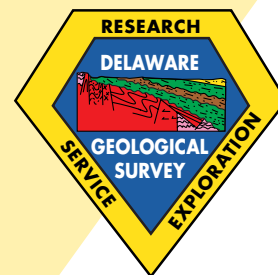


First State Geology

Current information about Delaware's geology, hydrology, and mineral resources

Published twice yearly by the Delaware Geological Survey
University of Delaware



Vol. 24, No. 1 • Winter 2006

New Geologic Map of New Castle County

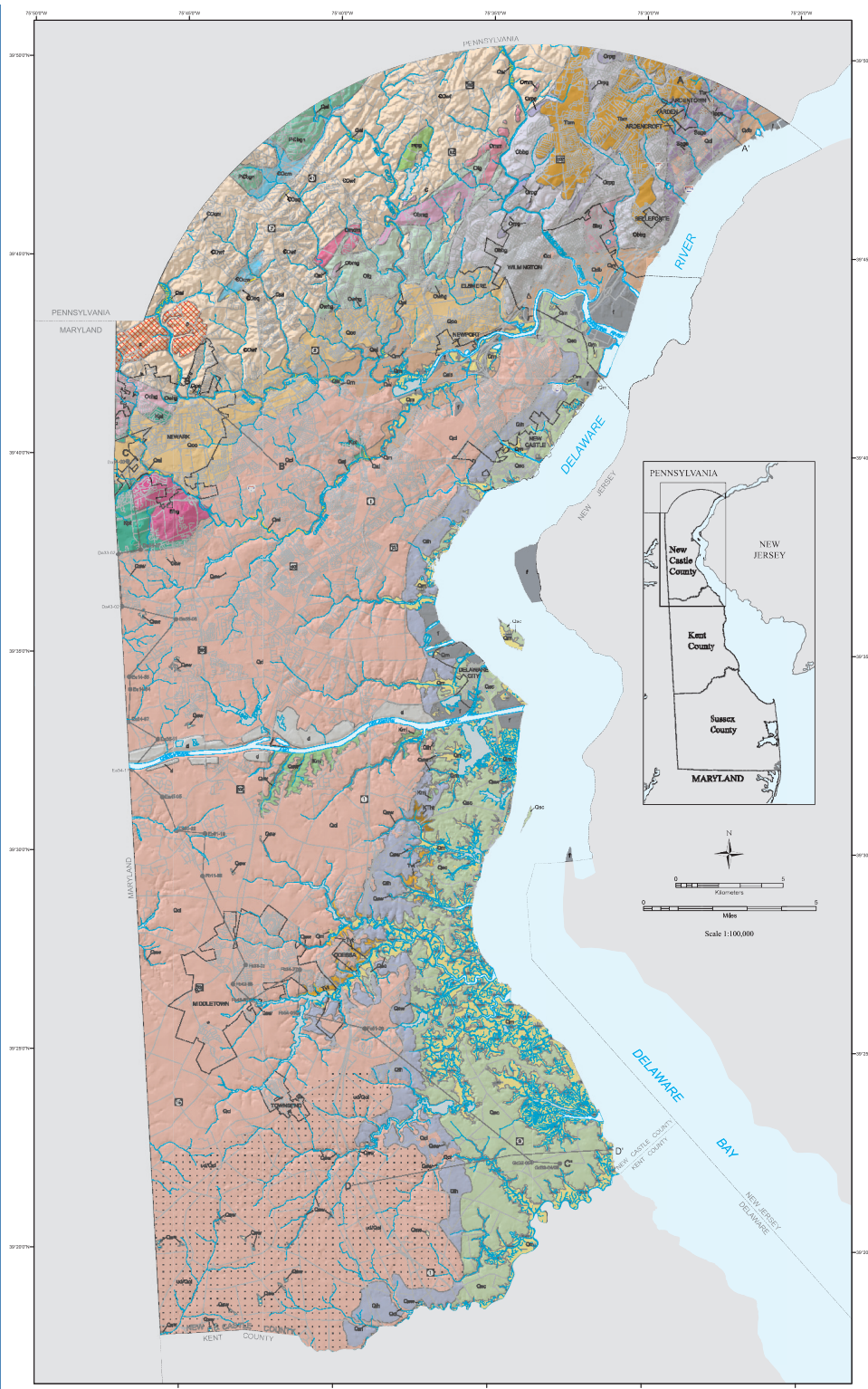
By K. W. Ramsey

This spring, the Delaware Geological Survey will release "Geologic Map of New Castle County, Delaware," which presents the results of research by Kelvin W. Ramsey.

