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ON THE COVER: "Chinese Wall" as it is called, is an outcrop of Sharp Mountain quartz-pebble conglomerate (Pottsville Group, Pennsylvanian). Located in Cold Spring Township, Lebanon County, within Pennsylvania State Game Lands No. 211. Photo courtesy of William H. Bolles.

PENNSYLVANIA GEOLOGY is published bimonthly by the Topographic and Geologic Survey, Pennsylvania Dept. of Environmental Resources, Harrisburg, Pennsylvania, 17120.

Editor, Arthur A. Socolow; Associate Editor, Donald M. Hoskins.

Articles may be reprinted from this magazine if credit is given to the Topographic and Geologic Survey.
SCIENCE PROGRAMS: BALANCING BENEFITS AND BUDGET

Recent pronouncements from such prestigious institutions as the National Academy of Sciences, the National Science Foundation, and the American Association for the Advancement of Science have all expressed concern that many basic and applied science research programs are being seriously jeopardized as a result of budget cutbacks at the national, state, and local government levels.

At a time of fiscal belt tightening, scientific programs will undoubtedly have to adjust to a share of the curtailment. But the concern in the scientific community is that in the absence of a large, vocal, public support group, the scientific programs may be asked to absorb more than a fair share of the cuts, and more than is safe for the national good.

The national science groups which are beginning to speak up are pointing out that curtailment of today's science programs will inevitably result in serious handicaps to the economy and security of our nation tomorrow.

As geologists we have an awareness of how today’s scientific investigations provide benefits and impacts to the state and nation tomorrow. We see this in energy resources and industrial raw materials which must be identified to keep our economy and our national defense strong; we see it in the research needed to define adequate water resources which we must have to sustain our homes, our agriculture, and our industries; and we see it in the careful studies needed to cope with problems of disposal sites for the massive quantities of municipal and industrial wastes.

When the public becomes aware of the significance of scientific programs to our nation’s well being and to the nation’s ability to compete economically and to maintain its security in the world, it will help to secure responsible and equitable budget support for the scientific programs of the nation and the states.

Arthur G. Storer
A SPECTACULAR
NEW

GEOLOGIC MAP OF PENNSYLVANIA
1960

DEVONIAN

EASTERN PENNSYLVANIA

CENTRAL AND EASTERN PENNSYLVANIA
GEOLLOGIC MAP
OF PENNSYLVANIA

A new Geologic Map of Pennsylvania, completely revised and including all new geologic mapping to date, has been published by the Bureau of Topographic and Geologic Survey. This map replaces the edition of 1960 and represents the fourth update since the first geologic map of Pennsylvania was issued in 1858.

The new state geologic map is much more detailed then the 1960 edition and shows many more subdivisions of rock units. The 1960 map delineated approximately 130 geologic rock formations, whereas the new edition shows close to 200 geologic units. Among the other new features of the new map is an overprinted grid showing the boundaries (and names) of the 7-½ minute quadrangles; there is also an overprint (in purple) of the axes of the major synclinal and anticlinal fold structures of the Appalachian Plateau.

The new full-colored Geologic Map of Pennsylvania is published at a scale of 1:250,000 (one inch equals approximately four miles) and is printed on two sheets. When the two sheets are joined, the map measures 58 by 81 inches; a third sheet (29 by 42 inches) shows four interpretive geologic cross sections. The brilliant, contrasting colors used on the map not only help to accentuate the geologic "grain" of Pennsylvania, but also result in national acclaim of the map as a work of art.

The map was compiled under the supervision of T. M. Berg, Chief of the Geologic Mapping Division, and was edited by C. M. Dodge, Geologic Editor for the Survey. The compilers working with Berg included W. E. Edmunds, A. R. Geyer, A. D. Glover, D. M. Hoskins, D. B. MacLachlan, S. I. Root, W. D. Sevon, and A. A. Socolow. The cartographic work was done by J. G. Kuchinski. The entire project was conducted under the direction of State Geologist Arthur A. Socolow. The color separations and printing were done by the Williams and Heintz Map Corporation of Capitol Heights, Maryland.

