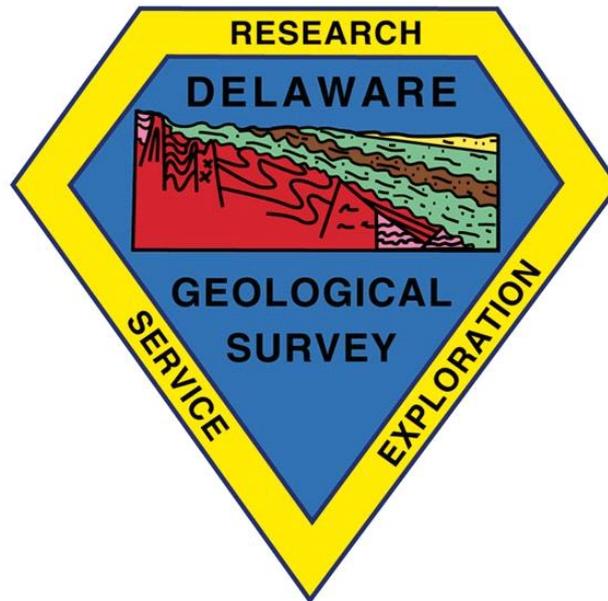


DELAWARE GEOLOGICAL SURVEY

Operating Budget Request

Fiscal Year 2021



February 10, 2020

Delaware Geological Survey

FY 2021 Administrative Hearing

Joint Finance Committee

Legislative Hall

February 10, 2020

Outline:

- I. Introduction**
- II. DGS Mission**
- III. DGS Budget Summary**
- IV. Annual Report of Programs and Activities
2018-19**
- V. Metrics, and Recent and In-Progress Products**



OUR MISSION

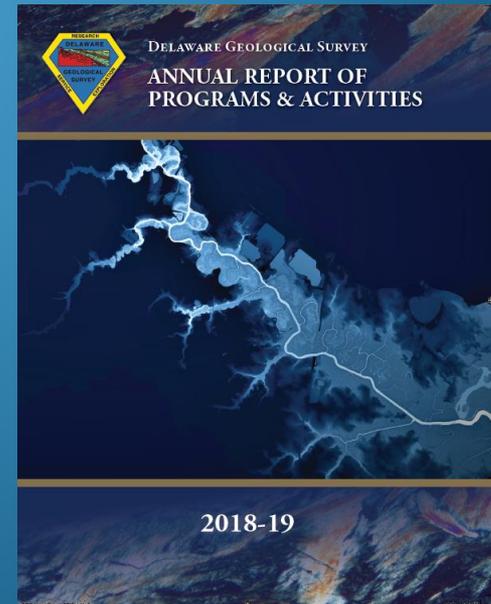
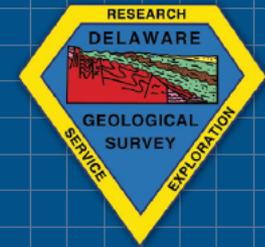
The Delaware Geological Survey's mission is, by statute, geologic and hydrologic research and exploration, and dissemination of information through publication and public service.



Delaware Geological Survey

DGS Building
257 Academy Street
University of Delaware
Newark, DE 19716-7501

www.dgs.udel.edu



Delaware Geological Survey:

- **Our focus is value-added science for public needs**
- **Program built on 5 primary areas:**
 - (1) geology
 - (2) hydrology
 - (3) natural hazards
 - (4) geospatial framework
 - (5) information and data dissemination



DGS Statutory Assignments:

- **Advisory Committees**
- **Coordinate USGS Activities for the State**
- **Licensing Boards**
- **Delaware Rivermaster Advisory Committee and Decree Party Principal**