This map is the first in a series of three 1:100,000-scale county-wide geologic maps showing the formations found at the land surface. Maps at this scale are useful for viewing general geologic framework on a county-wide basis, determining the geology of watersheds, and recognizing the relationship of geology to regional or county-wide environmental or land-use issues. This map, when combined with subsurface geologic information, provides a basis for locating water supplies, mapping ground-water recharge areas, and protecting ground and surface water. Geologic maps are also used to identify geologic hazards such as sinkholes and flood prone areas, to identify sand and gravel resources, and for supporting state, county, and local land-use, and regulatory planning decisions.

The map was compiled from topographic and geologic maps, aerial photographs, geologists' and drillers' logs, geophysical logs, soils maps, and sample descriptions. Other than the Old College Formation (see Summer 2005 issue of *First State Geology*) and the Bridgeton Formation, all geologic units were previously mapped or described in Delaware. Descriptions of geologic units were generated by the author after examination of cores, outcrops, and samples from the DGS Core and Sample Repository.

New Castle County encompasses two geologic provinces; the Piedmont, composed of structurally complex bodies of metamorphic and igneous rocks, and the Coastal Plain, composed of seaward-dipping strata of sand, silt, and clay. The boundary between the two provinces is known as the Fall Zone, which, in Delaware, extends from north of Newark to north of the Christina River in Wilmington. This map includes the distribution of the Piedmont rocks found at the surface of



northern New Castle County (see Winter 2001 issue of *First State Geology*) as well as the distribution of surficial Coastal Plain sediments in the remaining two-thirds of the county. In addition to the map, accompanying cross-sections show the stratigraphic units found in the subsurface in the Coastal Plain many of which function as aquifers and are used for public, domestic, irrigation, and industrial water supplies. Descriptions and ages of all the units found on the map and cross sections are also included.

This map documents a combination of several ongoing projects of the DGS to understand and map the geology of Delaware and was in part funded by a STATEMAP grant from the Association of American State Geologists and the U.S. Geological Survey.

The new map will be available to view online or as a downloadable product from the DGS Web page at www.udel.edu/dgs/publ.htm. Printed copies of the publication may be requested by contacting the DGS at (302) 831-2833 or via e-mail at delgeosurvey@udel.edu.



By M. L. Pomilio

The DGS began administering and managing the Delaware DataMIL website in January, 2005. The DataMIL is an interactive internet mapping service (IMS) which serves the Delaware Spatial Data Framework layers (see Summer 2001 issue of *First State Geology*). Many enhancements to the website have been implemented and many data layers have been updated since the DataMIL migrated to the DGS.

Data Updates and Improvements

Data that change frequently are updated on a regularly scheduled basis. For instance, the Municipal Boundaries are updated monthly and the County Tax Parcel data are updated quarterly. The DataMIL staff is updating the Geographic Names Information System (GNIS) dataset by utilizing public and private school names from the Delaware Department of Education thereby providing accurate locations and current school names. In addition, each county in Delaware maintains a "Communities" layer with associated names. These county datasets are scheduled to replace the GNIS-populated place names in the first quarter of 2006. The feature-based National Hydrography Dataset (NHD), which provides stream locations and names, will be used to label streams along their corridors.

Historic aerial photography is served directly through the Map Lab. These images were originally available only to users who had GIS software. Now these photos can be accessed directly in the Map Lab, which

Delaware DataMIL Statistics May 1 – October 31, 2005

Visits to the Portal (front page)	96,730
Maps Created	274,322
Images Downloaded	584
Data Extracts	1,254
Connections to Aerial Photography Web Mapping Service	18,021

Data Provided by State of Delaware Department of Technology & Information (DTI)

allows the general public to see how an area has changed over time. When the DataMIL came to the DGS it was serving the 1937, 1992, 1997, and 2002 aerial photography. This fall the DGS scanned and rectified the 1954 aerial photography, which is now being served on DataMIL. This winter, the DGS started to scan and rectify the 1961 aerial photography. This photography will be available in early spring.