Copies of the new map are available from the State Book Store, P.O. Box 1365, Harrisburg, PA 17125. The price of the map is $9.00 per copy (plus 6% sales tax if mailed to a Pennsylvania address). Checks should be made payable to Commonwealth of Pennsylvania. The map may be requested either rolled or folded. Folded copies will be sent unless rolled copies are specifically requested.
Changes in ground-water levels in the Susquehanna River Basin, October 1980—October 1981

By James M. Gerhart, U.S. Geological Survey and George J. Lazorchick, Susquehanna River Basin Commission

Water levels were measured in 322 wells in the Lower Susquehanna River Basin in Pennsylvania and Maryland during October 19-22, 1981 (see figure 1 for location). The measurements were made as part of a ground-water resource evaluation being conducted by the U.S. Geological Survey in cooperation with the Susquehanna River Basin Commission. This was the third measurement of water levels in these wells, the other two being in October 1980 and April 1981. October measurements generally represent annual low ground-water conditions while April measurements generally represent annual high ground-water conditions. With the three sets of measurements, it is possible to compare fall 1981 and spring 1981 ground-water conditions to fall 1980 conditions. Ground-water conditions in the fall of 1980 are of particular interest because below-normal precipitation in the fall and winter of 1980-1981 resulted in drought conditions which created many ground-water supply problems. A comparison between fall 1981 and fall 1980 water levels can be used to estimate the potential for similar drought conditions this winter.

In an article in this magazine in June 1981, the median water-level changes between October 1980 and April 1981 were reported. In nine of eleven counties in the lower basin, median water-level changes indicated various degrees of recovery; in the other two counties, the median water-level changes indicated continued decline. The data also indicated recovery in three physiographic sections and decline in one. The two counties and the one physiographic section showing no recovery of water levels were in the southeast part of the lower basin; the remaining counties and
physiographic sections showed a general increase in degree of recovery of water levels to the northwest. The exception to this trend occurred in the Triassic Lowland section and in those counties containing large areas of the Triassic Lowland section. Water levels there showed the greatest recovery in the lower basin.

The median water-level changes between April 1981 and October 1981 indicate declines in all eleven counties and four physiographic sections (table 1). The relative magnitudes of water-level decline follow the same trend as the degree of water-level recovery in the October 1980-April 1981 period. Declines in water level increase to the northwest, with the exception of the Triassic Lowland section and counties included therein which show the greatest water-level declines in the lower basin.

Median water-level changes from October 1980 to October 1981 indicate a net annual decline of water levels in nine of eleven counties and in all four physiographic sections. Figures 1 and 2 show these median water-level changes by county and physiographic section, respectively. Tables 2 and 3 contain summaries of the computed statistics by counties and physiographic sections, respectively.
Table 1. Water-level changes, in feet, by county and physiographic section, comparing April 1981 and October 1981.

<table>
<thead>
<tr>
<th>County</th>
<th>Median</th>
<th>Physiographic Section</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>-6.4</td>
<td>Great Valley</td>
<td>-4.4</td>
</tr>
<tr>
<td>Berks</td>
<td>-4.6</td>
<td>Triassic Lowland</td>
<td>-5.1</td>
</tr>
<tr>
<td>Cecil (Md.)</td>
<td>-2.2</td>
<td>Conestoga Valley</td>
<td>-2.8</td>
</tr>
<tr>
<td>Chester</td>
<td>-1.0</td>
<td>Piedmont Upland</td>
<td>-1.9</td>
</tr>
<tr>
<td>Cumberland</td>
<td>-5.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dauphin</td>
<td>-2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Franklin</td>
<td>-4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harford (Md.)</td>
<td>-1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lancaster</td>
<td>-2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>-5.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>York</td>
<td>-3.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The two counties with the greatest net water-level declines are Chester and Harford, the counties which showed no recovery of water levels between October 1980 and April 1981 (figure 1). Berks and Dauphin Counties show slight recoveries of water levels. The other seven counties show net declines ranging up to about 1.5 feet.

In figure 2, the Piedmont Upland section shows the greatest net decline of water levels; this physiographic section also showed a water-level decline between October 1980 and April 1981. The Triassic Lowland section shows essentially no net change in water levels. The remaining two physiographic sections show net water-level declines of about 1 foot.

