Desert and Sevier Lake bed. Several mineralized thermal springs discharge in the map area. They include Thermo, Roosevelt, Joseph, Red Hill, Monroe Meadow, and Hatton Hot Springs. Dissolved-solids concentrations of those springs range from about 1,500 to about 8,000 milligrams per liter. (USGS)

**MAP SHOWING GENERAL CHEMICAL QUALITY OF GROUNDWATER IN THE SALINA QUADRANGLE, UTAH**

Price: D.

**GEOLOGICAL SURVEY, WASHINGTON, D.C.**

Available for Sale by USGS, WASHINGTON, D.C. 20242, Price -75 CENTS. GEOLOGICAL SURVEY MISCELLANEOUS GEOLICAL INVESTIGATIONS MAPS, Map I-591-K, 1972, 1 SHEET, 1 MAP.

Journal Announcement: SWRA1509

This is one of several maps in the U.S. Geological Survey Miscellaneous Investigations Series that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. About 96 percent of the area drains to the Colorado River, mostly through the Escalante River and Wahweap, Warm, and Last Chance Creeks. The remaining 4 percent drains to the Great Basin through the Sevier River. The Escalante River and several of its headwater tributaries are perennial streams but most others in the area are intermittent ephemeral streams. Estimated average annual runoff in the area ranges from less than 1 inch in most places to more than 10 inches in the headwater area of the Escalante River. Most of the runoff, which occurs during late spring and early summer, results from melting snows and seasonal rains. Summer thunderstorm flooding is common throughout the area. Peak flood flows of more than 3,000 cubic feet per second have been recorded from drainage areas of less than 100 square miles, and a peak flood flow of more than 15,000 cubic feet per second has been recorded on the Paria River. (Woodard-USGS)

**MAP SHOWING SELECTED SURFACE-WATER DATA FOR THE ALTON-KOLOB COAL-FIELDS AREA**

Price: Don 1982

U.S. Geological Survey Miscellaneous Investigations Map 1-1235-D

**MAP SHOWING SELECTED SURFACE-WATER DATA FOR THE MANTI 30 X 60-MINUTE QUADARANGLE, UTAH**

Price: Don 1982

U.S. Geological Survey Miscellaneous Investigations Map 1-142?

**MAP SHOWING SELECTED SURFACE-WATER DATA FOR THE NEPHI 30 X 60-MINUTE QUADARANGLE**
SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN

Price, Don, 1982

GEOLOGICAL SURVEY, WASHINGTON, D.C.

Hydrologic Evaluation of the Alton Reclamation-Study Site, Alton Coal Field, Utah

Sandberg, G. W.

GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH

Hydrographs of wells indicate that there have been no significant depletions of storage in the basin owing to groundwater development.

Hydrologic Reconnaissance of the Southern Uinta Basin, Utah and Colorado

Price, Don; Mallet, L. L.
GROUND WATER CONDITIONS IN UTAH, SPRING OF 1970
SUMSION, C. T.; BJORKLUND, L. J.; BOLKE, E. L.; MOWER, R. W.; HERBERT, L. R.
GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
UTAH DIVISION WATER RESOURCES COOPERATIVE INVESTIGATIONS
REPORT NO 10, 1972, 73 P. $15, FIG. 2 TAB, 8 REF.
Journal Announcement: SWU0019

This report contains information on construction groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow in Utah. It also contains supplemental data that are related to groundwater use in some areas. Less than 2% of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, limestone, and sandstone. More than 98% of the wells in Utah draw water from unconsolidated rocks. Most wells that tap partly filled with debris from the adjacent mountains. The estimated total withdrawal of water from wells in Utah during 1969 was about 670,000 acre-feet, about 4,000 acre-feet more than that reported for 1968. Precipitation during most of the growing season was less than normal in parts of the state where the largest withdrawals are for irrigation. So irrigation withdrawals increased in these areas, although all types of generally rose throughout the state from March 1969 to March 1970 as a result of above-normal precipitation. Groundwater development and changes in groundwater conditions in the major areas of groundwater development are summarized. (Knap-USGS)

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN SELECTED COAL-ENERGY AREAS OF UTAH
WADDELL, K. M.
GEOLOGICAL SURVEY, SALT LAKE CITY, UTAH.
OPEN-FILE REPORT APRIL 1976, 21 P. 5 FIG. 2 TAB, 12 REF.
Journal Announcement: SWU0010

Planned coal development in Utah in the next decade includes thermal-electric and coal-gasification plants and slurry pipelines with estimated water requirements that may exceed 200,000 ACRE-FT (246,600 CUBIC HECTOMETRES) ANNUALLY. The U.S. GEOLOGICAL SURVEY PRESENTLY MAINTAINS A MINIMAL MONITORING PROGRAM ON STREAMS AND WELLS IN THE COALFIELDS. THE CHEMICAL-QUALITY DATA ARE OBTAINED AND 1% AT WHICH SEDIMENT DATA ARE OBTAINED. THE GROUNDWATER MONITORING PROGRAM CONISTS OF 170 WELLS FOR WATER-LEVEL MONITORING AND 76 WELLS AT WHICH SAMPLES ARE OBTAINED FOR CHEMICAL ANALYSIS. FIVE AREAL WATER-RESOURCES STUDIES ARE BEING MADE IN THE VICINITY OF UTAH COALFIELDS. THE PRINCIPAL STUDY WHERE COAL MINING IS MOST ACTIVE IS IN THE WASHATCH PLATEAU-BUCK CLIFFS AREA. THIS IS A 2-YEAR HYDROLOGIC RECONNAISSANCE DESIGNED TO PROVIDE AN ASSESSMENT OF THE CURRENT HYDROLOGY, WHICH WILL 490 IN THE SOLUTION TO SOME OF THE POTENTIAL PROBLEMS THAT MAY OCCUR AS A RESULT OF COAL-ENERGY DEVELOPMENT. (Wodd-USGS)

SELECTED COAL-RELATED GROUND-WATER DATA, WASHATCH PLATEAU-BUCK CLIFFS AREA, UTAH
SUMSION, C. T.
Geological Survey open-file report 79-915, 1979, 25 P. 1 FIG, 1 PLATE
Journal Announcement: SWU1317

The Wasatch Plateau-Book Cliffs area in east-central Utah consists of about 8,000 square miles within the upper Colorado River drainage system. Coal production in the area is expected to increase from 8 million tons to as much as 30 million tons annually within the next 10 years. Most sources of water supply will be subjected to possible contamination and increased demands by coal-related municipal and industrial growth in the area. The report presents a compilation of coal-related ground-water data from many unpublished sources for the use of local and regional water planners and users. The report includes generalized stratigraphic sections and hydrologic characteristics of rocks in the Wasatch Plateau-Book Cliffs area, records of selected test holes and wells, logs of selected test holes and wells, levels in selected wells, records of selected springs, records of ground-water discharge from selected mines, and chemical analyses of water from selected test holes, water wells, springs, and mines. (Kosco-USGS)
Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah


Journal Announcement: SWRA1505

Data obtained during a hydrologic reconnaissance in 1975-77 in the Wasatch Plateau-Book Cliffs coal area of Utah were correlated with existing long-term data. Maps were prepared showing average precipitation, average streamflow, stream temperature, ground- and surface-water quality, sediment yield, and geology. Recommendations were made for suggested approaches for continued monitoring in the coal areas. During the 1931-75 water years, the minimum discharges for the five major streams that flow through the area ranged from about 20,000 acre-feet per year, and the maximum discharges ranged from about 59,000 to 315,000 acre-feet per year. Correlations indicate that 3 years of low-flow records at stream sites in the Wasatch Plateau would allow the development of relationships with long-term sites that can be used to estimate future low-flow records within a standard error of about 20 percent. Most water-quality degradation in streams occurs along the flanks of the Wasatch Plateau and Book Cliffs. In the uplands, dissolved-solids concentrations generally ranged from less than 100 to in the Wasatch Plateau and Book Cliffs discharge from the Great Sur Vey Point Sandstone or younger formations, and the water generally contains less than from about 2.0 to 2000 gallons per minute. The Blackhawk Formation, which is the principal coal-forming formation, produces water in many of the mines. The dissolved-solids concentration in water discharging from springs

Selected hydrologic data, Price River Basin, Utah, Water Years 1979 and 1980


U.S. Geological Survey Open-File Report 82-916

BIBLIOGRAPHY OF U.S. GEOLOGICAL SURVEY WATER-RESOURCES REPORTS FOR UTAH


Announcement: SWRA1512

This bibliography contains a complete listing to December 31, 1977, of reports relating to the water resources of Utah prepared by personnel of the U.S. Geological Survey. Related subjects include geology, hydrology, and chemical quality of the water. The reports were for the most part prepared by personnel assigned to the Water Resources Division, Utah District, in cooperation with State and local agencies. The bibliography is divided into four major parts: (1) Publications of the Geological Survey; (2) Publications by agencies of the state of Utah; (3) Other publications prepared by survey personnel, but published by other agencies or by professional organizations in their journals; and (4) Open-File Reports of the Geological Survey.

Water Resources Data for Utah, Published annually since 1975


Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality in wells and springs. Additional water data were collected at various sites not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent the part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Utah.

(Woodard-USGS)
This Statement analyzes the impacts of surface mining 212 million tons of Dakota Formation coal, followed by underground mining 100 million tons over a period of 40 years. The coal would be slurried and pipelined 73 miles to the proposed Warner Valley power plant in Utah, and 183 miles to the proposed Harry Allen power plant in Nevada. The slurry would require about 8,300 acre-feet per year of water from the Navajo Sandstone, some 600 to 800 feet below the coal. The coal crops out on the eastern escarpment and southern tip of the southward sloping, elongate Paunsaugunt Plateau. The rocks dip gently northward. The coal-bearing Dakota Formation overlies by the 650- to 700-foot-thick, relatively impermeable Tropic Shale, and is separated from the Navajo Sandstone below by as much as 800 feet of relatively impervious rocks including the Carmel Formation. The area drains by through-flowing Kanab Creek and Johnson Canyon Wash and their steep ephemeral tributaries extending into the escarpments. Most of the base flow of Kanab Creek is diverted for irrigation above the site. Alluvial wells provide irrigation and stock water along Kanab Creek as it crosses the site, and along Johnson Canyon Wash downstream from the site. All drainages carry thunderstorms-induced heavy sediment loads. Small amounts of mineralized (up to several thousand milligrams per liter dissolved solids) water occurs perched in rocks above the Tropic Shale and issue as springs and seeps on valley sides. Alluvial valley floors undoubtedly exist in places along the major valleys but their existence must be verified. The Navajo Sandstone, as much as 2,000 feet thick, produces hundreds of gallons per minute of water containing less than 400 milligrams per liter dissolved solids to wells. Storage in the aquifer has been estimated to be from 19,000 to 200,000 acre-feet per square mile. Although contended by one investigator who believes significant Navajo recharge occurs vertically through the Tropic Shale, most recharge probably takes place at the outcrop. If so, effects of pumping for slurry would displace down dip, and would not extend to the outcrop area where the aquifer provides base flow to streams. Computer simulations of proposed Navajo pumping probably have produced the range of realistic results because of the variety of aquifer parameter values assumed by three independent investigators. Replacement water for the 20 springs removed by mining could be provided by the proponent. Owing to the existence of poor quality shallow ground water, disrupted aquifer water may not degrade receiving streams.

The Alton site, 3.6 square miles of the much larger Alton Coal Field, contains about 27 million tons of identified coal within 200 feet of land surface which could be surface mined. The main coal bed, 16 feet thick, is in the upper part of the Dakota (sandstone) Formation. It crops out near bottoms of steep-sided valleys, and in the north, is as much as 200 feet below the south-sloping mesa tops. The mesas are dissected by gullies draining ephemerally to the comparatively wide, flat valley of Skutumpah Creek and to the narrow, steep-sided valley of Thompson Creek. Both creeks are perennial, but flashy. The area is highly faulted, displacing both coal and aquifers. Little water occurs in the relatively impermeable Tropic Shale at the surface above the Dakota. In some places, small quantities are in the fractured coal beds, and in one place, in the Dakota more than 100 feet above the coal. Less than a mile away water is 130 feet below the coal. Dissolved solids in four test holes ranged from 661 to 2,210 milligrams per liter, sulfate being the chief constituent in the more highly mineralized waters. Mining will encounter less water than needed for operations. Special protection and restoration practices will be required to prevent further deterioration of water quality and to avoid increasing existing high erosion and sedimentation.

Most of the 3.5-square-mile Emery study site about 5 miles south of Emery in the Emery Coal Field occupies a gently north-westward sloping, slightly rolling, partially dissected mesa. Relief is about 1,000 (?) feet. The rugged east-facing escarpment in the northern part of the site drains into south-flowing Muddy Creek (lower part perennial). The southern part drains down the mesa to Quitchupah Creek. Annual precipitation is about 7.5 inches. An undetermined amount of strippable coal in the upper Ferron Sandstone Member of the Mancos shale formation underlies less than 100 feet of overburden in about 40 acres in the extreme south and + 30 acres in the extreme north. Small amounts of water may occur intermittently in and above the coal. Larger amounts occur in deeper aquifers.
Emery Power Plant, Utah
BLM, Richfield, Utah
FES, 1976

This document evaluates the impacts of an 860-megawatt coal-fired electric generating plant in Castle Valley, 20 miles north-northeast of Emery, central Utah. The plant would use 84 million tons of coal in 35 years from the existing Wilberg underground mine in Grimes Wash 13 miles northwest. The generator site required draining shallow, poor quality (9,000 milligrams per liter dissolved solids) ground water at a rate of 80,000 gallons per day into Rock Canyon Creek. About 10 million tons of ash and sludge would cover 160 acres an average of 15 to 25 feet thick in an area of shallow water table. About 7,000 acre-feet per year of water would be consumed by purchase of deeded water rights from Millecreek Reservoir on Ferron Creek 11 miles southwest of the plant. Coal is in the Hwathah and Bear Canyon seams of the Upper Cretaceous Mesaverde Group Blackhawk Formation, which crop out about 1,000 feet below the top of a south-pointing finger of the Wasatch Plateau (East Mountain). The coal is overlain by the Price River, North Horn, and Flagstaff Formations. These sedimentary strata dip about 5 degrees to the west. Consumption of 7,000 acre-feet of water annually would reduce dissolved solids content of the Colorado River system by nearly 8,000 tons (0.3 to 0.6 milligrams per liter), and reduce flow at Lee's Ferry by 2,000 acre-feet (0.15 percent of total flow) per year. Subsidence following mining, if it occurs, could affect springs and reduce flow in Roan Canyon, Deer Creek and Grimes Wash, and would raise or lower water levels in Snow and Flag Lakes.

Emery Power Plant, Units 3 and 4, Utah
BLM, Richfield, Utah
FES, 1979

This document evaluates the impacts of adding 800 megawatt generating capacity to the Emery Power Plant in Castle Valley, 20 miles north-northeast of Emery, central Utah. The plant would require 70 million additional tons of coal over 35 years from the existing Wilberg and Church mines and 14,000 acre-feet of water annually. The water would come from existing or proposed reservoirs on Ferron and Cottonwood Creeks, both tributary to the San Rafael, Green, and Colorado Rivers. Annual precipitation is 8.19 inches. About 10 million tons of ash and sludge would be deposited on 160 acres near the plant site. The coal is in the Hwathah and Bear Canyon seams of the Upper Cretaceous Mesaverde Group Blackhawk Formation. They crop out about 1000 feet below the top of a south-pointing finger of the Wasatch Plateau (East Mountain). The coal is overlain by the Price River, North Horn and Flagstaff Formations. These sedimentary strata dip about 5 degrees to the west. Water consumption would eliminate 3,415 irrigated acres, reduce San Rafael River flow by 7,700 acre feet per year (10%), and reduce annual flow at Lee's Ferry, Colorado River, by 3,850 acre-feet (0.03%). Mine subsidence, if it occurs, could affect aquifers above the mines, and springs and surface waters.

Rehabilitation Potential for the Henry Mountain Coal Field, Southeastern Utah
BLM, Denver, Colorado
EMRIA Report No. 15-78

The 8-square-mile Henry Mountain Coal Field study site is an irregular 6- by 2-mile strip extending across Wildcat Mesa on the west and Sweetwater Creek, Pete Steele Bench, Dugout Creek, and Apple Brush Flat on the east. Relief is about 600 feet. Dry washes draining to creeks extend into the mesa and piedmont escarpments. Precipitation is 8 to 9 inches, evaporation 64.8 inches and evapotranspiration 21 to 27 inches annually. Several thin coal beds occur in the Emery Sandstone tongue of the Nancos Shale Formation. Maximum coal thickness, in one of eight core holes, is 5 feet. Very little water occurs in the coal and overburden. Water for revegetation might come from water harvesting, 5,000-foot well(s) in the Navajo Sandstone Formation (uncertain yield and quality) or purchase, or any combination.

Intermountain Power Project
BLM, Richfield, Utah
FES, 1979

The operation of the plant would consume 50,000 acre-feet of water annually. The use of water from the Fremont River would decrease the downstream flow by 57 percent and increase the salinity of the Colorado River, and could require the retirement of 7,200 to 7,800 acres of irrigated farmland. The natural flow of 24 springs and seeps and four wells could be stopped for over 50 years beyond the life of the project.