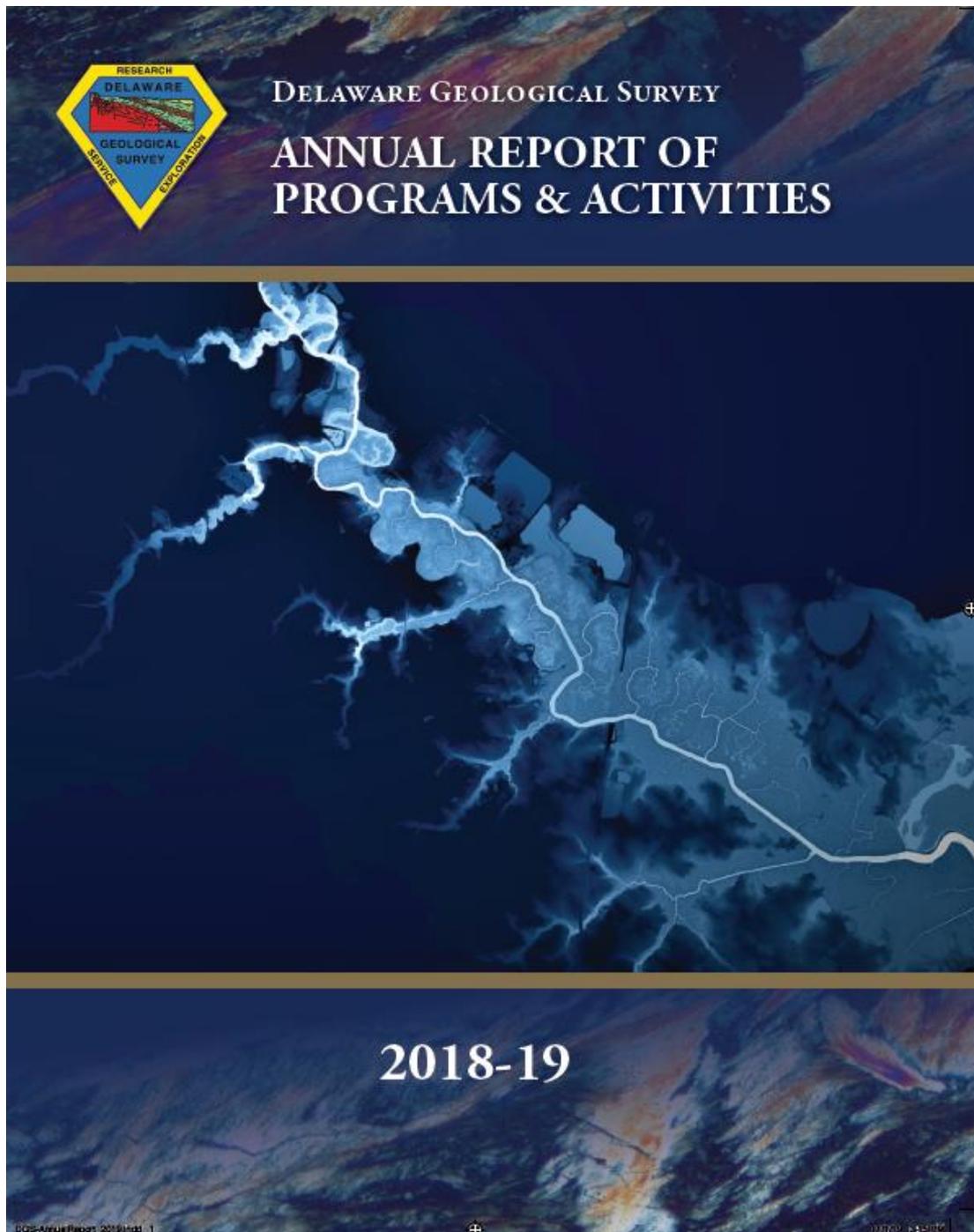
FY 2021 DGS Budget Request Summary

Category	FY2020 Final Budget	FY2021 Base	FY2021 Base Adjustment	FY2021 Enhancements	FY2021 Request
OPERATIONS 00275	1929.9	1965.3	0	20.9	1986.2
OPERATIONS SUMMARY	1929.9	1965.3	0	20.9	1986.2
RIVER MASTER 00475					
55352 Grants	127.3	127.3	0	0	127.3
RIVER MASTER SUMMARY	127.3	127.3	0	0	127.3
TOTAL	2057.2	2092.6	0	20.9	2113.5

Fiscal Year 2021 Delaware Geological Survey Governor's Recommended Budget

<u>Requested Items</u>	Recommended \$		Not Recommended \$	
	GF	ASF	GF	ASF
Fiscal Year 2020 Budget	\$2,057.2			
Increase to reflect projected salary needs	20.9			
Fiscal Year 2020 Personnel Contingency	35.4			
Fiscal Year 2021 Budget	\$2,113.5	\$0.0	\$0.0	\$0.0
\$ Increase/(Decrease)	\$56.3	\$0.0		
% Increase/(Decrease)	2.74%	0.00%		
% Increase/(Decrease) without Personnel Contingency	1.72%	0.00%		

(Please refer to enclosed copy of *Annual Report*)



Atlantic Outer Continental Shelf Sample and Data

Project Contacts: Mojisola A. KunleDare and Peter P. McLaughlin

NGGDPP funded project preserves valuable cores and data and helps maintain and enhance stakeholder access

- *Grant from US Geological Survey (USGS) through **National Geological and Geophysical Data Preservation Program (NGGDPP)** allowed DGS to replace storage boxes and better catalog the collection*