Table 2 shows the range of water-level changes and the percent of wells with net declines in each county. These data can be used in conjunction with the median water-level changes to describe the ground-water conditions in each county. Cumberland, Dauphin, Lebanon, Lancaster, Franklin, and York Counties all have some wells in which water levels declined over 10 feet during the period, with Cumberland County having some wells in which over 20 feet of decline was observed. In Harford, Cumberland, Franklin, Chester, and Lancaster Counties, about 80 percent of the measured water levels showed a decline over the period.

The statistics for water-level change by physiographic section between October 1980 and October 1981 are shown in table 3. All four physiographic sections have some wells that experienced over 10 feet of water-level decline; some water levels in the Great Valley section show over 20 feet of decline. Slightly more than half of the measured water levels in the Triassic Lowland section were below those of the previous fall. About 75 to 80 percent of the measured water levels in the other three physiographic sections were lower than those in the fall of 1980.
Figure 2. Median water-level changes, in feet, by physiographic section, for parts of sections in lower basin, for October, 1980-October, 1981.

Table 2. Water-level changes, in feet, by county, comparing October, 1980 and October 1981.

<table>
<thead>
<tr>
<th>County</th>
<th>Number of wells</th>
<th>Median</th>
<th>Range</th>
<th>Percent of wells showing decline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>high</td>
<td>low</td>
<td></td>
</tr>
<tr>
<td>Adams</td>
<td>20</td>
<td>.6</td>
<td>4.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Berks</td>
<td>6</td>
<td>+.4</td>
<td>2.9</td>
<td>2.3</td>
</tr>
<tr>
<td>Cecil (Md.)</td>
<td>6</td>
<td>-1.4</td>
<td>2.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Chester</td>
<td>5</td>
<td>-3.4</td>
<td>4.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Cumberland</td>
<td>36</td>
<td>-1.3</td>
<td>2.3</td>
<td>21.5</td>
</tr>
<tr>
<td>Dauphin</td>
<td>15</td>
<td>+.3</td>
<td>16.2</td>
<td>19.5</td>
</tr>
<tr>
<td>Franklin</td>
<td>6</td>
<td>-.5</td>
<td>.1</td>
<td>11.8</td>
</tr>
<tr>
<td>Harford (Md.)</td>
<td>15</td>
<td>-3.6</td>
<td>2.7</td>
<td>7.4</td>
</tr>
<tr>
<td>Lancaster</td>
<td>101</td>
<td>-1.2</td>
<td>13.3</td>
<td>12.3</td>
</tr>
<tr>
<td>Lebanon</td>
<td>31</td>
<td>-1.1</td>
<td>2.0</td>
<td>14.1</td>
</tr>
<tr>
<td>York</td>
<td>81</td>
<td>-.6</td>
<td>12.4</td>
<td>10.9</td>
</tr>
</tbody>
</table>
Table 3. Water-level changes, in feet, by physiographic section, comparing October, 1980 and October, 1981.

<table>
<thead>
<tr>
<th>Physiographic section</th>
<th>Number of wells</th>
<th>Median</th>
<th>Range</th>
<th>Percent of wells showing decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Valley</td>
<td>80</td>
<td>- .8</td>
<td>16.2</td>
<td>- 21.5</td>
</tr>
<tr>
<td>Triassic Low-land</td>
<td>72</td>
<td>- .1</td>
<td>10.3</td>
<td>- 13.3</td>
</tr>
<tr>
<td>Conestoga Valley</td>
<td>89</td>
<td>- .9</td>
<td>6.6</td>
<td>- 12.3</td>
</tr>
<tr>
<td>Piedmont Upland</td>
<td>81</td>
<td>- 2.2</td>
<td>13.3</td>
<td>- 10.9</td>
</tr>
</tbody>
</table>

The fall of 1980 and the winter of 1980-1981 were seasons of below-normal precipitation in the lower basin. Ground-water levels declined over these seasons and approached water levels observed during the drought of the early 1960's. Spring 1981 precipitation was near normal, but as the June 1981 article in this magazine showed, precipitation was not great enough to replenish the ground-water system in parts of the lower basin. Since most ground-water levels in the lower basin are at or below last fall's levels, below-normal precipitation again this fall and winter could result in water-supply problems of equal or greater magnitude than those of last year.