Kaparowits Project, southern Utah
BLM, Cedar City, Utah
FES, 1976

This statement evaluates impacts of a proposed 3,000 megawatt coal-fired electric generating plant, four underground coal mines, a limestone quarry, all in central southern Utah, and transmission lines extending to southern
California. The plant is on a narrow, southern canyon-bound extension (Fourmile Bench) of the Kaiparowits Plateau. The mine entries are inclined into the John Henry Member of the Cretaceous Straight Cliffs Formation. The mineable coal, in four principal beds, ranges from 100 feet beneath canyon floors to 900 feet below the bench surface. The proposed mine straddles the Smoky Mountain anticline. The underlying Dakota Sandstone dips several degrees northeast and southwest. The 47,768-acre lease includes more than 1.8 billion tons of coal in beds more than 4 feet thick. Twelve million tons will be mined and 9 million tons will be for use in the power plant. The plant and mine entrance areas are drained by ephemeral tributaries to Lake Powell (Colorado River). Annual precipitation is 10 inches at the mine site and 7 inches at the mine entrances, about 6 to 10 miles southeast and 500 feet lower than the plant site. The main ground water body begins about 1,000 feet below the plateau surface and 100 feet beneath the canyon bottoms. Small quantities of fresh to slightly saline water occur sporadically, perched in the coal and in lenticular sandstones above and below the coal, and issue as springs in the canyon sides. The power plant would consume 47,000 acfeet per year, and the mine 3,000 acfeet per year of water, both from Lake Powell, comprising 3.8 percent of Utah's allotment. The "new town" would need 9,690 acfeet per year from the underlying Upper Triassic (?) Navajo Sandstone, possibly tributary (bank storage) to Lake Powell. This consumption would increase salinity in Lake Powell by about 2 milligrams per liter. Mining could cause subsidence of 10 to 14 feet over 63 square miles and disrupt perched aquifers now yielding 160 acfeet per year and comprising 0.53 percent of the impact area.

Uinta - Southwestern Utah Regional Coal
BLM, Salt Lake City, Utah
DEIS, Undated (1981?)

This statement analyzes impacts of leasing 275.7 million tons of recoverable coal in 8 tracts in the Wasatch Plateau and Emery Coal Fields on the Wasatch Plateau and in 6 tracts in the Kaiparowits Coal Field on the Kaiparowits Plateau. The Wasatch Plateau coal, 187.8 million tons, is in the lower third of the Cretaceous Blackhawk Formation, and in the Ferron Sandstone Member of the Mancos Shale Formation. All but 50 million tons would be mined underground. The Kaiparowits coal, 19.5 million tons in the John Henry Member of the Cretaceous Straight Cliffs Formation would be mined underground. Precipitation on the Wasatch Plateau ranges from 6 to 25 inches per year, and on the Kaiparowits from 8 to 12 inches per year. Only one tract has a throughflowing stream, the sometimes dry perennial Muddy Creek. Small amounts of water occur perched above and in the coal layers, ranging from fresh to slightly saline. The Ferron Sandstone provides as much as 50 gallons per minute to wells in parts of the Wasatch Plateau. The Navajo Sandstone can sustain as much as 1,000 gallons per minute to wells beneath the Kaiparowits Plateau away from its outcrop area. Mining would have no effect on the regional groundwater system; impacts would be limited to mine areas. Surface-mined areas would have higher recharge and storage. Underground mining would diminish or alter points of spring discharge. Total mine drainage of less than 500 acfeet per year would not seriously affect water quality.

Uinta-Southwest Utah Regional Coal, Round Two
BLM, Salt Lake City, Utah
DEIS, 1983

This document describes the expected impacts of leasing 1.907 billion tons of Federal coal in 25 tracts in central and southern Utah and 2 in west-central Colorado. Of the 82,289.37 acres of overlying surface, only 687 acres (0.08 percent) would be surface mined (in the Emery and Alton coal fields). The Utah leases are in the Book Cliffs, Wasatch Plateau, Emery and Alton Coal Fields. Both Colorado leases are in the Paonia-Somerset coal field. By the year 2,000, 7,500 acfeet of water (7,000 for community use) would be required annually. In the Book Cliffs and Wasatch Plateau coal fields the coal is in the Cretaceous Blackhawk Formation. In the Emery field, the coal is in the Ferron Sandstone, lower in the Cretaceous section. The coal-bearing zone in the Alton coal field is the Dakota Sandstone. The Colorado coal is in the Cretaceous Mancos Shale Formation.
Stream quality in Appalachia as related to coal-mine drainage


A stream-quality reconnaissance at 318 locations in May 1955 offered the first opportunity for a contemporaneous regional collection and appraisal of water-quality data in Appalachia. The results provide a means of regional comparison of the influence of coal-mine drainage on stream quality at approximately median-streamflow. The results disclose that the chemical quality of the water at nearly 200 sites did not meet recommended drinking-water standards. At many of these sites, inferior quality was caused by excess concentrations of solutes commonly associated with coal-mine waters.

Water-quality damage from mine drainage is particularly severe in the more heavily mined northern one-third of the region. Where high sulfate contents, free mineral acidity, and low pH are typical of most affected streams, a deficiency in natural stream alkalinity in this part of the coal region contributed greatly to the massive effect of mine drainage upon stream quality. However, data collected from streams affected by mine drainage along the west edge of this part of the coal field suggest extensive neutralization of mine water. In southern Appalachian coal-mine drainage had less influence on stream quality than in northern Appalachia, fewer streams in this area were influenced by mine drainage and the magnitude of stream damage for affected streams was less than in northern Appalachia. (Author's abstract)

TECHNIQUES FOR QUALITY-OF-WATER INTERPRETATIONS FROM CALIBRATED GEOPHYSICAL LOGS, ATLANTIC COASTAL AREA

Techniques for calculating ground-water quality from calibrated geophysical logs, Atlantic coastal area

Journal Announcement: SwRau731

Ground-water resources of the eastern shore of Virginia and the James, York, and Rappahannock river basins of Virginia; east of the fall line

DeMUCHANNA, GEORGE D.,
U. S. GEOLOGICAL SURVEY.
Text; Map; 2 Sheets; 14 x 21 in.

Journal Announcement: SwKau803

Information from various sources is compiled, and broad interpretations of existing information are made. The coastal plain is divided by unconsolidated chertaceous and younger sediments which dip southeast 20° to 50° and in a gradually thickening wedge. Wells yields of 10 to 500 GPM from a few hundred GPM to several hundred GPM. Most of the developed groundwater in this area from Artesian aquifers.
study of groundwater availability and quality in the county of James City. The coastal plain sediments, parts of which underlie the county, are the largest source of groundwater in Virginia. Four aquifers form the complex aquifer system, hydraulic characteristics vary from aquifer to aquifer and from place to place. The Cretaceous aquifer furnishes nearly all the water for industrial and municipal needs. Movement of water in the Cretaceous aquifer is toward cones of depression formed by pumping centers at Williamsburg and Dow Baischke Co. All aquifers contain water that generally meets state standards for drinking water. Water in the Cretaceous aquifer is of the sodium chloride bicarbonate type. As depth of aquifer increases, the concentrations of dissolved solids and chloride also increase. If more water (more than 250 milligrams per liter) occupies the deeper parts of the confined aquifers. The amount of water stored in the coastal sediments is estimated to be 450,000 million gallons. All pumping plans to accommodate the expected daily demand of 9.6 million gallons per day in year 2000 is feasible provided pumpage is distributed over the county. (U.S.GS)

Acid mine drainage (AMD) and its impact on a small Virginia stream

Hoehn, R. C., and Sizemore, D. W., 1977

Hydrology of area in eastern coal province, Virginia, Tennessee, 1981
Hunsmith, W. M., and others

The coal provinces of the country are divided into hydrologic regions, hydrographs, and minor units as presented in textual, tabular, map, and other illustrations designed to be useful to mine owners, operators, and consulting engineers in planning and implementing surface-mine operations that comply with the environmental requirements of the "Surface Mining Control and Reclamation Act of 1977."

Hydrogeology of the Observation Well Site at the U.S. Geological Survey National Center, Reston, Virginia

Journal Announcement: SWA-140

The U.S. Geological Survey's National Center is on a 105-acre tract straddling rocks of two distinct types. These are petrific cherts of late Precambrian or early Paleozoic age and sandstone, shale, siltstone, conglomerate, and diabase
of Triassic age. Two observation wells and two core holes were drilled on the part of the property underlain by Triassic sedimentary rocks. The wells were drilled to monitor water levels, for equipment testing and to determine the hydraulic properties of the Triassic rocks. Geophysical logs were run and lithologic logs prepared from drill cuttings and cores. An aquifer test was conducted and indicated that the water comes from two thin zones, presumably bedding plane partings. The flow meter surveys, core samples, and geophysical logs suggest that the Triassic sandstone is a fractured-rock aquifer. A water sample taken at the close of the aquifer test was low in dissolved solids, soft, and of excellent quality. (Woodard-USGS)

Technique for estimating magnitude and frequency of floods in Virginia

Miller, E. H., 1978


Map Showing Drainage Basins and Location of Streamflow-Measuring Sites, Fairfax County, Virginia


A drainage basin map of Fairfax County shows basins for named streams and drainage areas of 1 sq mi (2.6 sq km) or more. Areas of minor streams draining directly into the Potomac River and Occoquan Creek are tabulated. The locations of flow and peak-record (peak-flow and low-flow) flow sites are shown. The use of topographic and climatic characteristics of drainage basins to transfer flow data from gauged areas to ungauged areas is discussed. (Woodard-USGS)

Water Resources of the Appalachian Region: Pennsylvania to Alabama, 1965


Acid streams in the Appalachian region are identified and discussed, and the amount of acidity as H2SO4 discharged annually into several streams is tabulated.

Virginia streamflow data program analysis

Nuckles, E. H., 1970

Also presented is a compilation of the available hydrologic data and a description of related studies expected to provide information and data useful to the on-going work. The data compilation includes: hourly precipitation for selected days and annual maximum daily precipitation for nine sites; annual maximum streamflow rates and stages for three stream-gaging sites; hourly gageheight and discharge rates for selected storms at four stream-gaging sites; flood profiles; flood-frequency relations; and other streamflow information.

GROUND-WATER RESOURCES OF ACCOMACK AND NORTHAMPTON COUNTIES, VIRGINIA

SINNOTT, ALLEN J.; CHASE, G. J.; TIBBITS, JR.


VIRGINIA DEP. OF CONSERV. AND ECON. DEVELOP., DIV. OF MINERAL RESOURCES, REPS. 9, 1968, 113 P. 7 FIG. 4 PLATE, 8 TAB., 25 REF.

Journal Announcement: SWRAL207

Groundwater resources of Accomack and Northampton Counties, in the Virginia part of the Delmarva Peninsula, are studied by the USGS and the Virginia Division of Mineral Resources. Mean annual temperature is 58 deg and the precipitation is 45 in. Thin surficial Pleistocene sands and clays are overlain by Miocene deposits which supply much of the water for municipal and industrial uses. Chemical character of the deeper water suggests hydraulic connection with the artesian aquifers east of Chesapeake Bay. Domestic water is mainly from wells in the Pleistocene deposits. Larger wells are mainly in Miocene aquifers: one near Exmore yielded 764 gpm with 37 ft of drawdown; and one at Cape Charles yields 645 gpm. The water is good, moderately hard, and usually low in iron and fluoride. Deep Miocene wells yield water high in bicarbonate and fairly high in chloride. Withdrawal is not excessive anywhere and the supply is adequate for foreseeable needs. Well descriptions, aquifers, water levels, yields, and chemical analyses are tabulated. Maps are cross sections and a stratigraphic column show well location, geology, and stratigraphy. (KNP-USSGS)

Geohydrologic Reconnaisance of the Upper Potomac River Basin

Trainer, Frank W., and Watkinson, F. A., Jr., 1975


Mineral Resources of the Appalachian Region


Water Resources of the Guyandotte River basin, West Virginia.

Hydrologic Data for the Guyandotte River Basin, West Virginia.
Bader, John S., Chisholm, James L., Downs, Sanford C., and Bragg, Robert L.

Bader, J. S.
U.S. Geological Survey Atlas, 1 Sheet, 6 Illus., 5 Tables, 16 Ref.

Water Resources of the Coal River Basin, West Virginia
Bader, J. S., Chisholm, J. L., Downs, S. C., and Morris, F. D., 1976

Stream Quality in Appalachia as Related to Coal-Mine Drainage, 1965. (Duplicated see Alabama and Pennsylvania)
Bieskecker, J. E., and George, J. R.

Effects of deep and surface coal mining on the hydrologic environment of selected stream basins in southern West Virginia

Geology and Economic Resources of the Ohio River Valley in West Virginia.
Carlston, Charles W., and Graeff, George D., Jr.
U.S. Geological Survey

Stress and Recovery of Aquatic Organisms as Related to Highway Construction Along Turtle Creek, Boone County, West Virginia
Chisholm, J. L.; Downs, S. C.
Journal Announcement: SWRA1115
During and after construction of Appalachian Corridor G, a divided, four-lane highway in West Virginia, five benthic invertebrate samples were collected at each of four sites on Turtle Creek, and, for comparative purposes, three samples were collected at each of two sites on Lick Creek, an adjacent undivided stream. Diversity indices, generic counts, and total count initially indicated severe depletion or destruction of the benthos of Turtle Creek, but, within 1 year after highway construction was completed, the benthic community of Turtle Creek was similar to that of Lick Creek. The greatest degradation occurred near the headwaters of Turtle Creek because of erratic movement of sediment resulting from high streamflow velocity. Diversity indices ranged from 0 to 3.41 near the headwaters in the original channel but only from 0.94 to 2.42 farther downstream in a freshly cut channel. The final samples from Turtle Creek, which were similar to those taken from Lick Creek at the same time, had generic counts of 10 at the most upstream site and 16 near the mouth. A total of 147 organisms was found near the headwaters, whereas a total of 688 was found near the mouth of the stream. The total number of organisms collected at each site was proportional to the drainage area upstream from the site. As a result of tributary inflow from unaltered drainage areas and organism drift, rapid repopulation and stabilization of the benthic community occurred. Channel relocation, bank recontouring, and reseeding also accelerated the recovery of the benthic community. (Woodard-7S55).


Surface mining of coal in the United States increased from 406 million in 1970 to almost 400 million tons from 1978 to 1979. In the coal-rich 1,560-square-mile Tug Fork basin located in Kentucky, Virginia, and West Virginia, there has been a 2,500 percent increase since 1950 in areas affected by surface-mining activities.

This study used a rainfall-runoff model to determine if land-use changes associated with surface mining in the Tug Fork basin have affected basin streamflow characteristics. The model was calibrated and verified for two periods, one representing 1980 land-use and one representing 1950 land-use. Two 29-year synthetic daily streamflow time series representing the two land-use conditions were generated. Statistical tests performed on the two time series at 15 points in the basin showed no difference at the 0.01 percent confidence level at any of the locations.

In addition, analyses were made to determine if future increases in surface-mining activities might affect basin streamflow. One analysis showed that increasing mining in an upland watershed by as much as 200 percent had little effect on streamflow in the intermediate area and no effect on streamflow at downstream locations along the Tug Fork. Even for a scenario where all areas disturbed by mining were assumed totally impervious, the modeling process demonstrated that the increase in mean annual 1-day high flows (for recurrence intervals of 2, 5, 10, 25, 50, 100, and 200 years) was less than 4 percent at the basin outlet.


FLUVIAL SEDIMENT IN SALEM FORK WATERSHED, WEST VIRGINIA FLINT, R. F., GEOLOGICAL SURVEY, WASHINGTON, D.C., GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1708-K, 1972, 29 P., 9 FIG., 11 TAB., 23 REF., JOURNAL Announcement: SWR602. SUSPENDED SEDIMENT DISCHARGED FROM THE 8.32-SQUARE-MILE SALEM FORK STUDY AREA IN HARRISON COUNTY, W. VA., AVERAGED 3,500 TONS PER YEAR DURING THE FIRST 4-YEAR PERIOD OF INVESTIGATION AND 1,770 TONS PER YEAR DURING THE SECOND 4-YEAR PERIOD. THE DIFFERENCE WAS ATTRIBUTED TO INCREASED FLOW CONTROL EFFECTED BY THE COMPLETION OF DETENTION STRUCTURES AND OTHER
W. Virginia


RECORDS OF WELLS, SPRINGS, AND TEST BORINGS, CHEMICAL ANALYSES OF WATER, SEDIMENT ANALYSES, STANDARD STREAMFLOW DATA SUMMARIES, AND SELECTED DRILLERS' LOGS FROM THE LITTLE KANAWHA RIVER BASIN IN WEST VIRGINIA.

FRIEL, E. A.; BAIN, G. L.

GEOLICAL SURVEY, CHARLESTON, W. VA. WATER RESOURCES DIV.

GEOLICAL SURVEY BASIC DATA REPORT NO 2, 1971, 96 P, 4 FIG, 10 TAB.

Journal Announcement: SWRA0509


(WOODARD-USGS)

RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER BASIN, WEST VIRGINIA.

FRIEL, E. A.; HOBBIE, W. A., JR; CHISHOLM, J. L.