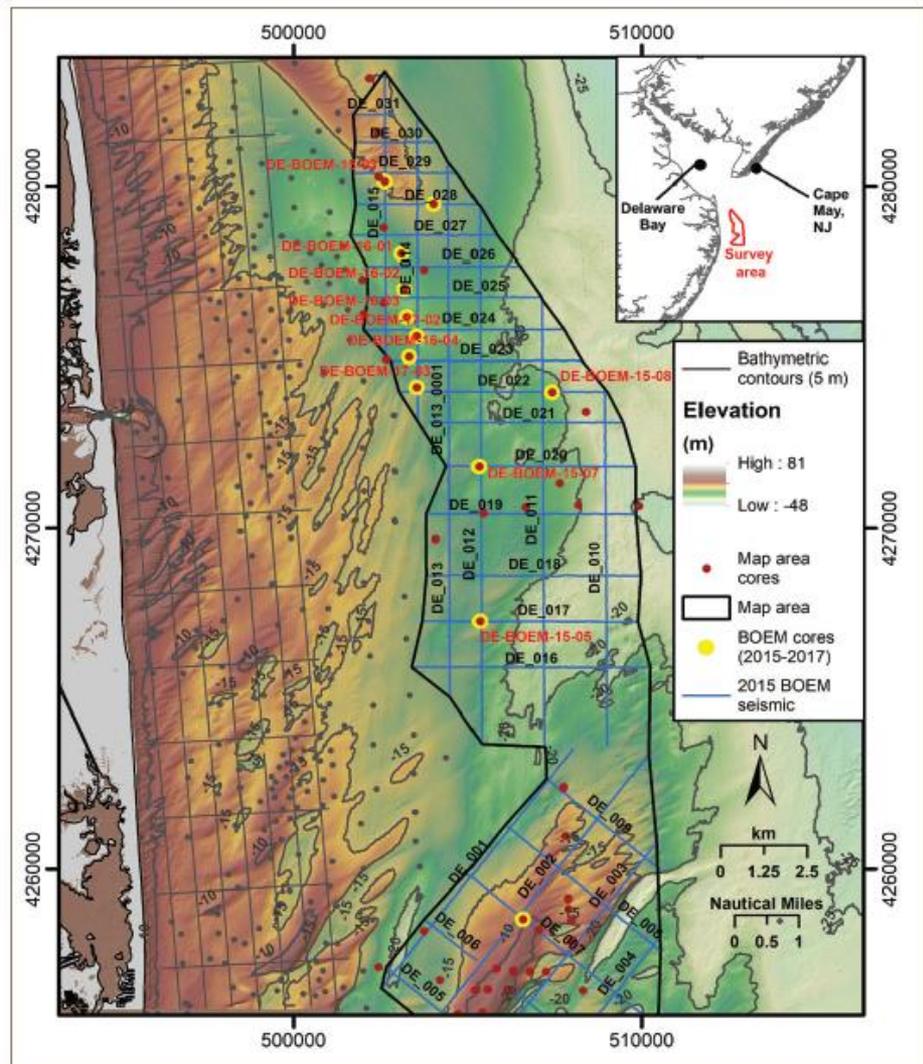
Images showing examples of cores before (left) and after (right) preservation.

Delaware Offshore Sand Resources

Project Contacts: Kelvin W. Ramsey and
C. Robin Mattheus

Identifying sand resources for coastal resiliency and
restoration projects

- Project support from the Bureau of Ocean and Energy management (BOEM) and partnerships with neighboring coastal states
- Dense data collection offshore of Delaware
- New DGS Geologic map of offshore Delaware!