U.S.G.S. INCREASES MAP PRICES

Prices for U.S. Geological Survey maps have been increased. The 1:24,000 quadrangle topographic maps will now sell for $2.00 each. The 1:50,000 county topographic maps are now priced at $3.25 per sheet. Other thematic maps have also increased in price. To obtain current price information and to order maps contact:
Eastern Region-Map Distribution
U.S. Geological Survey
1200 South Eads Street
Arlington, VA 22202

CORRECTION

EDWARD WALLER CLAYPOLE
-- CENTENNIAL

by Emily Giffin
Whitefish Bay, WIS

The last century has seen the development of the discipline of geology from a subunit of "natural history" to a broad subject encompassing fields as diverse as geophysics, comparative planetology and paleontology. Often preoccupied with our own isolated specialties, a look backward can remind us of the amazing breadth of early researchers. Such reflection is especially rewarding in a state which, like Pennsylvania, has a rich geological history. It is also particularly appropriate in 1981 to recognize one of Pennsylvania's early distinguished geologists on the centennial of his arrival in the state. Now, 100 years later, his geologic work in Perry County stands as a model of geologic mapping skills.

Edward Waller Claypole (1835-1901) was born in Herfordshire, England, the son of a Baptist clergyman. His strict early education was largely home-taught, and concentrated on the classics. He later took formal bachelor's degrees in the arts and sciences from the University of London in 1862 and 1864. In 1866 he was appointed a tutor in Classics and Mathematics at Stokescroft College in Bristol, a Baptist college. Here the controversy raging around the recent (1859) publication of Darwin's theory of evolution by natural selection touched his life. Forced to renounce evolution as heretical to the Baptist tenets of the school or lose his post, he chose the latter. This act was a decisive break with his upbringing, and left him, recently widowed with three children, without means of support. Forced to leave the existing academic climate in England, he emigrated, arriving in the United States in October, 1872.

Here, despite various personal problems, Claypole began a distinguished academic career. For eight years (1873-1881) he taught natural history at Antioch College in Yellow Springs, Ohio. There he concentrated on the nature of the preglacial surface of the Great Lakes area. He also published on such diverse topics as "Life History of the Buckeye Stem Borer," an "Upper Silurian Tree," and "Migration of Plants from Europe to America." When Antioch temporarily closed in 1881 with funding difficulties, Claypole left for the Pennsylvania Geological Survey.
Fig. 1. Edward Waller Claypole (1835-1901).

As a geologist for the Second Geological Survey under J. P. Les­
ley, Claypole was assigned Perry and Juniata counties as his field
area. Working primarily in Perry County, he was extremely success­
ful in recognizing the presence and absence of the classic units of
the New York sequence. Within unit No. V of the First Pennsylvania
Survey he recognized Onondaga as well as Clinton rocks. He also
demonstrated the absence of Niagaran and Corniferous rocks in the
county by the lack of their distinctive fossil fauna. Rocks previously
identified as Corniferous he assigned to the Marcellus Formation of
the Hamilton Group. The existence of the Perry County and Little
Germany faults were recognized on the basis of the excessive thickness of the Hamilton beds in the Mahanoy Ridge area and the contiguous occurrence of fossil faunas usually separated by a thick stratigraphic sequence. These and other findings were published in volume F2 of the Second Survey, accompanied by a revision of the geological map of Perry County.

Claypole's most notable contributions during his short two-year stay in Pennsylvania were, however, in the field of paleontology. His careful stratigraphic collections were documented in the second volume of his Perry County study (never published), in his additions to the Dictionary of Paleontology (P4), and in the Catalogue (O3) of the Second Survey fossil collections, recently curated and now housed at the William Penn Memorial Museum. His most famous collection was that of Silurian fish. He described *Palaeaspis (Americanaspis)*, which was at its discovery the world's oldest known fish,
Fig. 3. The dorsal shield of *Palaeaspis (Americaspis) americana* as described by E. W. Claypole in 1885.

from the Bloomfield Sandstone (Wills Creek Formation) of Perry County. He carefully documented its Silurian age by stratigraphic reasoning and its vertebrate identification by hand ground thin-sections that demonstrated its bony structure. He also described an ?acanthodian spine from the Rose Hill Formation, which still stands as the oldest known fragment of a jawed vertebrate.