GEOLICAL SURVEY, MORGANTOWN, W. VA.

WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY, (MORGANTOWN)

BASIC DATA REPORT NO 3, 1975, 96 P, 3 FIG, 10 TAB.

Journal Announcement: SWRA0973


(WOODARD-USGS)

Water Resources of the Monongahela River Basin West Virginia

FRIEL, E. A.; WILmoth, B. M.; WARD, P. E.; WARK, J. W.

U.S. Geological Survey

Hydrology of Area 5, Eastern Coal Province, Pennsylvania, Maryland, and West Virginia.

HERBA, W. J.; SHAW, L. C.; UPTON, D. E.

Geological Survey, Morgantown, West Virginia.

Water Resources Div.

Geological Survey Open-File Report 81-538 (WRI), September 1981, 92 p, 60 FIG, 22 TAB, 37 REF, APPENDIX.

Journal Announcement: SWRA1511

INVESTIGATION OF TRENDs IN FLOODING IN THE TUG FORK BASIN OF KENTUCKY, VIRGINIA, AND WEST VIRGINIA. HIRSCH, R. M.; SCOTT, A. G.; WYANT, T.


Available from U. S. Geological Survey, Reston, VA, 37 p, 10 FIG, 24 TAB, 38 REF, APPENDIX.

Journal Announcement: SWRA1601

Statistical analysis indicates that the average size of annual flood peaks of the Tug Fork (West Virginia and Kentucky) has been increasing. However, additional statistical analysis of data that do not indicate increases typically once or twice a year in the period 1947-1979 are any more likely to be exceeded now than in 1947. Possible trends in stream-channel size are also investigated at three locations. No discernible trends in channel sizes are noted. Further statistical analysis of the trend in the size of annual flood peaks shows that much of the annual variation is related to local rainfall and to the 'natural' hydrologic response in a relatively undisturbed subbasin. However, some statistical indication of trend persists after accounting for these natural factors, though it is of borderline statistical significance. This suggests the need for further study in the basin that may relate flood magnitudes to both rainfall and to land use.

(WOODARD-USGS)

Coal mines as a source of water for public supply in Upshur County, West Virginia, W. A., JR.

HOBBIE, W. A., JR.


Ground-Water Hydrology of the Little Kanawha River Basin, West Virginia.

HOBBIE, W. A., JR.
Effects of Underground Mining and Mine Collapse on the Hydrology of Selected Basins in West Virginia

Hobbs, William A., Jr.

The effects of underground mining and mine collapse on areal hydrology were determined at one site where the mined bed of coal lies above major streams and at two sites where the bed of coal lies below major streams. Subsidence cracks observed at land surface generally parallel predominant joint sets in the rocks. The mining and subsidence cracks increase hydraulic conductivity and interconnection of water-bearing rock units, which in turn cause increased infiltration of precipitation and surface water, decreased evapotranspiration, and higher base flows in individual streams. Water levels in observations wells in mined areas fluctuate as much as 100 feet annually. Both gaining and losing streams are found in mined areas. Mine pumpage and drainage can cause diversion of water underground from one basin to another. Areal and single-well aquifer tests indicated that near-surface rocks have higher transmissivity in a mine-subside basin that in unmined basins. Increased infiltration and circulation through shallow subsurface rocks increases dissolved mineral loads in streams, as do treated and untreated contributions from mine pumpage and drainage. Abandoned and flooded underground mines make good reservoirs because of their increased transmissivity and storage. Subsidence cracks were not detectable by thermal imagery, but springs and seeps were detectable.

Water Resources of the Potomac River Basin, West Virginia

Hobbs, W. A., Jr.; Friel, E. A.; Chisholm, J. L.

This report presents basic information and interpretations regarding the occurrence, availability, and quality of the water resources of the Potomac River basin in West Virginia. The basin includes an area of 3,446 square miles or about 15 percent of the state. The present population is 125,500. Considerable future increases in population, with increases in recreational and industrial expansion, are anticipated. Thus, the water resources is essential in proper planning for development. Virtually all water in the basin is derived from precipitation. Average annual precipitation is 38 inches per year. Of this amount 25 inches is returned to the atmosphere by evapotranspiration, 8 inches becomes ground-water recharge, and 5 inches becomes direct overland runoff. Average annual streamflow is 0.9 cubic feet per second per square mile. The carbonate rocks of Berkeley and Jefferson Counties are the best aquifers and may yield more than 600 gallons per minute to individual wells tapping cavernous zones. The shale rocks of the central part are generally the poorest aquifers. The chemical quality of both surface water and ground water is very poor to excellent, depending on location. (Woodard-USGS)

Abandoned Coal Mines in West Virginia As Sources of Water Supplies

Lessing, Peter, and Hobbs, William A., Jr.
U.S. Geological Survey Circular Number C-24

Water from underground coal mines may not be the best source for every community's water supply, but it could be considered and evaluated along with other possible sources. Water from coal mines may prove useful even if only a backup public supply, to augment low-flow in streams, and possibly for agricultural purposes. Considering the large quantities of mine water available throughout the State, its potential benefits could be explored. It may prove to be an excellent inexpensive water supply.

Hydrologic Data for the Coal River Basin, West Virginia

Morris, F. O.; Dadey, J. S.; Chisholm, J. L.; Downs, S. C.

During 1973-1975, the U.S. Geological Survey collected hydrologic data to describe the character of the ground- and surface-water resources of the Coal River basin in southern West Virginia. Streamflow and chemical, physical, and biological data were collected at about 15 stream sites, Descriptive data were collected at about 450 well sites and water samples from nearly 400 of them were analyzed for chemical and physical properties. The chemical composition of surface water at the time of low flow and moderate flow was determined for about 15 stream sites. (Woodard-USGS)

Hydrologic modeling in selected small watersheds in the coal areas of West Virginia

Puentes, C. L. and Atkins, J. T., 1983.


Hydrology of Area 4, Eastern Coal Provinces, Pennsylvania, Ohio, and West Virginia

Roth, D. K.; Engelke, M. J., Jr.

Area 4 (one of the 24 hydrologic areas defining the
Eastern Coal Province) is located at the northern end of the Eastern Coal Province in eastern Ohio, northern West Virginia, and western Pennsylvania. It is part of the upper Ohio River basin, which includes the Beaver, Mahoning, and Shenango Rivers. The area is underlain by rocks of the Pottsville, Allegheny, and Monongahela Groups (up to formations) and Dunkard Group. Area 4 has a temperate climate with an annual average rainfall of 38 to 42 inches, most of its area is covered by forest. The soils have a high erosion potential where the vegetation cover is removed. In response to Public Law 95-87, 132 sites were added to the existing surface-water data-collection network in area 4. At these added sites, collected data includes discharge, water quality, sediment, and biology. The data are available from computer storage through the National Water Data Exchange (NAWDEX) or the public water resources data banks. Hydrologic problems related to mining are: (1) Erosion and increased sedimentation, and (2) degradation of water quality. Erosion and sedimentation are associated chiefly with surface mining. Sediment yields increase drastically when vegetation is removed from the highly erosive soils. Degradation of water quality can be caused by acid-mine drainage from underground and surface mining. More than half the acid-mine drainage in area 4 comes from underground mines. The rest seeps from abandoned surface mines. Usually, in reclaimed surface mines the overburden is replaced in such a short time after the coal is taken out that acid-forming minerals, commonly pyrite or marcasite, is not complete or is neutralized by the buffering action of calcareous minerals in the soils. (USGS)

FLOOD ON BUFFALO CREEK FROM SAUNDERS TO MAN, WEST VIRGINIA

FOR SALE BY US GEOL. SURVEY, RESTON, VA 22092 - PRICE $1.50 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-547, 1974, 2 SHEETS, 13 FIGS, 4 TABLES, 2 REF.

Journal Announcement: SWRA817

ON FEBRUARY 26, 1972, AT APPROXIMATELY B.A.M., A COAL MINE REFUSE CASCADING ON MIDDLE FORK. A TRIBUTARY TO BUFFALO CREEK, WEST VIRGINIA. THIS 1-SHEET HYDROLOGIC ATLAS REPORT DOCUMENTS THE HYDROLOGIC EVENTS ASSOCIATED WITH THE BUFFALO CREEK FLOOD AS AN AID IN PLANNING REMEDIAL MEASURES TO REDUCE POTENTIAL FLOOD HAZARDS FROM SIMILAR DAMS AND IMPOUNDMENTS. THIS MOST DESTRUCTIVE FLOOD IN WEST VIRGINIA'S HISTORY SWIFT THROUGH 15.3 MILES OF THE BUFFALO CREEK VALLEY AT AN AVERAGE SPEED OF 25 MILES PER HOUR. AND REACHED THE TOWN OF MAN AT THE MOUTH OF BUFFALO CREEK AROUND 11 A.M. THE TRAVEL TIME FOR THE 15.3 MILES WAS ABOUT 3 HOURS. DURING THE 3-HOUR TRAVEL TIME THE VILLAGE AT LEAST 178 LIVES WERE LOST, 500 HOMES WERE DESTROYED, 4,000 PEOPLE WERE LEFT HOMELESS, PROPERTY DAMAGE EXCEEDED $50 MILLION AND HIGHWAY DAMAGE EXCEEDED $15 MILLION. (KKAPP-USGS)

West Virginia Department of Highways Research Project 16


A technique is presented for estimating the magnitude and frequency of floods on unregulated, virtually natural streams in West Virginia. Multiple-regression techniques were used to develop relations between dependent variables: flood peaks, and independent variables: drainage areas. Data collected at 170 stream-gaging sites were used in the analyses. Analyses of all residuals errors indicated that the best estimate of flood peaks could be made by dividing the state into three regions.

Peak discharges can be estimated for drainage areas from about 0.3 square mile up to 2000 square miles. Graphs are provided to estimate the flood peak having recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years and drainage areas between 1 and 1000 square miles. For drainage areas less than 1 and greater than 1,000 square miles peak flows can be estimated using equations listed on each graph.

Ground-Water Hydrology of the Upper New River Basin, West Virginia

Shultz, R. A.

U.S. Geological Survey

This atlas report describes the groundwater resources of the upper New River basin in West Virginia based on three earlier reports on the hydrology of the same basin. The basin drains 2,370 square miles in southeastern West Virginia and extends from the northeastern edge of Pocahontas County to the southwestern edge to the northwest edge of Mercer County. Precipitation is the principal source of ground-water recharge, averaging close to 40 inches basinwide and ranging from more than 40 inches in the southwestern part to less than 36 inches in the southeastern part. The yield of wells ranges from 0.5 to 500 gallons per minute and varies with topographic location, geologic structure, and geologic unit. Hilltop wells and a few hillside wells may fail to supply enough water for domestic use. Wells in valleys generally yield the greatest amounts of water. The chemical quality of the ground water ranges widely, but is generally good for most uses. In places it is subject to problems resulting from excessive concentrations of hardness, iron, and manganese.

Quality of Surface Water in the Coal-Mining Areas of Western Maryland and Adjacent Areas of Pennsylvania and West Virginia from April 1979 to June 1980 (duplicated see Maryland).

Adequate supplies of groundwater are available in the Monogahela Basin to meet present and future requirements. The best sources are wells in bedrock, particularly in sandstone. The most favorable areas are underlain by rocks of the Pottsville Group, Allegheny Group, Greenbrier limestone, and the Dunkard Group. Yields of 50-500 gpm are generally common in most areas. The Dunkard Group yields only about 21 gpm.

Development of water supplies in its outcrop area is difficult, requiring intensive investigation and test drilling. Alluvium is too thin and areally restricted for large groundwater development. Water quality is generally good, with high iron, hardness, and hydrogen sulfide concentration in a few places. Some salty water is found below 100-300 ft in the western part of the basin. Some oilfield, municipal, household, and chemical pollution occurs in a few areas. Coal mining and acid pollution has a small effect generally. In some populated areas it is a difficult problem. Descriptions of geologic units and their water-bearing properties are tabulated. Geology, water potential, and water quality are shown by maps.

Techniques for estimating streamflow characteristics in the eastern and interior coal provinces were described by Wales. A. L., and Batterman, James M., 1982 U.S. Geological Survey Water-Supply Paper.

W. Virginia


The Upper Potomac River Basin, in the central Appalachian region in Pennsylvania, Maryland, Virginia, and West Virginia, is a humid temperate region of diverse fractured rocks. Three geohydrologic terranes, which underlie large parts of the basin, are described in terms of their aquifer characteristics and of the magnitude and duration of their base runoff: (1) fractured rock having a thin regolith, (2) fractured rock having a thick regolith, and (3) carbonate rock. Crystalline rock in the mountainous part of the Blue Ridge Province and shale with tight sandstone in the folded Appalachians are covered with thin regolith. Water is stored in and moves through fairly unmodified fracture systems. Average transmissivity (T) is estimated to be 150 sq feet per day, and average storage coefficient (S) 0.005. Crystalline and sedimentary rocks in the Piedmont Province and in the lowland part of the Blue Ridge Province are covered with thick regolith, estimated average values for aquifer characteristics are 160 sq feet per day, and S 0.01. Carbonate rock, in which fractures have been widened, is selectively by solution, especially near streams, has estimated average aquifer characteristics of 500 sq feet per day, and S 0.03-0.04. This rock is the most effective in the basin in terms of water supply and base runoff.

Mineralized groundwater, and the high nitrate content of groundwater in some areas would probably have little adverse affect on the use of groundwater for low-flow augmentation. (Woodard-USGS)

Ground-water hydrology of the Monongahela River basin in West Virginia Ward, Porter, E. W., Wildom, Benton M. U.S. Geological Survey, West Virginia Geol. and Econ. Surv., River Basin Bull. 1, 54 p., 1968. 22 Fig. 6 Tab. 38 Ref.
Water resources data for the 1979 water year for coal regions of West Virginia consist of records of discharge and water quality of streams, wells, mines, and abandoned mine shafts; and water levels in wells and abandoned mine shafts. Section one consists of data obtained for the statewide Coal Hydrology Monitoring Project and includes discharge and water-quality data collected during two sampling periods at 361 sites. Section two consists of data obtained for the Mining Effects Research Project in five small basins in southwestern West Virginia during the period February 1976 to January 1980 and includes records of water quality for 53 stream sampling sites, 52 well sampling sites, 31 mine-discharge sampling sites, and 2 mine-shaft sampling sites; and water levels in 6 wells and 2 mine shafts. (USGS)

Water Resources Data for West Virginia, published annually since 1975
Available from the National Technical Information Service, Springfield, VA 22161.

Water resources data for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)

Ground-Water Levels in Wyoming, 1974
Bailance, Wilbur C., and Freudenthal, Pamela B.
Unnumbered Open-File Report, 1975
Ground-water levels are measured periodically throughout Wyoming in an observation-well network by the U.S. Geological Survey in cooperation with the Wyoming State Engineer and the city of Cheyenne. Water-level measurements provide information on the status of the ground-water supply and facilitate prediction of trends in water levels, which indicate change in ground-water storage. During 1974, about 1,500 measurements were made. Net water-level changes were computed using about 235 measurements made during the first 4 months of 1974 and 1975. Tables of well history, highest and lowest water levels, net changes, and hydrographs for most wells are included in this report.

Ground-Water Levels in Wyoming, 1975
Bailance, Wilbur C., and Freudenthal, Pamela B.
Ground-water levels are measured periodically in a network of about 260 observation wells in Wyoming to record changes in ground-water storage. The areas of water-level observation are mostly where ground water is used in large quantities for irrigation or municipal purposes. This report contains maps showing location of observation wells and water-level changes from 1975 to 1976.

Present and Potential Sediment Yields in the Yampa River Basin, Colorado and Wyoming (Duplicated see Colorado).
Andrews, E. D.

Journal Announcement: SWRA1214

Mining and alluvial valley floors
Armentrout, G. W., Jr., 1978
Star-Tribune, Casper, Wyoming, February 23, 1978

Wyoming Water Resources Data for the 1979 Water Year, for Coal Regions of West Virginia Consist of Records of Discharge and Water Quality of Streams, Wells, Mines, and Abandoned Mine Shafts; and Water Levels in Wells and Abandoned Mine Shafts. Section One Consists of Data Obtained for the Statewide Coal Hydrology Monitoring Project and Includes Discharge and Water-Quality Data Collected During Two Sampling Periods at 361 Sites. Section Two Consists of Data Obtained for the Mining Effects Research Project in Five Small Basins in Southwestern West Virginia During the Period February 1976 to January 1980 and Includes Records of Water Quality for 53 Stream Sampling Sites, 52 Well Sampling Sites, 31 Mine-Discharge Sampling Sites, and 2 Mine-Shaft Sampling Sites; and Water Levels in 6 Wells and 2 Mine Shafts. (USGS)

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Ground-Water Levels in Wyoming, 1975
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Ground-water levels in Wyoming, 1976
Ballance, William C., and Freudenthal, Pamela B.
Ground-water levels are measured periodically in a network of
about 250 observation wells in Wyoming to record changes in
ground-water storage. The areas of water-level observation are
mostly where ground water is used in large quantities for
irrigation or municipal purposes. This report contains maps
showing location of observation wells and water-level changes
from 1976 to 1977. Well history, highest and lowest water
levels, and hydrographs for most wells are also included in this
report.