School District Boundaries and Hundreds Boundaries are two new datasets that were added to the "Other Boundaries" category to enhance the Map Lab.

Website Updates and Improvements

Many website-related fixes and enhancements have been completed. Redesigned and updated portal pages improve site navigation. The "News" section was redesigned allowing DGS staff to easily make updates.

Fully functional tools include GNIS Search, Extract Data, and Create A Map. Most of these functions were enhanced to make them more user friendly. For instance, the Extract Data tool now extracts all data into a single zipped file that includes the metadata. The Image Download function was enhanced by adding the functionality to zip all of the images and the world file into one file for easier download and incorporation into a GIS application.

We upgraded the DataMIL website to run on current software, and new scripting is underway to provide new functionality to the site. Some of the goals for early 2006 include: (1) making the DataMIL cross-browser compatible; (2) scripting the site to be accessible and functional to handheld devices such as palm pilots, and (3) using new technology to enhance the look, feel, and ease of use of the Map Lab.

Coast Day 2005

By L. T. Wang

The DGS hosted activities on October 2nd at Coast Day, an annual open house sponsored by the University of Delaware, College of Marine Studies, in Lewes, Delaware. One attraction at the DGS booth, a jar containing 291 marine mammal bones, was on display and visitors were asked to guess how many there were. Congratulations to our young winners who out-guessed 176 other participants.

To round out the educational experience

offered by the DGS, visitors also examined local coastal fossils, drew pictures with natural paints made from local iron minerals, viewed the height of a 25-foot storm surge (the surge experienced by residents of New Orleans, Louisiana during Hurricane Katrina),

visualized how Cape Henlopen Point has changed over the last 80 years (Special Publication No. 26), and learned why ground-water recharge and water-table mapping are so important (Special Publication No. 27).

Officials from NOAA's National Weather Service (NWS) joined Governor Minner and other State leaders to recognize Delaware's emergency management team for completing a set of rigorous criteria necessary to earn the entire state the distinction of being "StormReady" — an NWS-designed program to help communities better prepare for and mitigate effects of extreme weather-related events. The Delaware Emergency Management Agency acknowledged the DGS for its participation on the Delaware StormReady Committee and for its contributions to emergency planning, response, and recovery in Delaware.

Special thanks to Bailey Dugan, Steve McCreary, Tom McKenna, Miriam Pomilio, Kelvin Ramsey, Charles Smith, Andrea Wedo, and Dorothy Windish for making DGS at Coast Day 2005 a success.

Coast Day 2005 Winners

1 st Place	Julia Griffith (age 3)	Pennsville, New Jersey
2 nd Place	Jan Bannan (age 8)	Lewes, Delaware
3 rd Place	Jared Sensenig (age 5) and Leslie Swift	Millsboro, Delaware Lewes, Delaware

Bringing GIS into the Classroom

By M. L. Pomilio

On October 7, the DGS co-presented "Introduction to Computer Mapping in the Classroom" at a session of the 7th Annual Statewide Staff Development Day sponsored by the Delaware Department of Education. Several members of the Delaware GIS Education Working Group, a subcommittee of the Delaware Geographic Data Committee, presented the class.

This class provided teachers with an introduction to the basics of Geographical Information Systems (GIS) and how this tool can be incorporated into the classroom. The benefits of bringing GIS into the classroom were discussed as well as how GIS can enhance teaching state curriculum standards. Participants included middle and high school-

level teachers interested in using GIS in their classes.

The GIS Education Working Group offered to extend this type of instruction based upon individual school, district, or classroom need. A variety of resources were made available, including a list of GIS Professional Partners, which can be found at www.state.de.us/planning/dgdc/ppg.shtml. This list is a resource for teachers looking for GIS help. A number of GIS professionals in Delaware have volunteered to assist teachers on a variety of GIS projects.