When the Pennsylvania legislature restricted Survey funds in 1883, Claypole moved on, this time to newly-established Buchtel College in Akron, Ohio. There he continued to publish on his Pennsylvania field work for several years. While at Buchtel he submitted his original work on the geology of Pennsylvania and Ohio to the University of London, and in 1888 he returned temporarily to England to receive the degree of Doctor of Science. During this same time, he was a founder of the journal *American Geologist*, which he also served as editor.

Fig. 4. *Onchus clintoni*, the ?acanthodian spine described from the Rose Hill Formation of Perry County by E. W. Claypole.

Claypole stayed at Buchtel College for fifteen years, publishing on a wide variety of topics. In the 1890s his papers concentrate on the Devonian placoderms and sharks of Ohio, as well as Pleistocene studies. In 1898 he moved again, this time to the Throop Institute (now California Institute of Technology) in Pasadena, for health reasons. His last papers dealt with the geology of California. Claypole died in Long Beach, California in 1901.
In addition to an extensive publishing career, Claypole was engaged during almost his entire adult life as a teacher. He taught not only geology, but zoology, botany, and Latin. He was an innovative instructor in a time of dry memorization, for which he was criticized. Nevertheless, he remained dedicated to a more practical view of life and education, much to the delight of his students.

Even after 100 years, the breadth and excellence of Edward Waller Claypole’s work serves as an inspiration to those who love nature and seek to understand it.

REFERENCES

SURVEY ANNOUNCEMENTS

REPORT ON THE MEDINA GROUP

The Pennsylvania Geological Survey has recently published a report on the Medina Group in the subsurface of northwestern Pennsylvania. The report, entitled “Geology and Natural Gas Production of the Lower Silurian Medina Group and Equivalent Rock Units in Pennsylvania”, was written by Robert G. Piotrowski, formerly of the Survey’s Oil and Gas Geology Division. The Medina Group was classified as a tight formation in September, 1981, by the Federal Energy Regulatory Commission, allowing gas well operators to receive peak prices for their product. This incentive has stimulated exploration and development of the Medina as a natural gas reservoir in
Erie, Crawford, Mercer, Venango, and Warren Counties. As such, this report should be of particular interest to those active in the Medina fields.

The report, which includes a short text and 11 plates, details the structure, stratigraphy and depositional framework of the Medina Group, and its relationship to the Tuscarora Sandstone and Shawangunk Conglomerate of central and eastern Pennsylvania. The plates include isopach, lithofacies, structure, drilling depth and field outline maps which are discussed in the text.

Mineral Resources Report 82, Geology and Natural Gas Production of the Lower Silurian Medina Group and Equivalent Rock Units in Pennsylvania, is available for $6.20 (plus 6% sales tax for Pa. residents) from the State Book Store, P.O. Box 1365, Harrisburg, PA 17125.

REPORT ON THE HUNTLEY MOUNTAIN FORMATION

When the new state geologic map of Pennsylvania was being prepared, it was recognized that a discrete succession of nonmarine strata in the north-central part of the Commonwealth had traditionally carried names that had some time significance. Specifically, a line had been drawn on older maps that was in effect, the presumed boundary between Mississippian and Devonian rocks. The strata above and below that presumed line are nearly identical, and in fact constitute a transitional succession between the underlying Devonian Catskill Formation and the overlying Mississippian Burgoon Sandstone. This 650-ft-thick sequence of greenish-gray to light-olive-gray flaggy sandstone having minor grayish-red shale beds has been named the Huntley Mountain Formation. The type section is at Huntley Mountain just north of Waterville, Pennsylvania. The new formation has been traced from Centre and Clearfield Counties northward through Cameron and Potter Counties, and eastward from Clinton and Lycoming Counties through Tioga, Sullivan, Bradford, and Wyoming Counties.