Geology and ground-water resources of the Rawlins area, Carbon
County, Wyoming
Berry, D. W., 1960

Reconnaissance of the geology and ground-water resources of the
Cokeville area, Lincoln County, Wyoming
Berry, D. W., 1955

Geologic map and coal sections of the Pats Bottom quadrangle,
Carbon County, Wyoming
Blanchard, J. F., and Comstock, M. C.
U.S. Geological Survey Open-File Report 80-52, 2 sheets, scale
1:24,000.

WATER-QUALITY DATA FOR THE FLAMING GORGE RESERVOIR AREA,
UTAH AND WYOMING, 1969-72
Holker, E. L.; Wadbell, K. M.
GEOLICAL SURVEY, SALT LAKE CITY, UTAH.
GEOLICAL SURVEY OPEN-FILE REPORT (DUPLICATED AS UTAH
BASE-DATA RELEASE NO 24). 1972, 50 P. 1 FIG. 6 TAB. 7 REF.
Journal Announcement: SWAU609
SAMPLES FOR CHEMICAL QUALITY ANALYSIS WERE COLLECTED FROM
FLAMING GORGE RESERVOIR IN UTAH AND WYOMING BETWEEN OCTOBER 1970
AND SEPTEMBER 1972 AT 17 SITES. CHEMICAL AND PHYSICAL DATA WERE
MEASURED IN SITU AT 36 SITES. THE CHEMICAL-QUALITY DATA FOR THE
1969-71 WATER YEARS FOR STREAMS FLOWING INTO AND OUT OF THE
RESERVOIR ALSO ARE TABULATED. THE SAMPLING STATIONS FOR THESE
STREAMS ARE GREEN RIVER NEAR GREEN RIVER, WYO., BLACKS FORK

NEAR LITTLE AMERICA, WY., HENRYS FORK AT LINWOOD, UTAH, AND
GREEN RIVER NEAR GREENDALE, UTAH. IN ADDITION TO THE
GEOLICAL SURVEY STATION IDENTIFICATION NUMBER, EACH
STREAM SITE HAS BEEN ASSIGNED A LETTER TO IDENTIFY ITS POSITION
ON A MAP. (WOODARD-USGS)

Geohydrologic reconnaissance and measurement of perennial
streams crossing outcrops of the Madison Limestone, northeastern
Wyoming, 1974
Bonner, F. C., Lowry, M. E., Lines, G. C., and Powell, J. E.
1976

Preliminary digital model of the Arikaree aquifer in the
Sweetwater River basin, central Wyoming
Morchert, W. J., 1977
U.S. Geological Survey Water-Resources Investigations Open-File
Report 77-107.

Geology and ground-water resources of the Upper Niobrara River
Basin, Nebraska, and Wyoming with a section on Chemical quality
of the ground water by F. M. Rainwater
Bradley, Edward, 1956

Correlation of paleostructure and sediment deposition in the
Madison Limestone and associated rocks in parts of Montana, North
Dakota, South Dakota, Wyoming, and Nebraska
Brown, D. L., Blankenburg, R. K., MacCary, L. M., and
Peterson, J. A., 1982

Hydrogeologic features of the alluvial deposits in the Lincoln
River drainage areas, Bighorn Basin, Wyoming
Cooley, M. E., and Head, W. J., 1979
U.S. Geological Survey Water-Resources Investigations Open-File

Hydrologic features of the alluvial deposits in the Owl Creek
valley, Bighorn Basin, Wyoming
Cooley, M. E., and Head, W. J., 1979
U.S. Geological Survey Water-Resources Open-File Report

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Analysis of Runoff from Small Drainage Basins in Wyoming

G. S. Gordon, Jr., and Rankie James G.


A rainfall-runoff model was used to synthesize long-term records of runoff volume and peak discharge from long-term records (73 years) of rainfall and evaporation. The long-term data was transferred from a base station, Cheyenne, Wyoming, to 13 other weather stations in Wyoming. Volume and peak discharge frequencies were developed for the intermontane areas on 22 drainage basins smaller than 11 square miles relative to rainfall at the nearest weather station. Runoff volumes and peak discharges were related to basin parameters with a high degree of correlation. Flood volumes were related to drainage area, maximum relief, basin slope, and channel slope. Recurrence intervals considered were 2, 5, 10, 25, 50, and 100 years.

A dimensionless hydrograph was developed to define the characteristic shape of flood hydrographs to be expected from small drainage basins in Wyoming. The method requires a peak discharge in cubic feet per second and a volume in acre-feet to produce a synthetic hydrograph. Some selectivity was used in the development to avoid multipeak events or unusually shaped hydrographs.

An investigation of storage behind a highway embankment with a culvert to allow outflow has shown that the single fast-rising peak is most important in culvert design. Single peaks cause higher elevations behind embankments than do multipeak events of the same magnitude and volume. The study was limited to simple box culverts with inlet control.

GROUND-WATER RESOURCES OF NATRONA COUNTY, WYOMING

CRIST, M. A.; LOWRY, M. E.

GEOLoGICAL SURVEY, WASHINGTON, D.C. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1897, 1972, 92 p., 21 FIGS, 3 PLATE, 4 TAB, 44 REF.

A network of observation reservoirs was operated during the 4-year runoff seasons from 1951 to 1954. The number of reservoirs observed ranged from 48 to 57 and produced a total of 212 station-years of record. A complete record for each observation reservoir is included in this report.

An analysis of the observation reservoir records permitted the computation of volume of annual inflow to reservoirs in all parts of the basin, volume of inflow retained by reservoirs, and volume of retained inflow depleted by evaporation and seepage. Complete computations were made of 1-year, 10-year, and 20-year runoff producing storms typical of the Cheyenne River basin.

Water retained by reservoirs is subjected to two major types of depletion-evaporation and seepage. The water evaporated from the water surface constitutes a complete loss chargeable against the reservoirs; but, because seepage may contribute in some degree to ground-water recharge, reservoir loss from this source may in part be recovered. The collected data permitted a fairly comprehensive analysis of the variations of runoff and storage within the basin. Based on this analysis, estimates of losses
Confined to the reservoirs range from 19,000 acre-feet in a dry year to a maximum of 80,000 acre-feet in a very wet year. Discharge from the basin ranges from 50,000 to 180,000 acre-feet.

Geology and mineral resources of the Laramie Basin, Wyoming
Darton, N. N., and Siebenthal, C. E., 1909

Water demands for expanding energy development

Predicting effects of coal development on surface-water salinity: Green River Basin, Wyoming
Delong, L. L., 1978
Abstract, Annual Meeting AGU, San Francisco December 4-8, 1978

An Analysis of Salinity in Streams of the Green River Basin, Wyoming
Delong, L. L.

Dissolved-solids concentrations and loads can be estimated for streamflow records using a regression model derived from chemical analyses of monthly samples. The model takes seasonal effects into account by the inclusion of simple-harmonic time functions. Monthly mean dissolved-solids loads simulated for a 6-year period at U.S. Geological Survey water-quality stations in the Green River basin of Wyoming agree closely with corresponding loads estimated from daily specific-conductance records. In a demonstration of uses of the model, an average gain of 114,000 tons of dissolved solids per year was estimated for a 6-year period in a 70-mile reach of the Green River from Fontenelle Reservoir to the town of Green River, including the lower 30-mile reach of the Big Sandy River. (Woodard-USGS)

Predicting effects of coal development on surface-water salinity: Green River Basin, Wyoming
Delong, L. L., 1979
University of Wyoming; Wyoming Mining Hydrology Seminar, Laramie, Wyoming, April 19-20, 1979

Verification of Step-backwater Computations on Ephemeral Streams in Northeastern Wyoming
Drus, Stanley A.

Step-backwater computations were verified by subsequent discharge measurements at three ephemeral streamflow stations in northeastern Wyoming. The standard step-backwater method for gradually varied, subcritical flow was used in computing the water-surface profiles and stage-discharge ratings. Step-backwater computations were made at selected intervals from 1 through 1,000 cubic feet per second on Lodgepole Creek, through 150 cubic feet per second on Raven Creek, and through 600 cubic feet per second on Sand Creek. Stage-discharge rating curves and discharge measurements are illustrated for the three sites, with
lines of 15-percent departure from the rating curves drawn to measure accuracy of the results. All discharge measurements showed departures of less than 15 percent at the high end of the rating curves.

Base Flow and Chemical Quality of Streams in the Northern Great Plains Area, Montana and Wyoming, 1977-78. Druse, Stanley A., Dodge, Kent A., and Hutchins, W. R. Geological Survey WRI-81-692. Base-flow discharge and chemical-quality measurements were made at 233 selected sites on streams during October-November 1977, August-September 1978, and October 1978 to provide data on the interaction between surface-water and ground-water systems in the northern Great Plains area of Montana and Wyoming. The tabulated data provide an areally broad data base of con-current base-flow conditions.

Streamflow gains or losses were computed for stream reaches not significantly affected by irrigation. On October 17, 1978, the change in flow of the upper Powder River between Sullana and Arvada, Wyoming, was a loss of 14 cubic feet per second. On the same date, the change in flow of the lower Powder River between Arvada, Wyoming, and Moorhead, Montana, was a gain of 6 cubic feet per second. Except for August-September 1978, major subbasins showed little significant differences in water discharge, chemical character, or dissolved-solids concentrations.


An analysis of the surface effects of past underground coal mining in the Sheridan, Wyoming, area suggests that underground mining of strippable coal deposits may damage the environment more over long periods of time than would modern surface mining, provided the surface mining procedures are followed after surface mining. Subsidence depressions and pits are a continuing hazard to the environment and to man's activities in the Sheridan, Wyo., area above the abandoned underground mines in weak overburden less than about 60 m thick and where the overburden is less than about 10-15 times the thickness of coal mined. In addition, fires commonly start by spontaneous ignition when water and air enter the abandoned mine workings via subsidence cracks and pits. The fires can then spread to unmined coal as they create more cavities, more subsidence, and more cracks and pits through which air can circulate.

In modern surface mining operations the total land surface underlain by mineable coal is removed to expose the coal. The coal is removed, the overburden and topsoil are regressed, and the land is regraded and revegetated. The land, although disturbed, can be more easily restored and put back into use than can land underlain by abandoned underground mine workings in areas where the overburden is less than about 60 m thick or less than about 10-15 times the thickness of coal mined. The resource recovery of modern surface mining commonly is much greater than that of underground mining procedures. Although present-day underground mining technology is advanced as compared to that of the 25-60 years ago, subsidence resulting from underground mining of thick coal beds beneath overburden less than about 60 m thick can still cause greater damage to surface drainage, ground water, and vegetation than can properly designed surface mining operations. This report discusses (1) the geology and surface and underground effects of former large-scale underground coal mining in a 50-square kilometers area 5-20 km north of Sheridan, Wyo., (2) a ground and aerial reconnaissance study of a 5-square kilometers coal mining area 8-10 km west of Sheridan, and (3) some environmental consequences and problems caused by coal mining.

The Biology of Salt Wells Creek and Its Tributaries, Southwestern Wyoming. Engelken, R. J., Jr. Geological Survey Cheyenne, WY. Water Resources Div. Available from the National Technical Information Service, Springfield, VA 22161 as PB80-30828. Price codes: ADS in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-12%, 1978. 82 p. + 43 Fig. 15 Tab. 22 Ref. Journal Announcement: SWM330. A description of aquatic organisms and biological communities is presented for Salt Wells Creek, a plains stream in the Green River basin. The description includes seasonal population fluctuations of benthic organisms and algae, the food pyramid, and nutrient relations between various types of plants and animals. The algae and stream invertebrates were studied to determine baseline data and biological indicators of water quality. (Woodard-USGS).


Water-Quality Data for the Hanna and Carbon Basins, Wyoming


Journal Announcement: SWRA1314


Permit applications made to the Office of Surface Mining for mining of near-surface coal deposits contain both mining and reclamation plans. These plans must be evaluated by regulatory authorities for compliance with the permanent regulations of the Surface Mining Control and Reclamation Act of 1977. Methodologies are presented for assessing the effects of mining and reclamation on the hydrologic system of a potential permit area and the adjacent area, together comprising about 1.6 square kilometers in the drainage basin of Separation Creek, Carbon and Sweetwater Counties, Wyoming. The study area is representative of the hydrologic problems that exist in a semiarid environment of the high plains in Wyoming.

The premining hydrology and geology of the study area are described primarily as a basis for evaluation of potential changes that may occur. Data for soil-moisture relations in seven soil-moisture types show that differences in void space and particle surface area available for water storage are important factors in planning reclamation. Estimates are also made of runoff volumes and peak discharges for flow magnitudes of specified recurrence intervals using a regression model developed for the State of Wyoming. A shallow aquifer and its hydraulic characteristics are described in the study area. Methods for estimating erosion and sediment yield in the study area by means of the Universal Soil Loss Equation (USLE) and reservoir sedimentation surveys are described.

Selected Hydrologic Data, Yampa River Basin and Parts of the White River Basin, Northwestern Colorado and South-Central Wyoming.

Wyoming. (Duplicated see Colorado).


Journal Announcement: SWRA120


The recovery of shale oil by the in situ retort process may cause hydrologic impacts, the most significant being ground-water contamination and possible transport of contaminants into unaffected areas. Although these impacts are site-specific, many of the techniques used to investigate each retort operation commonly will be the same. The U.S. Geological Survey has begun a study of hydrologic impacts in the area of an in situ retort near Rock Springs, Wyoming, as a means of refining and demonstrating these techniques. Geologic investigations include determining the areal extent and thickness of aquifers. Emphasis will be placed on determining lithological variations from geophysical logging. Hydrologic investigations include mapping of potential sources, determining rates of ground-water discharge, and estimating aquifer properties by analytical techniques. Water-quality investigations include monitoring solute migration from the retort site and evaluating sampling techniques by standard statistical procedures. A ground-water-flow and solute-transport model will be developed to predict future movement of the solute plume away from the retort.


Hydrologic Effects of Water Spreading in Box Creek Basin, Wyoming.


A study was made during the summer seasons of 1956 and 1957 to determine the use of water by a water-spreading system in Box Creek basin, Converse County, Wy., which was designed to reduce sediment yield and fluvial erosion. The water-spreading system on Box Creek consists of 27 small dams that divert the flow directly to the flood plain where it is used to irrigate a hay meadow of 360 acres.

Two gaging stations were established, one above the water-spreading system and one below, to measure inflow, outflow, and suspended sediment. Also, a network of precipitation gages, ground-water observation wells, and observations on soil-moisture were an integral part of the hydrologic investigation.

There were six runoff events during the 1956 and 1957 seasons for which inflow and outflow through the water-spreading system could be determined. The total inflow for the six runoff periods was 2,026 acre-feet, and the outflow was 1,330 acre-feet which represents a loss of 34 percent of surface flow entering the water spreading.

Total reduction in suspended-sediment load for the six runoff periods was not determined because of the many ungauged tributaries between gaging stations. However, two of the storms originated above the upper gaging station, and the suspended-sediment load in the inflow was 4,513 tons and the outflow was 1,119 tons, which represents a decrease of 75 percent between stations. During the 2 years of observation, the total sediment deposition on the water-spreading system was 17.8 acre-feet or 0.049 acre-foot per acre. Most of this sediment was derived from slopes adjacent to the water-spreading and, therefore, not influenced by uncertainties in evaluating the sediment-retention efficiency of this type of land treatment.

Data from ground-water observation wells show that some of the surface flow entering the water-spreading system at the upper end may penetrate to a perched water table.

Preliminary applications of Landsat images and aerial photography for determining land-use, geologic, and hydrologic characteristics—Tampa River basin, Colorado and Wyoming.
Wyoming

RECOMMENDED MAXIMUM CONCENTRATIONS FOR DOMESTIC AND MUNICIPAL USE ARE GIVEN. THE DISSOLVED SOLIDS RANGED FROM 58 TO 30,000.

WATER RESOURCES OF THE POWDER RIVER BASIN AND ADJACENT AREAS. SOUTHERN WYOMING. HODSON, W. G.; PEARL, R. H.; DRUSE, S. A. GEOLOGICAL SURVEY, WASHINGTON, D.C.

HYDROLOGIC INVESTIGATIONS ATLAS HA-665, 1973. 4 SHEETS. 9 FIG, 11 TAB, 4 MAPS. 70 REF.