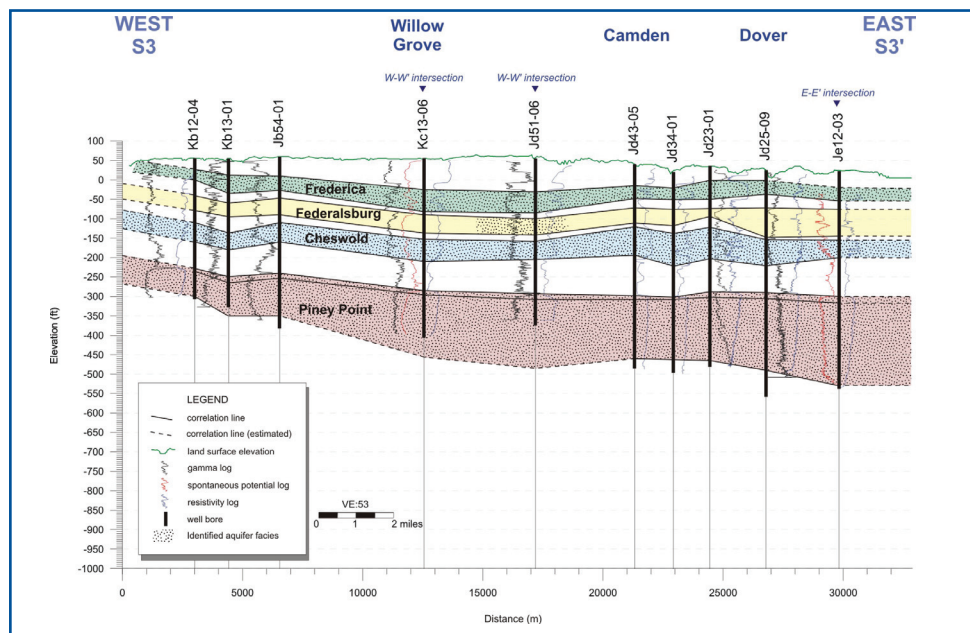
New Report Documents the Confined Aquifers of Kent County

By P. P. McLaughlin, Jr.

Delaware relies heavily on ground water to meet the water needs of its citizens. Population growth, development, and changing land-use practices in Kent County have resulted in an increase in water usage, from 6.5 million gallons/day in 1955 to 31 million gallons/day in 2000. Ground water represents 90 percent of the water used in Kent county and is the sole source of drinking water. To better understand the availability of this valuable natural resource, the DGS recently completed a study that took a close look at confined aquifers in Kent County.

An aquifer is an underground geologic formation that is able to yield significant quantities of water to wells. In the Coastal Plain of Delaware, aquifers are best developed in clean, sandy beds. There are two types of aquifers, and both are important resources in Kent County. A confined aquifer is completely filled with water under pressure greater than atmospheric and is overlain by a less permeable, usually muddy, confining layer that restricts the movement of water. An unconfined aquifer, in contrast, occurs near the surface with no confining layer; it is sometimes characterized as the water-table aquifer.

The aim of this study was to provide an up-to-date geologic framework for the seven confined aquifers used for water supply in Kent County. Kent County's confined aquifers have long been recognized to occur at progressively greater depths south-southeastward, reflecting a subtle slope of the subsurface geology of the Delaware Coastal Plain. However, because these aquifers occur tens or hundreds of feet below surface, the details of their geology are not entirely understood. This study established a more comprehensive understanding of the distribution and geologic characteristics of these aquifers. Eight geologic cross-sections were constructed to illustrate how the aquifers connect in the subsurface – essentially, their “underground plumbing” – and revealed northwest to southeast changes in



This profile shows the stratigraphic correlation of the Piney Point, Cheswold, Federalsburg, and Frederica aquifer intervals in an approximate strike direction.

the character of several of the aquifer intervals across Kent County. Depth and thickness maps were constructed for each of the seven confined aquifers using all available subsurface geologic data.