The new formation is defined and described in detail in Information Circular 83 authored by Thomas M. Berg and William E. Edmunds, and is titled: The Huntley Mountain Formation: Catskill-to-Burgoon Transition in North-central Pennsylvania. This publication of the Bureau of Topographic and Geologic Survey is available from the State Book Store, P.O. Box 1365, Harrisburg, PA 17125. The price is $2.75 (plus 6% sales tax for Pennsylvania residents).
NEW GROUNDWATER REPORTS PUBLISHED—SURVEY ATTACKS THE DROUGHT

With the 1980-1981 drought in eastern Pennsylvania still continuing, the Survey announces the release of four “key” comprehensive groundwater reports. Throughout the eastern part of the state the need is great and every effort is being made to meet that need. This timely release of four publications that will aid all those seeking private and public groundwater supplies is an outgrowth of the Survey’s increased effort to study Pennsylvania’s groundwater resources.

W-49, *The Groundwater Resources of the Gettysburg and Hammer Creek Formation, Southeastern Pennsylvania*, written by C. R. Wood, includes portions of Berks, Lancaster, Lebanon, Dauphin, York and Adams counties. These important aquifers of southeastern Pennsylvania are capable of yielding large quantities of groundwater for public, industry, and private water supplies. This report with a full-color map shows where these high groundwater yields may be expected, optimum depths to drill, and an indication of the groundwater quality to be expected.

W-50, *The Groundwater and Geology of the Cumberland Valley, Cumberland County, Pennsylvania*, by A. E. Becher and S. I. Root, describes the limestone and shale aquifers of the Valley. The extremely high groundwater yields of certain limestone formations in the Valley make this an important publication for anyone planning to drill for a water supply. By use of the full-color map, text, and well-tables in this report, it is possible to select the best site for a high-yield well.
W-51, The Groundwater Resources of the Williamsport Region, Lycoming County, Pennsylvania, by O. B. Lloyd, Jr. and L. D. Carswell, includes an evaluation of all the unconsolidated and rock units of southern Lycoming County. Among these aquifers is the important, extremely high-yielding sand and gravel aquifer along the Susquehanna River. Large industrial and public water supplies are available from this formation. Equally important is the quality of the groundwater in this aquifer and a thorough analysis of this quality concern is given.

W-52, Summary Groundwater Resources of Adams County, Pennsylvania, written by L. E. Taylor and D. W. Royer, gives an overview of the groundwater availability of every rock unit in the county. This report is another of the Survey’s series of county groundwater summary reports. Eventually all 67 counties of Pennsylvania will be studied. A full-color geologic and groundwater availability map is included. Hundreds of wells are plotted on the map and a well-table provides the reader with specific groundwater and well characteristics.

Wherever possible the maps included with these reports are to a scale of 1.25 inches equals a mile. The topographic and culture base is that of the Survey’s new county topographic maps. Each of these reports is available at the following cost: Bulletin W-49 @ $9.60; W-50 @ $10.60; W-51 @ $8.50; W-52 @ $10.70. Residents of Pennsylvania must include 6% state sales tax. All publications are available from the Department of General Services, State Book Store, P.O. Box 1365, Harrisburg, PA 17125.

REPORT ON SHALES AND CLAYS OF PA

The Bureau of Topographic and Geologic Survey announces the publication of Mineral Resource Report 79, Properties and Uses of Shales and Clays, South-central Pennsylvania, by Bernard J. O’Neill, Jr., and John H. Barnes. This report contains data on 143 samples of shales and clays from 10 counties (Bedford, Blair, Centre, Fulton, Huntingdon, Juniata, Mifflin, Perry, Snyder, and Union). Included are unfired properties, fired properties, major- and minor-oxide content, and approximate mineralogic composition.

M-79 is available for $5.60 from the Department of General Services, State Book Store, P.O. Box 1365, Harrisburg, PA 15125.
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TOPOGRAPHIC DIVISION

In Cooperation with The U.S. Geological Survey

GROUND WATER DIVISION

In Cooperation with The U.S. Geological Survey
GROUND WATER LEVELS
FOR
November 1981

Bureau of Topographic and Geologic Survey
Dept. of Environmental Resources
P.O. Box 2357
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Address Corrections Requested