JOURNAL ANNOUNCEMENT: SWRAU723

GENERAL INFORMATION IS GIVEN CONCERNING THE AVAILABILITY AND QUALITY OF GROUNDWATER RESOURCES OF THE POWDER RIVER BASIN, WYOMING, IN A 4-SHEET HYDROLOGICAL ATLAS. THE POWDER RIVER BASIN IS A STRUCTURAL AND TOPOGRAPHIC BASIN BOUNDED ON THE WEST BY THE ROCKY MOUNTAINS, ON THE SOUTHWEST BY THE CASPER ARCH, ON THE EAST BY THE BLACK HILLS, AND ON THE SOUTH BY THE LARAMIE RANGE AND MARTVILLE UPLIFT. MEAN ANNUAL PRECIPITATION DECREASES BASINWARD FROM 16.52 INCHES AT SUNDANCE AND 15.91 INCHES AT SHERIDAN TO 14.00 INCHES AT GILLETTE AND 11.80 INCHES AT CASPER. POTENTIAL EVAPORATION IS HIGH, ESPECIALLY IN THE POWDER RIVER BASIN, AND IS SEVERAL TIMES THE PRECIPITATION; CONSEQUENTLY, MUCH SNOW, SURFACE WATER, AND SOIL MOISTURE EVAPORATE TO THE ATMOSPHERE. ALLUVIUM ALONG IRRIGATED VALLEYS IS RECHARGED IN PART FROM IRRIGATION WATER. SOME MOVEMENT OF WATER BETWEEN FORMATIONS PROBABLY OCCURS IN THE SUBSURFACE. DISCHARGE IS MAINLY BY EVAPORATION, SEEPAGE TO SPRINGS AND LAKES, TRANSPARATION BY PLANTS, AND PUMPAGE FROM WELLS. MOST GROUNDWATER DEVELOPMENT HAS BEEN FOR STOCK AND WELLS ARE USUALLY DRILLED AND DEVELOPED TO SUPPLY WATER SUFFICIENT FOR THESE NEEDS ONLY. THE QUALITY OF GROUNDWATER RANGES FROM GOOD TO HIGH MINERALIZED. DISSOLVED SOLIDS CAN BE EXPECTED TO BE LESS AND FROM INTRUSIVE IGNEOUS ROCKS OF TERTIARY AGE. THE AVERAGE RATE OF DISCHARGE PER SQUARE MILE IS SHOWN ON A MAP FOR EACH STATION. THE YIELDS FROM THE NONMOUNTAINEOUS BASINS (BELLE FOURCHE RIVER, CHEYENNE RIVER, AND THE SOUTHERN AND EASTERN PARTS OF THE POWDER RIVER BASIN) GENERALLY ARE LESS THAN 0.05 CFM (CUBIC FEET PER SECOND PER SQUARE MILE), AND FROM THE MOUNTAIN MOUNTAINS GENERALLY ARE MORE THAN 0.3 CFM. DISCHARGE FROM STREAMS IN THE NONMOUNTAINEOUS AREAS IS GREATLY AFFECTED BY STORAGE IN STOCKWATER RESERVOIRS AND BY THE VARIABLE PATTERN OF THUNDERSTORM ACTIVITY OVER THE AREA. (KNAPP-USGS)

A Guide to State Programs for the Reclamation of Surface Mined Lands. Results of analyses of those programs and ancillary data are presented in: (1) A table (matrix) which has been designed for the notation and elaboration of information pertaining to the mined-area reclamation programs of the 50 States; (2) a primer on surface mining activities and related reclamation practices and problems; and (3) a listing of types of non-Federal governmental controls applicable to reclamation. Interpretations of the status and content of State programs suggest that although a common thread runs through State statutory language, administrative requirements vary from State to State in order to meet different natural economic, social, and political considerations. A general trend is seen in State programs toward the requiring of an integration of land-use planning and mine planning, with increased local governmental involvement.

Geology and ground-water resources of the Kaycee irrigation project, Johnson County, Wyoming with a section on chemical quality of the ground water by F. H. Rainwater. Kahout, F. A., 1957


Campbell County along the east margin of the Powder River Basin contains more coal than any other county in the United States. The principal deposit is the Wyodak-Anderson coal bed. The bed is 50-100 feet (15-30 meters) thick over large areas, lies less than 200 feet (60 meters) deep in some areas, and ranges from 10 to 100 miles (16 to 161 kilometers) long and 2-3 miles (3-5 kilometers) wide, and contains an estimated 15 billion tons (13.6 billion metric tons) of subbituminous coal. The low-sulfur coal is considered to be more accessible to surface mining. Extensive mining of this deposit has the potential for causing a variety of environmental impacts and has been a matter of public concern and debate in recent years.

An integrated program of geologic, hydrologic, geochronological, and related studies by the U.S. Geological Survey in central Campbell County, Wyoming, provides basic information about the land and its resources, including (1) characteristics of the landscape, (2) properties of rocks and surface materials, (3) depth and thickness of coal, (4) streamflow, (5) depth to ground water, (6) quality of ground water, (7) sediment yields, (8) concentrations of trace elements in soils, rocks, coal, vegetation, and water, and (9) current land use. The data are used to analyze and predict some of the potential environmental effects of surface mining, such as the extent of land disturbance, nature and degree of surface mined lands. Results of analyses of those programs and ancillary data are presented in: (1) A table (matrix) which has been designed for the notation and elaboration of information pertaining to the mined-area reclamation programs of the 50 States; (2) a primer on surface mining activities and related reclamation practices and problems; and (3) a listing of types of non-Federal governmental controls applicable to reclamation. Interpretations of the status and content of State programs suggest that although a common thread runs through State statutory language, administrative requirements vary from State to State in order to meet different natural economic, social, and political considerations. A general trend is seen in State programs toward the requiring of an integration of land-use planning and mine planning, with increased local governmental involvement.

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of landscape modification, and disruption of surface-water and ground-water systems. Advance knowledge and understanding of these and other problems are useful in the planning and regulation of future leasing, mining, reclamation, and related activities.

Energy resources map of the Powder River basin, Wyoming and Montana (superseded see Montana).

U.S. Geological Survey Miscellaneous Investigations Map I-847-A

Sediment Transport and Source Areas of Sediment and Runoffs, Big Sandy River Basin, Wyoming.

Kircher, James E.,
A study was conducted for the resolution of sediment source areas in the Big Sandy River Basin, southwestern Wyoming. Suspended-sediment and bedload data were collected in order to determine total sediment transport at several locations within the basin.

Bedload data were compared to the Einstein bedload function and total load data were compared to the Colby method. The bedload comparison showed a higher estimation of transport rates with the Einstein-Smith sampler measurements than with the Einstein bedload function. The Colby method yielded higher transport rates at high flows and lower transport rates at low flows than the measured total transport rate.

The basin is under control in the basin. The area upstream of the reservoir was interpreted separately from the area downstream for source-area determination. In the arid plains the area of the reservoir, the amount of sediment transported increased 98 percent with an increase in runoff of only 1 percent.

Water Resources of Upper Separation Creek Basin, South-Central Wyoming

Larson, L. R., and Zimmermann, E. A.,

Journal Announcement: SWA1420
Expected development of coal in the 85-square-mile Upper Separation Creek Basin of south-central Wyoming will greatly increase the demands on water resources. Flows in Separation Creek are seasonal and highly variable. Streamflow is primarily caused by snowmelt. In the spring of 1977 resulted in annual runoff being only 10 percent of that for the previous year. Surface-water quality is variable in both time and space. Dissolved-solids concentrations ranged from less than 150 to more than 1,300 milligrams per liter. Flushing of accumulated salts occurs during a rising stage. Ground water is obtainable from the Mesaverde Formation, the Lance and Fort Union Formations, and from alluvium. Yields from wells and springs are usually less than 10 gallons per minute, though some springs flow as much as 35 gallons per minute. Ground-water quality varies with the formation. Stream biota are governed by the intermittent nature of the stream and by habitat. Daily mean sediment concentrations ranged from 34 to 11,900 milligrams per liter. (USGS)

WATER RESOURCES OF THE THRUST BELT OF WESTERN WYOMING LINES, G. C., GLASE, W. R., GEOLOGICAL SURVEY, CHEYENNE, WY. FOR SALE BY USGS, RESTON, VA. 22092; PRICE $2.00 PER SET. HYDROLOGIC INVESTIGATIONS ATLAS HA-539, 1975. 3 SHEETS, 38 REF.

Journal Announcement: SWA0913
THIS ATLAS REPORT DESCRIBES THE RESULTS OF ONE OF A SERIES OF WATER-RESOURCES RECONNAISSANCE STUDIES OF LARGE AREAS IN WYOMING BY THE U.S. GEOLOGICAL SURVEY IN COOPERATION WITH THE WYOMING STATE ENGINEER. THE PURPOSES OF THE STUDY ARE TO OBTAIN A GENERAL KNOWLEDGE OF THE OCCURRENCE, AVAILABILITY, AND QUALITY OF GROUNDWATER AND TO SUMMARIZE FLOW CHARACTERISTICS AND CHEMICAL QUALITY OF MAJOR STREAMS IN THE THRUST BELT OF WESTERN WYOMING. THE THRUST BELT IS AN ELONGATE, NEARLY RECTANGULAR AREA OF ABOUT 5,300 SQ MI IN THE MIDDLE ROCKIES PHYSIOGRAPHIC PROVINCE. THE LARGEST USE OF WATER IN THE AREA IS FOR IRRIGATION OF ALFALFA, GRASS HAY, AND PASTURE TO COMPLEMENT LIVESTOCK GRAZING ON THE PLEISTOCENE LARGER AREAS OF FOREST AND RANGE LAND. IN THE WEST PART OF THE BEAR RIVER BASIN THAT IS IN WYOMING, AN ESTIMATED 58,700 ACRES WERE IRRIGATED IN 1970 (HUNTER AND OTHERS, 1971) ONLY ABOUT 2,000 ACRES OF THIS TOTAL WAS IRRIGATED WITH WATER FROM WELLS. INDUSTRIAL WATER USE IN 1970 IS ESTIMATED AT 6 MG D WITH ABOUT 80 PERCENT OF THE WATER DERIVED FROM SURFACE-WATER SOURCES. APPROXIMATELY TWO-THIRDS OF THE ESTIMATED 18,000 PEOPLE THAT LIVED IN THE STUDY AREA IN 1970 WERE SERVED BY MUNICIPAL WATER SUPPLIES IN AFTON, COKEVILLE, EVANSTON, KEMMERER, JACKSON, AND THAYNE. ESTIMATED USE IN 1970 BY THESE MUNICIPAL SUPPLIES WAS 3.4 MGD. THREE AREAS OF THERMAL-WATER DISCHARGE ARE KNOWN IN THE AREA. (WOODARD-USGS)
Reconnaissance of the geology and ground-water hydrology of the Laramie Basin, Wyoming
Littleton, R. T., 1950

Preliminary potentiometric-surface map showing freshwater heads for the Lower Cretaceous rocks in the Northern Great Plains of Montana, North Dakota, South Dakota, and Wyoming
Lohmeyer, D. H., 1980

A Plan for Study of Water and Its Relation to Economic Development in the Green River and Great Divide Basins in Wyoming
OPEN-FILE REPORT 76-349, MAY 1976. 92 P. 37 FIGS. 11 TABS. [73]

Journal Announcement: S.W.A.D.924
DEVELOPMENT OF EXTENSIVE COAL, OIL, GAS, TRONA, AND OIL-SHALE RESOURCES AS WELL AS OTHER DEVELOPMENTS IN THE GREEN RIVER AND GREAT DIVIDE BASINS IN WYOMING WILL REQUIRE A PROJECTED INCREASE IN WATER CONSUMPTION OF 400,000 ACRE-FT PER YEAR BY 2020. DEVELOPMENTS OF ENERGY RESOURCES IN OTHER PARTS OF WYOMING WILL ALSO REQUIRE LARGE AMOUNTS OF WATER; TRANSBASIN DIVERSION OF GREEN RIVER WATER TO OTHER AREAS COULD TOTAL AN ADDITIONAL 270,000 ACRE-FT PER YEAR. IN CANTICIPATION OF THIS INCREASED DEMAND, WATER PLANNERS AND MANAGERS NEED MUCH MORE INFORMATION ABOUT AVAILABLE GROUND AND SURFACE WATERS. PRESENT QUALITY OF THE WATER NEEDS TO BE CONSIDERED. HYDROLOGIC EFFECTS THAT WOULD BE CAUSED BY DEVELOPMENT OF ENERGY RESOURCES. THE U.S. GEOLOGICAL SURVEY IS CONDUCTING AN EXTENSIVE HYDROLOGIC STUDY OF THE BASINS. THIS REPORT SUMMARIZES THE STUDY PLAN AND DISCUSSES PARTIAL METHODS OF APPROACH THAT WOULD BE UTILIZED IN THE STUDY. REGARDING WATER QUALITY, PARTICULAR ATTENTION IS BEING GIVEN TO TRACE METALS, BIOLOGICAL CHARACTERISTICS, AND TRENDS IN WATER TEMPERATURE. SUMMARY OF THE STUDY PLAN AND DISCUSSION OF NEXT STEPS IN METHODS OF APPROACH THAT WOULD BE UTILIZED TO STUDY THE MATTER OF WATER QUALITY. DETAILED STATISTICAL ANALYSES, AND MATHEMATICAL MODELS ARE BEING APPLIED TO SURFACE-WATER STUDIES. AN UPDATED WELL INVENTORY, AQUALFER TESTS, AND BOREHOLE AND SURFACE GEOPHYSICAL SURVEYS ARE BEING USED IN GROUND-WATER STUDIES. [WODDAR-USGS]

An analysis of stream temperatures, Green River Basin, Wyoming
Lowham, H. W., 1978

This report presents a method for estimating temperatures of streams in the Green River Basin, Wyoming. The procedure utilizes a regional model for estimating mean daily temperature of streams at unmeasured sites. The regional model was developed by describing annual temperature patterns at 43 measured sites in the basin and by applying the harmonic function: \[ T = M + A \sin (0.02 \pi t + C) \] where \( T \) is mean daily temperature, \( M, A, \) and \( C \) are harmonic coefficients calculated from data for each stream-temperature station, and \( t \) is the day of the water year. Application of the above equation for estimating temperatures at unmeasured sites requires regionalized estimates of \( M, A, \) and \( C. \) Regional estimates were developed with the aid of multiple-regression techniques, whereby the calculated harmonic coefficients were regressed against physical and climatic characteristics of the stream-temperature stations. Stream elevation was found to be a significant factor affecting water temperature.

Analysis of areal and temporal variations in temperature showed that springs, irrigation return flows, and reservoir storage were affecting reaches of several major streams.

Streamflows and Channels of the Green River Basin, Wyoming
Lowham, H. W.
U.S. Geological Survey Water Resources Investigation Report 81-81 P.

Width, depth, cross-sectional area, and velocity of streamflow were depicted for 51 gaged sites by summarizing data obtained from current-meter discharge measurements. Using these at-a-station relations as a base, regional relations were then developed that characterize hydraulic features of streams throughout the study area.

Channel size is an indication of flow magnitude. High flows influence channel formation and the annual peak-flow array is a representation of these flows. The geometric mean of this array is a statistical index of channel-forming flows because it represents the relative magnitude of high flows at a site. Bankfull discharge is a physical index of flows dominating channel formation. The magnitude of the geometric mean equals closely to bankfull discharge, on the average. Relations depicting hydraulic characteristics to a discharge equal to the geometric mean of annual peak flows may therefore be considered to be generally representative of channel conditions existing during bankfull discharge. The relations have application for predicting channel response to developments that would alter streamflow.

Hydrology of Salt Wells Creek--A Plains Stream in Southwestern Wyoming
Available from the National Technical Information Service, Springfield, VA 22151 as PB82-201211. Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources
Investigations 81-62, April 1982. 52 p, 32 Fig, 2 Tab, 24 Ref.,
Journal Announcement: SWRA1512

Development of energy minerals in plains areas of Wyoming is expanding rapidly. Such development may affect water resources and hydrologic relations of the plains; however, little information exists concerning hydrologic processes for these areas. This report summarizes results of a hydrologic study made during 1975-78 of Salt Wells Creek, a drainage area of about 500 square miles located southeast of Rock Springs, Wyoming. The area is typical of arid and semiarid plains areas in southwestern Wyoming where mineral development is occurring. Salt Wells Creek is predominately an intermittent stream. Numerous springs in the headwaters cause small perennial flows in some upstream tributaries; but evaporation, freezeup, and seepage deplete these flows so that the middle and lower reaches of the main channel have only intermittent flows. The water table is an intermittent nature of streamflow affects water quality. It was observed that a flushing of dissolved solids and suspended sediment occurs during the first flows of a runoff event. A striking feature of the stream is its deeply incised channel. The downcutting is attributed to the cumulative effects of: (1) a change in the relative climate, amounts of annual precipitation occurring as rain and snow, (2) change in base level due to downstream channelization, and (3) changes in land use. Because of the incision, erosion is now expanding to include intervening tributaries. (USGS)

CHEMICAL ANALYSES OF GROUNDWATER IN THE BIGHORN BASIN, NORTHERN WYOMING
LOWRY, M. E., LINES, G. C.
GEOLICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
WYOMING DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT
BASIC-DATA REPORT, 1972. 16 p, 1 Fig, 2 Tab, 9 Ref.,
Journal Announcement: SWRS0513


Hydrology of the uppermost Cretaceous and lowermost Paleocene rocks in the Hightail oil field, Campbell County, Wyoming
LOWRY, M. E., 1973


Ground-water resources of Sheridan County, Wyoming
Lowry, M. E. and Cummings, T. R., 1966
Sheridan County is in the north-central part of Wyoming and is an area of about 2,500 square miles. The western part of the county is in the Bighorn Mountains, and the eastern part is in the Powder River structural basin. Principal streams are the Powder and Tongue Rivers, which are part of the Yellowstone River system. The climate is semiarid, and the mean annual precipitation at Sheridan is about 16 inches.

Rocks of Precambrian age are exposed in the central part of the Bighorn Mountains, and successively younger rocks are exposed eastward. Deposits of Tertiary age which are exposed throughout a large part of the Powder River structural basin. Deposits of Quaternary age underlie the flood plains and terraces along the larger streams, particularly in the western part of the basin.