The three geologically oldest aquifers of Kent County – the Mount Laurel (Cretaceous), Rancocas (Eocene), and Piney Point (Eocene-Miocene) aquifers – are used for water supply in northern and north-central Kent County. All three units are characterized by a notable component of black or green sand grains (glauconite), which were deposited by ancient seas that covered Delaware approximately 84 to 40 million years ago. Geological changes in these aquifer intervals make them suitable ground-water sources in some parts of the county and inadequate in others. South of northernmost Kent County, the Mount Laurel and Rancocas aquifers do not contribute significantly to water supply; in contrast, the Piney Point aquifer becomes more important southward in the county. The reduced importance of the Mount Laurel and Rancocas aquifers can be attributed to lithologic changes and depth; both intervals become muddier to the south and occur at greater depths than most wells drilled in the area. The Piney Point aquifer interval shows the opposite lithologic trend, changing from muddy sand lithologies in its northern extent to cleaner, sandier facies in central and southern Kent County.

Four geologically younger confined aquifers are commonly ground-water sources in central and southern Kent County. These Miocene-age sands (approximately 20 to 16 million years ago) are known, from the oldest to youngest, as the Cheswold, Federalsburg, Frederica, and Milford aquifers. The occurrences, in map view, of these aquifers step

southward in the same order, with the Cheswold aquifer as the northernmost, occurring near the surface in north-central Kent County, and the Milford aquifer as the southernmost, occurring near the surface in the southern reaches of the county. Analysis of well records on cross sections indicates that each of the four sands represents the culmination of a shallowing-upward succession of shallow-marine to coastal deposits. In general, coarser-grained sands are more typical in the northern extent of each of these aquifers, and finer-grained sands are more typical further south in the county. In most areas, these aquifers are separated by thin but distinct, fine-grained confining layers. However, in some areas these fine-grained intervals are absent or appear to be too thin or coarse-grained to be effective confining layers and, as a result, the ground-water systems in some of these sands may be in communication with those of overlying or underlying sands.

The results of this work will be released in Spring 2006 as DGS Report of Investigations No. 72, “Geology and Extent of the Confined Aquifers of Kent County, Delaware” by Peter P. McLaughlin and Claudia C. Velez. These findings should be of significant value to state natural resource managers, utilities, and water well professionals in finding and managing ground-water resources and provide a basis for water-use planning efforts by municipal, county, and state officials. This publication will be available to view online or as a downloadable product from the DGS Web page at www.udel.edu/dgs/publ.htm. Printed copies may be requested after publication by contacting the DGS at (302) 831-2833 or via e-mail at delgeosurvey@udel.edu.

Publications

Other Publications by DGS Staff

Sugarman, P.J., Miller, K.G., Browning, J.V., **McLaughlin, P.P. Jr.**, Brenner, G.J., Buttari, B., Cramer, B.S., Harris, A., Hernandez, J. Katz, M.E., Lettini, B., Misintseva, S., Monteverde, D.H., Olsson, R.K., Patrick, L., Roman, E., Wojtko, M.J., Aubry, M.-P., Feigenson, M.D., Barron, J.A., Curtin, S., Cobbs, G., Cobbs, G., III, Bukry, D., and Huffman, B.A., 2005. Millville site. In Miller, K.G., Sugarman, P.J., Browning, J.V., et al., Proc. ODP, Init. Repts., 174AX (Suppl.), 1–94 [Online]. Available from World Wide Web: http://www-odp.tamu.edu/publications/174AXSIR/VOLUME/CHAPTERS/174AXS_5.PDF

Staff Notes

Kevin Burdette joined the Delaware Geological Survey as a Research Assistant working on the geologic map of Sussex County funded by the STATEMAP Program. Kevin has a B.S. and a M.S. in geology from East Carolina University. He is currently enrolled in the Ph.D. program in the Department of Geology at the University of Delaware.

Presentations

The following presentations were given by DGS staff at the Geological Society of America Annual Meeting, October 16-18: **Andrew Klingbeil**, "Hydrologic Mapping of the Unconfined Aquifer in Sussex County, Del."; **Matthew Martin**, "Digital Water-Table Mapping in Delaware"; **Mark Neimeister**, "Modeling Ground-Water Contaminant Flow Paths in Delaware"; and **Vincent Pellerito**, "Development of a Ground-Water Quality Database for Historic Occurrences of Contaminants in Delaware Shallow Domestic Wells."