Aquifers of pre-Tertiary age are exposed in the western part of the county, but they dip steeply and are deeply buried just a few miles east of their outcrop. Aquifers that might yield large supplies of water include the Bighorn Dolomite, Madison Limestone, Amsden Formation, and Tensleep Sandstone. The Flathead Sandstone, Sundance Formation, Morrison Formation, Cloverly Formation, Newcastle Sandstone, Frontier Formation, Parkman Sandstone, Bearpaw Shale, and Lance Formation may yield small or, under favorable conditions, moderate supplies of water. Few wells tap aquifers of pre-Tertiary age, and these are restricted to the outcrop area. The meager data available indicate that the water from the Lance Formation, Bearpaw Shale, Parkman Sandstone, Tensleep Sandstone and the Flathead Sandstone is of suitable quality for domestic or stock purposes, and that water from the Tensleep Sandstone and Amsden Formation is of good quality for irrigation. Samples could not be obtained from other aquifers of pre-Tertiary age; so the quality of water in these aquifers could not be determined.

Adequate supplies of ground water for stock or domestic use can be developed throughout much of the report area from the Fort Union and Wasatch Formations of Tertiary age; larger supplies might be obtained from the coarse-grained sandstone of the Wasatch Formation near Moncreefe Ridge. Four aquifer tests were made at wells tapping formations of Tertiary age, and the coefficients of permeability determined ranged from 2.3 to 7.9 gallons per day per square foot. The depths to which wells must be drilled to penetrate an aquifer differ within relatively short distances because of the lenticularity of the aquifers. Water in aquifers of Tertiary age may occur under water-table, artesian, or a combination of artesian and gas-lift conditions.

Water from the Fort Union is usable for domestic purposes, but
the iron and dissolved-solids content impair the quality at some localities. Water from the Fort Union Formation is not recommended for irrigation because of sodium and bicarbonate content. Water is regarded as good for stock use. Water from the wasatch Formation generally contains dissolved solids in excess of the suggested domestic standards but this water is usable in the absence of other supplies. The development of irrigation supplies from the Wasatch Formation may be possible in some areas, but the water quality should be carefully checked. Water of good to very poor quality for stock supplies is obtained, depending upon the location. Hydrogen sulfide, commonly present in water of the Fort Union and Wasatch Formations, becomes an objectionable characteristic when the water is used for human consumption.

Deposits of Quaternary age generally yield small to moderate supplies at the wells. Two pumping tests were conducted, and the coefficients of permeability of the aquifers tested were 380 and 1100 gallons per day per square foot. Usable supplies of geolocal materials can be developed from the deposits of Quaternary age, principally along the valleys of perennial streams that head in the mountains and from terraces in the western part of the county. The thickest known deposit of alluvium is in the valley of Dutch Creek, which heads in the Powder River structural basin. Water from the alluvium is usable as a stock supply but has objectionable characteristics for domestic and irrigation use.

Recharge to ground-water reservoirs is from precipitation and seepage from streams and irrigation. Recharge conditions are generally better in the western part of the basin, where precipitation is greater, and where there are some seasonal and perennial streams and irrigated lands. Discharge from the ground-water reservoirs is by seepage to streams, evaporation, transpiration, and by wells and springs.


This 2-sheet map report includes the part of the Bighorn Basin located in the mountains in Northwestern Wyoming. Water-bearing properties of the geologic units are summarized. The hydrogeologic map illustrates the distribution of wells in the different units and gives basic data on the yields of wells, depth to water, and dissolved solids and conductance of the water. Aquifers capable of yielding more than 1,000 gpm (gallons per minute) underlie the area everywhere except in the mountains on the periphery of the basin. In 1970, approximately 29,500 of the 40,475 people living in the Bighorn Basin were served by municipal water supplies. The municipal supply for about 6,300 of these people was from ground water. The natural flows of streams in the Bighorn Basin differ greatly due to a wide variety of geographic, topographic, and geologic conditions of the basin. The station locations and the average discharge per square mile are shown on the map and give an indication of the geographic variation of basin yields. The maximum instantaneous discharge that has occurred at each station during its period of record is shown. Most of the runoff in the basin is from snowmelt in the mountains. (Woodard=USGS)


THE AVAILABILITY AND QUALITY OF GROUNDWATER AND FLOW CHARACTERISTICS AND QUALITY OF WATER IN THE MAJOR STREAMS WERE STUDIED IN THE LARAMIE BASIN, THE SHIRLEY BASIN, AND THE HANNA BASIN, ALL IN SOUTHEASTERN WYOMING. TREMENDOUS QUANTITIES OF WATER ARE PRESENT IN ROCKS UNDERLYING THE AREA. POROSITY THERE WOULD BE IN EXCESS OF 64 ACRE-FEET OF WATER STORED IN A SANDSTONE 1 FOOT THICK AND 1 MILE SQUARE. GROUNDWATER SUITABLE IN QUANTITY AND QUALITY FOR STOCK USE IS GENERALLY AVAILABLE AT DEPTHS OF 500 FEET OR LESS. MOST WELLS FOR WHICH DATA ARE AVAILABLE ARE USED FOR STOCK OR DOMESTIC SUPPLIES. FLOW-DURATION CURVES SHOW THE DISTRIBUTION OF DAILY DISCHARGES FOR THE PERIODS FOR WHICH DATA ARE AVAILABLE, THERE IS, IN MOST PLACES, A FREE EXCHANGE OF WATER BETWEEN STREAMS AND FLOODPLAIN DEPOSITS TO THE EXTENT THAT ANY SIGNIFICANT CHANGE IN THE QUANTITY ON ONE SIDE WILL BE REFLECTED IN THE OTHER, NO AREAS WERE IDENTIFIED DURING THIS STUDY WHERE PERENNIAL STREAMS LOSE WATER TO JEDROCK FORMATIONS, THE MOST PREVAILING CONDITION TYPIFIED BY THAT IN THE LARAMIE BASIN. THERE, THE RELATIONS OF WATER IN BEDROCK TO WATER IN THE LITTLE LARAMIE AND LARAMIE RIVERS INDICATE THAT BEDROCK UNDERLYING THE FLOOD PLAIN OF THESE RIVERS IS NOT SIGNIFICANTLY PERMEABLE TO MEASURABLY AFFECT THE FLOW OF THE LARAMIE RIVER BY EITHER INCREASING OR DECREASING DISCHARGE. (KNAPP-USGS)

CHEMICAL QUALITY OF SURFACE WATER IN THE FLAMING GORGE RESERVOIR AREA, WYOMING AND UTAH

MADISON R. J., WADDELL K. M.

GEOLOGICAL SURVEY, WASHINGTON, D.C.

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2009-C, 1973, 18 P., 8 FIG., 1 PLATE, 3 TAB., 4 REF.,

Journal Announcement: SWAG615


Geology and coal resources of the Buffalo-Lake DeSmet area, Johnson and Sheridan Counties, Wyoming

Mapes, W. J., 1959

Preliminary reconnaissance of the southern Powder River Basin uranium districts, Wyoming

Marler, J. R., Rucker, S. J., Freudenthal, P. B., and Ringen, B. H.

Mississippian rocks in the Laramie Range, Wyoming and adjacent areas. 40 short papers in geology and hydrology. Article 66

Maughan, E. K., 1963

Preliminary map showing freshwater heads for the Mission Canyon and Lodgepole Limestones and equivalent rocks of Mississippian age in the Northern Great Plains of Montana, North and South Dakota, and Wyoming (duplicated see Montana).


Preliminary map showing freshwater heads for the Red River Formation, Big Horn Dolomite, and equivalent rocks of Ordovician age in the Northern Great Plains of Montana, North and South Dakota, and Wyoming. (Duplicated see Montana).


Reconnaissance of the geology and ground-water resources in the Cheyenne River drainage basin in northern Converse County, Wyoming

Morris, D. A., 1956

Preliminary report of ground water from an underground coal gasification experiment, Hanna, Wyoming

Peter, K. D.

Subsurface geology and porosity distribution, Madison Limestone and underlying formations, Powder River Basin, northeastern Wyoming and southeastern Montana, and adjacent areas

Peterson, J. A., 1978

Stratigraphy and sedimentary facies of the Madison Limestone and associated rocks in parts of Montana, North Dakota, South Dakota, Wyoming, and Nebraska.

Peterson, J. A., 1981

An Empirical Method for Determining Average Soil Infiltration Rates and Runoff, Powder River Structural Basin, Wyoming

Rankl, J. G.
U.S. Geological Survey Water Resources Investigation Report 81-76, 43 P.

This report describes a method to estimate infiltration rates of soils for use in estimating runoff from small basins. Average rainfall intensity is plotted against storm duration on log-log paper. All rainfall events are designated as having...
either runoff or nonrunoff. A power-decay-type curve is visually fitted to the two types of rainfall events. This separation curve is an incipient-ponding curve and its equation describes infiltration parameters for a soil. For some soils with more than one soil complex, only the incipient-ponding curve for the soil complex with the lowest infiltration rate can be defined using the separation technique. Incipient-ponding curves for soils with infiltration rates greater than the lowest curve are defined by ranking the soils according to their relative permeabilities and optimizing the curve position.

A comparison of results for six basins produced computed total runoff for all events used ranging from 16.6 percent less to 2.3 percent more than measured total runoff.

Rainfall and Runoff Data from Small Basins in Wyoming
Publication of the Wyoming State Engineer and Wyoming Department of Economic Planning and Development Prepared by the U.S. Geological Survey, 479 p., 25 illus., 1 table, 1 ref.

Rpt contains water-level measurements made in observation wells in Wyoming by the U.S. Geological Survey and cooperative state and Federal agencies during the period 1940-71. The data are listed by counties. Maps showing locations of the observation wells are included. Aquifers tapped by the observation wells are identified.

Ringen, Bruce M., Publication of the Wyoming State Engineer and Wyoming Department of Economic Planning and Development Prepared by the U.S. Geological Survey, 147 p., 12 illus., 5 tables, 1 ref.

This report contains tables of water-level measurements made in observation wells in Wyoming by the U.S. Geological Survey in cooperation with State and Federal agencies during the period 1972-73. The data are listed by counties. Maps showing locations of the observation wells are included. Aquifers tapped by the observation wells are identified.
An overview of River-Basin assessment techniques in an energy-impacted region—Yampa River Basin, Colorado and Wyoming by D. E. Steele 1979  ••

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING—PHASE 1 WORK PLAN (Duplicated see Colorado). ••

Assessment of impacts of proposed coal-resource and related economic development on water resources, Yampa River basin, Colorado and Wyoming—A summary. ••

U.S. Geological Survey Circular 839, 56 p. ••

Wyoming

International Water Resources Association: 1976. 14 p. 1 Fig, 1 Tab, 17 Ref, 77-04994. ••

On the magnitude of mining and use of coal resources in the basin, an estimated 0.7 to 2.7 million tons (0.6 to 2.4 million metric tons) of waste residuals may be discharged annually into the environment by coal-resource development and associated economic activities. If the assured development of coal resources in the basin occurs, annual consumptive use of water which was approximately 142,000 acre-feet (175 million cubic meters) during 1975 may almost double by 1990. In a related analysis of alternative cooling systems for coal-conversion facilities, four to five times as much water may be used consumptively in a wet-tower, cooling-pond recycling system as in once-through cooling. An equivalent amount of coal transported by slurry pipeline would require about one-third the water used consumptively by once-through cooling for in-basin conversion.

Current conditions and a variety of possible changes in the water quality of the basin's water resources and stream flows due to coal development were assessed. Basin population may increase by as much as threefold between 1975 and 1990. Volumes of wastes requiring treatment will increase accordingly. Potential problems associated with ammonia-nitrogen concentrations in the Yampa River downstream from Steamboat Springs were evaluated using a waste-load assimilative-capacity model. Changes in sediment loads carried by streams due to increased coal mining and construction of roads and buildings may be apparent only locally; projected increases in sediment loads relative to historical loads from the basin are estimated at 1 to 2 percent.

Solid-waste residuals generated by coal-conversion processes and disposed of into old mine pits may cause widely dispersed ground-water contamination based on simulation results. Projected increases in year-round water use will probably result in the construction of several proposed reservoirs. Current seasonal patterns of streamflow and of dissolved-solids concentrations, and appreciable increases in streamflow will be altered by these reservoirs. Decreases in time-weighted median-dissolved-solids concentrations of as much as 34 percent are anticipated. Models used upon model simulations of several configurations of proposed reservoirs.

Detailed statistical analyses of water-quality conditions in the Yampa River basin were made. Regionalized maximum water-quality conditions were estimated for comparison with future conditions. Using Landsat imagery and aerial photographs, potential remote-sensing applications were evaluated to monitor land-use changes and to assess both snow cover and turbidity levels in streams. The technical information provided by the several studies of the Yampa River basin assessment should be useful to regional planners and resource managers in evaluating the possible impacts of development on the basin's water resources.

Wyoming

Wyoming
AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER RESOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING--PHASE-II WORK PLAN. (DUPLICATED SEE COLORADO).
STEEL, T. D.; JAMES, I. C.; BAER, D. P.
GEOLOGICAL SURVEY, DENVER, COLO.
OPEN-FILE REPORT 76-368, MAY 1976, 33 P, 2 FIG, 2 TAB, 60 REF.
Journal Announcement: SWRAU921

Stevens, Marvin D.
Ground-water levels are measured periodically in a network of observation wells in Wyoming, principally in areas where ground water is used for irrigation or municipal purposes. In areas of heavy ground-water pumping, measurements of water levels are made usually in January, February, or March. However, sometimes weather conditions prevent reaching some wells until April. The time selected for measuring is when recovery of water levels from pumping effects of the previous irrigation season is virtually complete. These water-level measurements indicate changes in ground-water storage when compared with previous measurements.

Water levels measured in about 240 wells during the first 4 months of 1978 were compared with measurements made during the same period in 1977 to give the net change in water levels for this period. These net changes along with depth to water in 1978 are shown in tables and on maps.

Water levels were measured periodically in about 290 wells for a total of about 1,150 measurements in 1977. Twenty-three wells were equipped with water-stage recorders in 1977. Hydrographs of most wells in the observation-well network were made using periodic measurements or the highest water levels recorded for the first 15 days of each month for those wells equipped with water-stage recorders.

Five previous reports of ground-water levels in Wyoming were compiled by the U.S. Geological Survey (Ringen, 1973; Ringen, 1974; Ballance and Freundenthal, 1975; Ballance and Freundenthal, 1976; and Ballance and Freundenthal, 1977).
POTENTIAL OF MADISON GROUP AND ASSOCIATED ROCKS TO SUPPLY INDUSTRIAL WATER NEEDS, POWDER RIVER BASIN, WYOMING AND MONTANA
SWENSON, F. A.
GEOLOGICAL SURVEY, DENVER, COLO.
IN: WATER RESOURCES PROBLEMS RELATED TO MINING: AMERICAN WATER RESOURCES ASSOCIATION PROCEEDINGS SERIES NO 18, P 210-218, JUNE 1974, 5 FIG, 4 REF.
Journal Announcement: SWRA0902

A LARGE PART OF THE NATION'S ENERGY RESERVES ARE IN THE COAL DEPOSITS OF THE POWDER RIVER BASIN IN WYOMING AND MONTANA. ONE OF THE LIMITING FACTORS OF INDUSTRIAL DEVELOPMENT OF THESE GREAT ENERGY RESERVES IS THE AVAILABILITY OF WATER, SURFACE-WATER SUPPLIES THAT HAVE NOT BEEN APPROPRIATED FOR

OTHER USES WITHIN THE BASIN ARE LIMITED. A RECONNAISSANCE STUDY BEGAN IN JULY 1973 TO ASSESS THE POTENTIAL OF THE MADISON GROUP AND OTHER DEEP CARBONATE AQUIFERS TO SUPPLY WATER NEEDS FOR ENERGY DEVELOPMENT OF THE POWDER RIVER STRUCTURAL BASIN THAT LIES BETWEEN THE BLACK HILLS AND THE BIGHORN-PYOR MOUNTAINS, EXTENDING FROM ABOUT CASPER, WYOMING, TO THE YELLOWSTONE RIVER IN MONTANA. MAPS HAVE BEEN PREPARED OF THIS AREA SHOWING (1) THICKNESS OF MADISON GROUP, PLUS ADDITIONAL CARBONATE AQUIFERS UNDERL I NG AND IN HYDROLOGIC CONTINUITY WITH MADISON, (2) STRUCTURE CONTOURS SHOWING TOP OF MADISON GROUP, (3) POTENTIOMETRIC MAP SHOWING THE HEIGHTS TO WHICH WATER WILL RISE IN TIGHTLY CASED WELLS BOTTOMED IN THE MADISON AND OTHER CARBONATE AQUIFERS, AND (4) A MAP SHOWING LINES OF EQUAL DISSOLVED-SOLIDS CONCENTRATION IN WATER FROM THE CARBONATE AQUIFERS. ABOUT 40 WATER WELLS, SOME YIELDING MORE THAN 9,000 GALLONS PER MINUTE, WITH MAXIMUM DEPTHS EXCEEDING 10,000 FEET HAVE BEEN COMPLETED. THE GOOD QUALITY OF THE WATER (FOR EXAMPLE, 860 MILLIGRAMS PER LITRE DISSOLVED SOLIDS IN WATER FROM A DEPTH OF 8,000 FEET AND 80 MILES FROM AREA OF RECHARGE) TENDS TO INDICATE GOOD CIRCULATION OF WATER. IT APPEARS THAT SIGNIFICANT QUANTITIES OF WATER CAN BE MADE AVAILABLE FROM THESE DEEP AQUIFERS FOR INDUSTRIAL DEVELOPMENT OF THE ENERGY RESERVES OF THIS AREA. (WOODARD-USGS)

Land and Coal ownership in the Gillette area, Wyoming.
U.S. Geological Survey, 1973
U.S. Geological Survey Miscellaneous Investigations Map 1-848-B.

U.S. Geological Survey, 1974

Plan of study of the hydrology of the Madison Limestone and associated rocks in parts of Montana, Nebraska, North Dakota, South Dakota, and Wyoming.
U.S. Geological Survey, 1975

Coal Fields of east-central Carbon County, Wyoming.
Weathers A. C., 1907

Reconnaissance of the geology and ground-water resources of the Paws Creek Flats area, Carbon County, Wyoming.
Visher, F. N., 1952

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Physical, chemical, and biological relations in the Hidden Water Creek Strip-Mine Area, Powder River Basin, Wyoming


The Hidden Water Creek area in Wyoming was mined from 1944 to 1955 and abandoned. The open pits filled with water and pond-type ecosystems developed. Light was transmitted to greater depths within two control ponds located outside the mine area. The lower light transmittance in the ponds within the mined area probably was due in part to the greater number of phytoplankton cells. Also, unconsolidated soil material within the mine area was observed to slough off the pond banks, which could add to the concentration of suspended sediments. Dissolved oxygen concentrations were lower in the ponds within the mined area. Most of the major ions (calcium, magnesium, sulfate, and sodium) were present in greater concentrations in the ponds within the mined area. Higher concentrations of bicarbonate and total hardness were in the water within the mined area. Biological communities were less diverse and chemical concentrations fluctuated more in the mined area than in the ponds outside the mined area. (Woodard-USGS)

Physical, chemical, and biological relations in a potential coal surface-mine area, Clear Creek Drainage, Powder River Basin, Wyoming


Biological reconnaissance of the Powder River structural basin, Wyoming


Geology and ground-water resources of the Kaycee area, Wyoming


Ground-water reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, southwestern Wyoming


GROUNDWATER RECONNAISSANCE OF THE GREEN RIVER BASIN, SOUTHWESTERN WYOMING


This report consists of a hydrologic atlas of 3 maps on 2 sheets and a separate text, describes the occurrence and quality of groundwater in the Green River structural basin of Wyoming. Some general information relationship of groundwater to surface water in parts of the basin. The area consists of approximately 10,000 square miles, which is about 60% of the Wyoming part of the Green River Drainage basin. The rocks that underlie the area range in age from Precambrian to recent. Rocks at the surface are divided as follows: 82% of Tertiary and Quaternary Age, 18% of Paleozoic and Mesozoic Age, and 1% of Precambrian Age. Recharge to groundwater reservoirs is mainly by seepage from precipitation and streams. Yields of most wells range from about 10 to 100 GPM. The quality of groundwater ranges from very poor to excellent with a range of dissolved solids from less than 500 to more than 3,500 PPM. The water in most of the perennial stream contains less than 500 PPM total dissolved solids. Two exceptions are the reaches in the Big Sandy Creek below the Eden-Farson Irrigation Project and Blacks Fork below the Lyman Irrigation Project. Total dissolved solids in the surface water of these reaches generally exceed 1,500 PPM. (Woodard-USGS)

Analysis of stream quality in the Yampa River Basin, Colorado and Wyoming. (Duplicated see Colorado).


Ground-water resources and Geology of Niobrara County, Wyoming.
Whitcomb, Harold A.


Niobrara County occupies an area of about 2,600 square miles in the northeastern part of the county. The region lies in the western part of the High Plains and is characterized by rolling grasslands, isolated low mountains, and local badlands. The climate is typical of the northern Great Plains - a region of low precipitation, high rate of evaporation, and a wide range in temperature. The economy of Niobrara County is based principally on ranching. The rocks exposed in Niobrara County are mostly sedimentary deposits that range in age from Cambrian to Recent. Igneous and metamorphic rocks of Precambrian age crop out in the core of the Hartville uplift in the southcentral part of the county. Through most of the area older rocks are overlain by deposits of Late Cretaceous and Tertiary age. Aquifers of pre-Cretaceous age generally lie too deep to be considered potential sources of ground water in the area. The 150 to 300 feet of interbedded sandstone and shale that composes the basal unit of the Cretaceous System in Niobrara County is designated as the Inyan Kara Group in the northern part of the report area and the Clovery Formation in the southwestern part. Although the correlation between these formations has not been established, they are believed by some authors to be lithostratigraphic equivalents. In this report, the Inyan Kara Group and Clovery Formation yield small quantities of water to domestic and stock wells drilled in or near areas of outcrop and moderate quantities to wells supplying the Lance Creek oil field. The water is generally under artesian pressure. In the Clovery Formation, the Lance Creek wells flowed at a rate of 1,000 gpm (gallons per minute) and several larger capacity pumps can be developed in some areas. The thickness of the alluvium ranges from a few feet in the upper reaches of Lance Creek to a reported 100 feet near the confluence with the Cheyenne River. Most water utilized in Niobrara County is obtained from drilled wells because surface-water supplies are ephemeral and unpredictable. Some water is pumped for irrigation from Lance Creek and the Cheyenne River during periods of surface and perennial flow in the Niobrara River provides water for irrigation along the lower reaches in Niobrara County. Most additional pumping of ground water could be increased without noticeably affecting water levels or seriously decreasing the quantity of water in storage. Recharge to the ground-water reservoir is principally from precipitation per year which averages about 15 inches in Niobrara County. Recharge to the Arickaree Formation has been estimated to be only about 0.33 inches per year, probably a somewhat smaller amount. The ground-water reservoir is the finer grained rocks underlying most of the northern part of the county. Ground-water discharge in Niobrara County is principally under pressure, though smaller quantities are discharged by springs and seeps. Evapotranspiration and discharge from wells. Approximately 5 to 8 million gallons of along the east margins of their outcrops to an estimated combined thickness of about 4,000 feet at the county line between Niobrara and Converse Counties.

The White River Group of Oligocene age, which unconformably overlies older rocks ranging in age from Early Cretaceous to Precambrian, yields to small quantities of water to stock wells in the central part of the report area. Larger quantities might be obtained from coarse channel deposits that occur at some places in the formation. The thickness of the White River Group ranges from a thin edge overlapping older rocks to about 550 feet in the eastern part of the outcrop area. The Arickaree Formation of Miocene age is the only known source of large quantities of ground water in Niobrara County. It yields water to many stock and domestic wells, 16 irrigation wells, and the wells supplying the communities of Lusk and Hardin. Supplies of the irrigation wells are calculated to be as much as 500 gpm (gallons per minute) and several would probably produce 1,000 gpm with suitable pumping equipment. Even larger yields may be expected from wells penetrating arm-saturated thicknesses of the aquifer. The Arickaree is thin where it wedges out against the Hartville uplift but is estimated to be 600 to 700 feet thick in the vicinity of the Nebraska State Line. The alluvial deposits of quaternary age in the valleys of the Cheyenne River and Lance Creek yield water to a few stock and domestic wells and to several irrigation wells. These deposits are the principal potential source of moderate to large quantities of ground water in the northern part of Niobrara County. Reported yields of irrigation wells range from 170 to 300 gpm (gallons per minute) with larger capacity pumps probably can be developed in some areas. The thickness of the alluvium ranges from a few feet in the upper reaches of Lance Creek to a reported 100 feet near the confluence with the Cheyenne River. Most water utilized

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water per day moves as underflow through the Arikaree Formation eastward across the Nebraska State line. Appreciably larger quantities of ground water probably move westward through the Fox Hills Sandstone and the Lance and Fort Union Formations into the Powder River Basin. A study of the use of ground water by cottonwood trees along Lance Creek indicates that about 4 million gallons of ground water is withdrawn daily from alluvial deposits.

Ground-water Resources and Geology of Northern and Central Johnson County, Wyoming.


Northern and central Johnson County, Wyoming, is an area of about 2,600 square miles that lies principally in the western part of the Powder River basin and also includes the east flank of the Bighorn Mountains. The Tensleep Sanstone reportedly yields 600 gallons per minute along Lance Creek indicates that about 4 million gallons of ground water is withdrawn daily from alluvial deposits.

The Madison Limestone had not been tapped for water in Johnson County at the time of the present investigation (1963), but several wells in eastern Big Horn and Washakie Counties, on the west flank of the Bighorn Mountains, reportedly have flows ranging from 1,100 to 2,600 gallons per minute. The Madison Limestone contains fine-grained sandstone, siltstone, and shale of Paleocene and Eocene age. Owing to the regional structure, most aquifers in Johnson County contain water under artesian pressure.

The Tensleep Sandstone reportedly yields 600 gallons per minute along Lance Creek, which indicates that about 4 million gallons of ground water is withdrawn daily from alluvial deposits.

The Madison Limestone has not been tapped for water in Johnson County at the time of the present investigation (1963), but several wells in eastern Big Horn and Washakie Counties, on the west flank of the Bighorn Mountains, reportedly have flows ranging from 1,100 to 2,600 gallons per minute. Comparable yields of water can also be obtained from the Madison Limestone in those areas where the limestone is fractured or cavernous. The Tensleep Sanstone reportedly yields 600 gallons per minute along Lance Creek, which indicates that about 4 million gallons of ground water is withdrawn daily from alluvial deposits.

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The Madison Limestone contains fine-grained sandstone, siltstone, and shale of Paleocene and Eocene age. Owing to the regional structure, most aquifers in Johnson County contain water under artesian pressure. The Madison Limestone is approximately 1,400 feet thick in the study area.

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The Madison Limestone contains fine-grained sandstone, siltstone, and shale of Paleocene and Eocene age. Owing to the regional structure, most aquifers in Johnson County contain water under artesian pressure. The Madison Limestone is approximately 1,400 feet thick in the study area.

The Tensleep Sanstone reportedly yields 600 gallons per minute along Lance Creek, which indicates that about 4 million gallons of ground water is withdrawn daily from alluvial deposits.

The Madison Limestone contains fine-grained sandstone, siltstone, and shale of Paleocene and Eocene age. Owing to the regional structure, most aquifers in Johnson County contain water under artesian pressure. The Madison Limestone is approximately 1,400 feet thick in the study area.

Water from the Fort Union and Wasatch Formations is available for stock supplies, and the Parkman Sandstone has limited potential as a source of water because of its high salinity and high sodium hazard. As a source for stock supplies, the Parkman Sandstone yields water of fair quality.

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Water from the Fort Union and Wasatch Formations is available for stock supplies, and the Parkman Sandstone has limited potential as a source of water because of its high salinity and high sodium hazard. As a source for stock supplies, the Parkman Sandstone yields water of fair quality.
meets suggested domestic standards with respect to dissolved solids, iron, manganese, and sulfate. Hydrogen sulfide is an objectionable constituent of water from some wells. The water generally is unsuitable for irrigation, either because of its high sodium and high bicarbonate content or because of its high salinity hazard. It ranges from good to poor quality for stock use.

**GROUND-WATER RESOURCES AND GEOLOGY OF THE WIND RIVER BASIN AREA, CENTRAL WYOMING**

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The Wind River Basin is a 12,000-sq-mi area in central Wyoming where climate ranges from humid to arid. The basin, a structural depression uplifted and faulted along the margins, contains several thousand ft of tertiary rocks. Mountains around the basin are formed by rocks, Precambrian to cretaceous, which dip beneath the basin. Groundwater occurs under both water-table and artesian conditions. Principal water-bearing units are alluvial deposits and tertiary sandstones. Karikaree and Wind River formations, which have the potential to yield large quantities of water at places, are the tertiary Fort Union Formation and several of the pre-tertiary formations. Groundwater locally, quality of the groundwater varies from low in mineral content and suitable for domestic use to unusable for stock supplies. Groundwater locally contains undersirable amounts of dissolved solids, fluoride, chloride, sodium, or hydrogen sulfide. Water in alluvial deposits underlying the Riverton Irrigation Project area is highly mineralized due to infiltration of stream flow. Analyses of water are given in a table, and the lithologic and hydrologic characteristics of Geologic Formations, on a chart. Maps at 1:250,000 show geology, piezometric contours, well data, and specific conductance of water.
Wyoming


Journal Announcement: SWRA&918

The U.S. Geological Survey, in cooperation with the State of Wyoming and other Federal Agencies, has five data-collection activities and fourteen water-resource investigations of the major coal and oil shale areas of Wyoming. These activities are located primarily in the Northern Great Plains Region of northeastern Wyoming; the Powder River Structural Basin and the Green River, Bear River, and Great Divide Basins of continuous records of streamflow and reservoir storage; (2) peak flow information at partial-record sites; (3) sampling and chemical analyses of water from streams and wells; (4) sampling and sediment analysis of water from streams; and (5) measurements of water levels in wells. This report contains lists of monitoring sites for these data-collection activities. (Woodard-USGS)

Beams Spring, Table, and Black Butte Creek Projects Preference Right Lease Applications, southwestern Wyoming

BLM, Rock Springs, Wyoming

FPA, 1982

About 51 million tons of coal would be surface-mined in Sweetwater County, in three mines—Beams Spring, 35 miles south; Table, 19 miles northeast; and Black Butte Creek, 25 miles southeast of Rock Springs. The three proposed mines are on the Rock Springs Uplift, a semiarid high plateau characterized by high evaporation, wind speeds and percentage of possible sunshine. Coal in the Beams Spring and Table areas is in the late Cretaceous Almond Formation. The Black Butte Creek area is in the Lance and Fort Union Formations. The Beams Spring area is drained by tributaries to through-flowing Gap and Salt Wells Creeks. The Table area is in the headwaters of tributaries to Killpecker Creek. The Black Butte Creek area is drained by tributaries to through-flowing Black Butte Creek. Erosion and sedimentation is a problem in the Table and Black Butte Creek areas. The mines are in groundwater recharge areas but recharge is small because of high evaporation rates. Groundwater occurs under both confined and unconfined conditions. Large withdrawals probably would exceed recharge and lower water levels. Mining would increase sediment loading of streams. Spoil leachate would affect groundwater quality within one mile of the mines.

Proposed Buckskin Project

IN: Eastern Powder River Coal DES

BLM, Cheyenne, Wyoming

DES, 1978

This document analyzes the impacts of approval of a mining and reclamation plan to recover 80 million tons of 84 million tons of federally leased surface mineable coal in the Powder River Basin, in northeastern Wyoming, over 20 years. The site, proposed Buckskin Mine, consists of 600 acres 10 miles north of Gillette in Campbell County. Most of the site is a gentle south slope, dissected by intermittent Rawhide Creek (69 square mile upstream drainage area, average flow 0.8 cubic feet per second) and ephemeral Spring Draw (drainage area 2.13 square miles). Maximum relief near Rawhide Creek is about 150 feet. Annual precipitation of 15 to 16 inches results in 14 gallons per minute runoff. The coal occurs in two seams at the top of the Fort Union Formation: the Anderson seam, about 40 feet thick, separated by 3 feet of shale from the underlying Canyon seam, about 64 feet thick. The coal is overlain by 0 to 215 feet of the Wasatch Formation. The beds dip less than two degrees southwest into the Basin. Small quantities of water are in the coals and discontinuous sandstones in the Wasatch Formation. The site contains 6 shallow wells, 5 reservoirs, irrigation ditches and spreader dams. Both surface and ground water is too highly mineralized (4,000 to 6,000
milligrams per liter dissolved solids) for human consumption. Surface mining would require dewatering 400 gallons per minute during years 3 to 4, reducing to 260 gallons per minute during the 16th year. About 30 gallons per minute would be used. The remainder would be discharged to Rawhilde Creek after treatment. Dewatering of the sandstone would extend 1,000 to 1,500 feet. The coal dewatering would extend about 3 miles from the site. About 456 acres of shallow aquifers would be modified, resulting in a deterioration of water quality.

Proposed Coal Leasing in the Carbon Basin Area, Wyoming
BLM, Cheyenne, Wyoming
PES, 1979

This statement analyzes impacts of leasing 6,146 acres of Federal coal in the Carbon Basin, interspersed among private coal, in order to create logical mining units. The surface of the basin is characterized by a northeast-trending ridge, maximum relief 400 feet, dissected by ephemeral Second and Third Sand Creeks and Chapann Draw draining eastward to the Medicine Bow River, and by First Sand Creek, also ephemeral, a closed basin. These creeks are estimated to flow only 10 to 15 days per year. Annual precipitation is 10 inches and lake evaporation ranges from 36 to 42 inches per year. The coal, in the Paleocene-Eocene Hanna Formation, crops out on the southern end of the Basin. The main coal, the Johnson Bed, ranges from 8 to 22 feet thick. Two other coals, the Finch Group, more than 13 feet thick locally, and the Blue Group, more than 13 feet thick locally, overlies the Johnson Bed. About 10 million tons could be surface-mined to a depth of 150 feet and 95 to 98 percent of less than 400 million tons could be recovered underground by continuous and longwall mining. The coal beds and overlying sandstones are poorly productive aquifers, confined toward the basin center. Aquifers in the deeper Mesa Verde Formation are isolated from the Hanna Formation by the intervening Lewis Shale. Surface mining would remove one shallow well, seven stock ponds and two surface diversions. A maximum mine inflow of 40,000 gallons per day would have to be handled. Water in four test holes ranged from 672 to 8,084 milligrams per liter total dissolved solids.