A. Scott Andres, "Delaware's Water Supply, Where Will It Come From?", annual meeting of

Chesapeake Section, American Water Works Association, Dover, August 17; and with William J. Ullman and Karen D. Savidge, University of Delaware College of Marine Studies, "Phosphorus Loss from End-Member Watersheds in Southern Delaware," SERA-17 meeting, July 28; William J. Ullman, A. Scott Andres., Karen D. Savidge, Joseph Skudlark, and J. Volk., "Nutrient transport in southern Delaware streams - lessons learned from TMDL and CISNet," Center for the Inland Bays, Scientific and Technical Advisory Committee, Lewes, DE, invited presentation, November 4.

Peter P. McLaughlin, Jr., "What Geologists Do: A Sampling of Delaware Geological Survey Work for Delaware's Water Drillers," Delaware Board of Well Drillers seminar, Dover, November 18; "Kent County Ground-Water Availability Study: Confined-Aquifer Geologic Framework," Citizens and Technical Advisory Committee of the Delaware Source Water Assessment and Protection Program, Dover, December 7; "Life of Our Ancient Lands and Seas: Dinosaurs, Plants, and Marine Life of the Delaware Valley Region in the Mesozoic Era," at Dino Days, Delaware Museum of Natural History, Wilmington, December 27-28.

Miriam L. Pomilio, "DataMIL Update," Delaware Geographic Data Committee meetings, Dover, August 31 and November 18; co-presented "Introduction to Computer Mapping in the Classroom," 7th Annual Statewide Staff Development Day, Dover, October 7.

Kelvin W. Ramsey, "Geology of Delaware," Delaware Nature Society workshop, August 1.

William S. Schenck, "Delaware Piedmont Geology," Professional Development Workshop for K-12 Teachers in Delaware, Maryland, and Washington, D.C., Virden Center, College of Marine Studies, Lewes, July 27; "Vertical Control in Delaware," Flood Resistant Development Workshop, University of Delaware, Newark, October 27.

John H. Talley, provided opening remarks at the Mid-Atlantic Area Water Availability Workshop sponsored by the U.S. Geological

Survey, Water Resources Division, Clayton Hall, June 7; and with **Kimberly K. McKenna**, "Investigations for Sand Resources Offshore Delaware, a Cooperative Effort Between the Delaware Geological Survey and the U.S. Minerals Management Service," Clean Beaches Council, Sustainable Beaches Conference, November 1.

Lillian T. Wang, "Landsat Atmospheric Correction: the Good, the Bad and the Ugly," ESRI International User Conference, July 27.

Service and Awards

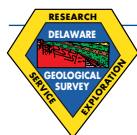
Congratulations to **Richard N. Benson** for 30 years of service and to **Stefanie J. Baxter** for 11 years of service at the Delaware Geological Survey.

A. Scott Andres was re-elected chairman of the Internet Ground-Water Data Interest Group of the National Ground Water Association and was the session convener for the Internet Ground-Water Data Interest Group Technical Session at the 2005 National Ground Water Association annual Expo on December 14.

Thomas E. McKenna and Douglas C. Miller, University of Delaware College of Marine Studies, chaired a session entitled "Impact of direct ground-water inputs to estuarine ecosystems," at "Estuarine interactions: biological-physical feedbacks and adaptations," 18th biennial conference of the Estuarine Research Federation, October 16-21.

Peter P. McLaughlin, Jr., co-chaired technical session, "NAMS Symposium: Integration of Micropaleontology and Petroleum Exploration: From Mature Basins to the Frontiers," Annual Meeting of the American Association of Petroleum Geologists and the Society for Sedimentary Geology, June 20.

William S. Schenck, represented Delaware at the 2005 annual meeting of the National Association of State Boards of Geology, November 2-6; represented Delaware at the 2005 annual meeting of the National States Geographic Informational Council, September 25-30.



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First State Geology is published by the Delaware Geological Survey, a State agency established by an Act of the Delaware General Assembly in 1951 and organized as a unit of the University of Delaware.

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