Creeko Proposed Project
BLM, Cheyenne, Wyoming
IM: Development of Coal Resources in Southcentral Wyoming, PES, 1978

The proposed Cherokee surface mine of 10,671 acres 30 miles west-southwest of Rawlins in Carbon and Sweetwater Counties, is near the Continental Divide, the saddle between the Great Divide and Washakie Basins. The relatively level landscape is underlain by nearly horizontal beds of the Fort Union/Wasatch Formation which contains two main coal seams, 12 and 14 feet thick. Annual precipitation of 10 inches produces probably poor quality ephemeral runoff of less than 0.17 inches to closed basins. Small amounts of poor quality, dissolved solids, 2,040 to 3,760 milligrams per liter occur in the coals and lenticular sandstone above. Potentially 500 gallons per minute of water containing less than 1,000 milligrams per liter of dissolved solids could be obtained from a well in the Port Union basal sandstone at a depth of about 3,500 feet. Mining would destroy two or three stock reservoirs and moist coal washing wastes conceivably could contaminate heavily mineralized ground water in Cow Butte Basin, a small playa, less than one square mile.

Eastern Powder River Coal
BLM, Cheyenne, Wyoming
DSE, 1978

This statement updates the Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming (PES 74–55). It evaluates impacts of surface coal mining and related activities by the year 1990 at three levels, 1) low–169 million tons per year from 14 surface mines presently operating or pending approval, 2) probable–173 million tons per year, one additional mine, and 3) high–15 existing or pending mines and 23 new mines producing 329 million tons per year, and one gasification plant. It also evaluates site-specific impacts of the one mine responsible for the probable level. The study area is the eastern flank of the Powder River Basin in Wyoming, comprising about 5 million acres, bound on the east by the coal outcrop, on the south by the North Platte River, on the west by the Powder River, and on the north by the Montana–Wyoming state line. The northern part of the area is characterized by open, rolling hills having relief of 500 to 1,000 feet. The southern part is plains and table land with relief of 300 to 500 feet. The Powder and Little Powder Rivers drain the north, Donkey Creek and Belle Fourche River drain the middle, and South Fork, Cheyenne River, Lance Creek and North Platte River tributaries drain the south. Streams have ephemeral but some have isolated intermittent reaches. Annual precipitation increases from less than 12 inches in the south to 17 inches in the northwest. More than 15 billion tons of mineable (less than 300 feet deep) coal occurs in 9 coal fields in the Eocene Wasatch Formation and the Paleocene Port Union Formation. The alluvium in larger streams has produced several hundred gallons per minute of usable quality water. The Wasatch and Port Union Formations and underlying Lance Formation and Fox Hills Sandstone contain sandstone layers that produce about 25 gallons per minute of hard water at shallow depths (less than 1,000 feet) near outcrop areas, and industrial size supplies of softer water usually containing 500 to 1,300 milligrams per liter of dissolved solids at depths of 3,000 to 5,000 feet where the water is confined. In deep (below 5,000 feet) parts of the basin, where the Madison Limestone is fractured and cavernous, flows of as much as 7,000 gallons per
Energy Transportation Systems, Inc. (ETSI) proposed to transport 37.4 million tons of coal per year for fifty years from the Powder River Basin near Gillette, Wyoming, by slurry pipeline to various power plants in Oklahoma, Missouri, Arkansas, and Louisiana. Slurry would require 20,000 acre-feet of water per year to be pumped from the Madison Formation in Niobrara County. A numerical model predicted drawdowns of more than 100 feet would occur in a 3,400-square-mile area around the well field, extending into southwestern South Dakota, affecting some existing Madison water users, including the City of Edgemont, South Dakota. Surface waters would also be affected, including base flow reductions of 1 to 4 cubic feet per second in the Cheyenne River, and Cascade and Hot Springs. Drawdowns of more than 100 feet in the Inyan Kara aquifer would extend over 1,600 square miles. Six water supply alternatives were analyzed. One alternative would purchase part of the required water from the City of Gillette well field, reducing drawdowns around the Niobrara County well field by 30 percent, but extending drawdowns much of Crook County. Another alternative to develop a well field in Crook County would extend drawdowns of more than 23 feet over 23,600 square miles including adjacent parts of Montana and South Dakota, and 7,800 square miles of the Inyan Kara aquifer. Using Gillette and Crook County well fields would reduce the overall affected area but it would extend further south than if the Crook County well field was used alone. Obtaining the required water half from the Crook County well field and half from the Niobrara County well field would reduce the extent of 100-foot drawdown in the Madison to 3,700 square miles and 330 square miles in the Inyan Kara. Obtaining water from the Oahe Reservoir in South Dakota would not impact ground or surface waters. Using treated wastewater from South Dakota would not impact ground water but would reduce four South Dakota streams' flow by 1.3 to 12.4 cubic feet per second. Document is supported by Well Field Hydrology, Surface Water Quality, and Ruptures and Spills Technical Reports.

This statement analyzes the impacts of leasing as many as 16 tracts of Federal coal beneath 30.2 square miles in a 37,000 square-mile area in northwestern Colorado and south-central Wyoming. The Colorado tracts are in the Yampa and Danforth Hills Coal Fields. The Wyoming tracts are along the east side of the Washakie and Great Divide Basins and in the Hanna Basin. In both states, the tracts are in mountain-bound areas of relatively low relief, consisting of low, rolling hills, broad plains and river valleys, and cuestas, in many places characterized by dip slopes and subdued escarpments. In Colorado, the coal is in the Illies and Williams Fork Formations of the Mesaverde Group, and the Lance Formation, all Upper Cretaceous, and in the Paleocene Fort Union Formation. The Wyoming coals are in upper Cretaceous formations and the Paleocene Fort Union Formation. The region is semiarid, annual precipitation ranging from about 9 inches in Wyoming to as much as 13 inches in parts of the Colorado region. The tracts are drained by ephemeral streams in small watersheds of tributaries to the North Platte River in Wyoming, and the Yampa River in Colorado. Annual runoff from the tracts is about 0.7 inches in Colorado and 0.2 inches in Wyoming. Runoff contains half of the sediment, and two to three times the dissolved solids of nearby mountain streams. In some places, small amounts, less than 10 gallons a minute to wells, of shallow ground water is perched above unsaturated coal layers. In Colorado, the water is of marginal quality for domestic use, and in Wyoming it contains 2,000 to 6,500 milligrams per liter of dissolved solids. Shallow ground water issues in a few springs in Colorado. Impacts to both surface and ground water would be local, relatively minor and generally short lived. Mining following maximum leasing would disturb no more than 0.23 percent in Colorado, and less than 0.05 percent in Wyoming, of the shallow aquifers in their respective watersheds. Alternate water would have to be furnished for 14 shallow wells and 9 springs in Colorado, and 47 small reservoirs, each less than 3 acre-feet, and rapidly filling with sediment.
Medicine Bow River to the east. Small amounts of water occur in thin sandstone layers above the coal, and slightly larger amounts are found in fractures in the coal beds. Water to water ranges from 12 to more than 100 feet depending on topography. Flow is westwardly toward the North Platte River from the Seminole Reservoir. Total dissolved solids in ground water ranges between 1,000 and 4,000 milligrams per liter, many toxic constituents exceeding EPA recommended standards. Surface water will necessitate draining the coal below the reservoir level. Reversal of the gradient will increase flow into the mine, increasing the amount of water to be handled. No existing wells will be affected. Proper restoration practices will eliminate increased stream sedimentation.

Hanna South Proposed Project
BLM, Cheyenne, Wyoming
18: Development of Coal Resources in Southcentral Wyoming, FES, 1978

The proposed Hanna South surface mine of 4,127 acres just south of Hanna, Wyoming, includes 640 acres of Federally owned coal and surface. Mining would disturb 90 public acres and 642 private acres containing four coal beds averaging 41.2 feet in total thickness beneath less than 150 feet of overburden. The coal beds dip 25 to 40 degrees northwesterly into the Hanna Basin. The terrain is gently sloping at the head of northeasterly draining ephemeral draws. Small amounts of confined water occur near the mine, at depths ranging from 26 to 115 feet. Total dissolved solids ranged from 470 milligrams per liter in a shallow, 130-foot-deep well, to 9,140 milligrams per liter in a well 240 feet deep. Annual precipitation of 10 inches produces runoff of 0.5 inch in ephemeral draws. Runoff is high in dissolved solids and sediment. Mining would lower water level in an unused nearby well and destroy one stock reservoir. Water levels would recover by about 1996.

Powder River Regional Coal, Montana and Wyoming
BLM, Casper, Wyoming
FES, 1981

Leasing of 14 tracts within the Powder River region of Montana and Wyoming is proposed to all for development of 1.5 billion tons of associated coal reserves. Development of the leases would affect Big Horn, Powder River, and Rosebud Counties in Montana, and Campbell, Converse, Crook, Johnson, Natrona, Sheridan, and Weston Counties in Wyoming. Maintenance tracts to be leased would include the Colstrip A and B, Colstrip C, Colstrip D, Cook Mountain, Coal Creek, Northeast Otter Creek, Timber Creek, Duck Nest Creek, Kints Creek, and Keeline Tracts. All mined land would be reclaimed. Mining processes would consume 8,310 acre-feet of water, and associated municipal uses would consume 33,400 acre-feet of water in 1990. Approximately 310 wells and 35 springs would be destroyed. Approximately 247,000 acres of shallow aquifers would be removed to depths of 100 to 400 feet, although they would eventually be replaced by spoil aquifers. Surface outflow from the region would be reduced by approximately 350 acre-feet per year during mining. Between 20 and 33 point-watering sources would be destroyed.

Red Rim Study Site Coal Resource and Surface Mining Potential Reclamation
Evaluation in the Green River Coal Region, south-central Wyoming
BLM, Denver, Colorado
EMRLA Report No. 7-76

The Red Rim study site is above the northwestward dipping sediments of the southern (Red Desert) part of the Great Divide closed Basin. The coal is in the lower part of the Tertiary Fort Union Formation, and overlies a thick sandstone whose outcrop forms the Basin's Red Rim to the southeast. Nearly 40 thousand tons of the estimated coal resource are in beds more than 2.5 feet thick covered by less than 200 feet of overburden. Most of the site is composed of remnants of hogbacks, severely eroded into rolling to rugged high plains. Climate is semiarid. Snow melt provides 40 percent of the annual precipitation of 10.43 inches. The sites are drained by intermittent Separation Creek and tributaries. Little runoff originates on the site. Little water occurs above and in the coal. Only one of 10 test holes encountered water. Moderate (several hundred gallons per minute) quantities of good quality water may be available from a thick (500-600 feet) sandstone below the coal downdip from the site. Mining should encounter little water. Protective measures and restoration practices could eliminate degradation of water quality.

Sand Butte Preference Right Lease Application, southwestern Wyoming
BLM, Rock Springs, Wyoming
EA, 1981

This document assesses the impacts of an extension of the Black Butte mine in Sweetwater County, about 28 miles east-southeast of Rock Springs, southwestern Wyoming. The 5,078-acre area is a semiarid (annual precipitation 8.8 inches) high plateau, consisting of a series of northeast trending escarpments and 4- to 6-degree dip slopes. About 33 million tons of coal occur in several beds averaging 3.7 to 9.3 feet thick, in the Fort Union and Lance Formations under less than 200 feet of overburden. The area is drained by ephemeral Patrick Draw, tributary to Bitter Creek, several miles northeast. About 60 percent of the surface is bare ground. Small quantities of poor quality water occur in and above the coal beneath drainage ways. No wells exist nearby. It is doubtful that mining would significantly change occurrence of ground water.
Proposed Development of Coal Resources in Southwestern Wyoming
BLM, Cheyenne, Wyoming
FES, 1978

The statement assesses impacts of five proposed coal mines in Lincoln, Uinta and Sweetwater Counties in southwestern Wyoming, three in the Hanna Fork Coal subregion and two in the Green River subregion. The Hanna Fork region mines straddle, or are on limbs of the northerly trending Laramie syncline where dips range from 15 to 50 degrees. Coal is in numerous Adaville Formation beds ranging up to 70 feet thick, covered by less than 1,000 feet of overburden. One Green River region mine area overlies 6 Rock Springs Formation coal beds ranging from 4 to 14 feet thick, overlain by as much as 800 feet of gray sandstone. Another mine overlies the Prospect Mountain Formation. The other mine includes two seams as much as 26 feet thick in the Fort Union and Lance Formations, and the 10- to 12-foot-thick Almond coal seam. There is a total of 357 million tons of coal beneath the five mine areas. Average precipitation in the region is 9.5 inches, and ranges from 7.89 inches at Rock Springs to 17.92 inches at Afton. Most of the area is drained by ephemeral drainages. Small quantities of water occur unconfined in outcrop areas in the coal beds, interbedded sandstone layers and fractured shale and mudstone, and confined downsip. Mining in the Hanna Fork subregion could affect two springs, and in the Green River subregion, could affect six or more nearby wells. Sedimentation in main drainages could also occur.
White Tail Butte Study Site Coal Resource and Surface Mining Potential
Reclamation Evaluation in the Little Powder River Coal Field, northeastern Wyoming
BLM, Denver, Colorado

The gently rolling uplands and isolated knobs and buttes of the 3.6-square-mile White Tail Butte study area cover an elongate drainage divide between intermittent Elk and White Tail Creeks. Maximum relief is 350 feet. Precipitation is about 16.3 inches. Three Tongue River Member (Fort Union Formation) coal beds crop out or are covered by less than 200 feet of overburden: the Anderson, averaging 34.3 feet thick; the Dierz, 18 to 28 feet thick; and the Canyon, averaging 21.6 feet thick. Small amounts of water containing about 2,000 milligrams per liter dissolved solids occur in shallow layers above, in and between the coals. Small amounts of less mineralized water occur below the Lebo Shale member which lies below the lowest, the Canyon, coal bed. Surface mining will alter shallow aquifers, displace springs, and destroy several stock ponds. Aquifers below the Lebo Shale Member (bottom of the Fort Union Formation) would not be affected.
Control and Reclamation Act of 1977 is the understanding of the actual and proposed surface-watershed areas. Surface-water data for small specific-sites and for larger areas such as adjacent and general areas are needed also to satisfy the hydrologic requirements of the Act. The Act specifies that surface-water modeling techniques may be used to generate the data and information. The purpose of this report is to describe how this can be achieved for smaller watersheds. This report also characterizes 12 'state-of-the-art' strip-mining assessment models that are to be tested with data from two data-intensive studies involving small watersheds in watersheds with specific-site data. Extending specific-site data techniques to larger watersheds remains relatively untested, and to date the upper limits for application have not been established. The U.S. Geological Survey is currently collecting regional hydrologic data in the major coal provinces of the United States and this data will be used to help fill the 'general-area' data requirements of the Act. This program is reviewed and described in this report. (USGS) Chemical quality of public water supplies of the United States and Puerto Rico, 1962 Surfor C. N., and Becker, Edith, 1964 U.S. Geological Survey Hydrologic Investigations Atlas HA-200, 1 sheet.


The most abundant and available federal coal reserves in the United States are in and near the National forests. The National forest areas offering the greatest potential for coal development are in or near the Daniel Boone in Kentucky and Tennessee, Hoosier in Indiana, Jefferson in Virginia, Monongahela in West Virginia, Shawnee in Illinois, and Wayne in Ohio. An evaluation of the available data and published information on coal mining at the water resources of these areas identifies informational needs. Three such needs common to all six National forest areas are for (1) numerical characterization of streamflow, water-quality, and sedimentation characteristics; (2) information about ground-water availability, movement, and quality before, during and after mining; and (3) a hydrologic reconnaissance of all major lakes and impoundments within the prospective Federal coal-lease areas. Investigations of the Act would address these and other informational needs are outlined for each forest area. A schedule is proposed for completion of these investigations by the U.S. Geological Survey over a 6-year period. The application of sophisticated analytical and interpretive techniques in these studies must be preceded by the collection and preparation of adequate hydrologic data.


In the past decade hydrologists have emphasized the development of computer-based mathematical models to aid in the understanding of flow, the transport of heat, and deformation in the groundwater system. These models have been used to provide information and predictions for water managers. Too frequently, groundwater was neglected in water-resource planning because managers believed that it could not be adequately evaluated in terms of availability, quality, and effect of development on the water supplies. Now managers, with newly developed digital groundwater models, effects of development can be predicted. Such models have been used to predict hydrologic and quality changes under different stresses. These models have grown in complexity over the last 10 years from simple one-layer flow models to three-dimensional simulations of groundwater flow which may include discrete transport to effects of land subsidence and evaporation of salt water. This paper illustrates, through case histories, how predictive groundwater models have provided the information needed for the sound planning and management of water resources in the United States.

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