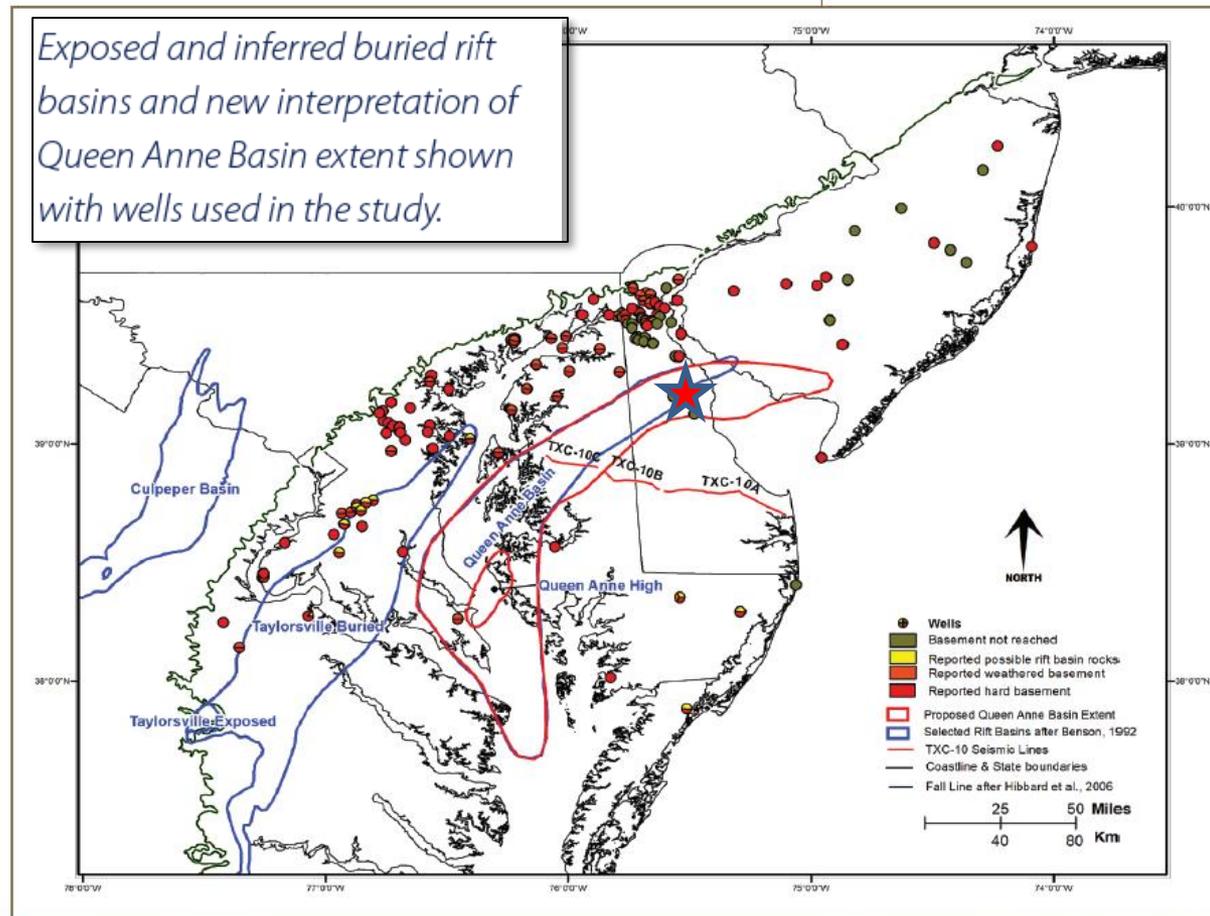
Data distribution map. The BOEM survey area, which is entirely within federal waters, is outlined in black. There is a noticeable decrease in data density in this area compared to areas closer to shore. Cores collected as part of the Atlantic Sand Assessment Project are highlighted in yellow and labeled by local ID.

Early Mesozoic Buried Rift Basins in Delaware and Their Carbon Storage Potential

Project Contacts: Mojisola A. KunleDare and Peter P. McLaughlin

Review and synthesis of available data suggests buried rift basins may occur in Delaware with adequate potential resources for carbon storage

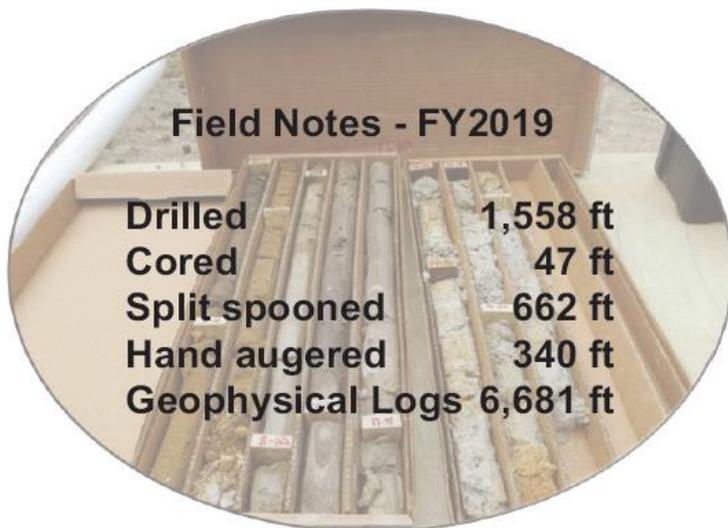
- Regional cooperative project with Midwest Regional Carbon Sequestration Partnership
- Geologic information from one project can aid in understanding of other geologic issues (e.g., earthquakes)



Delaware Geologic Mapping Program – Update

*Project Contacts: Kelvin W. Ramsey and
Jaime L. Tomlinson*

*Mapping the surficial geology of Delaware through
the STATEMAP federal cost-share program*



*DGS staff member, Jaime Tomlinson,
uses a hand auger to extract shallow,
subsurface sediments as part of a
STATEMAP project.*

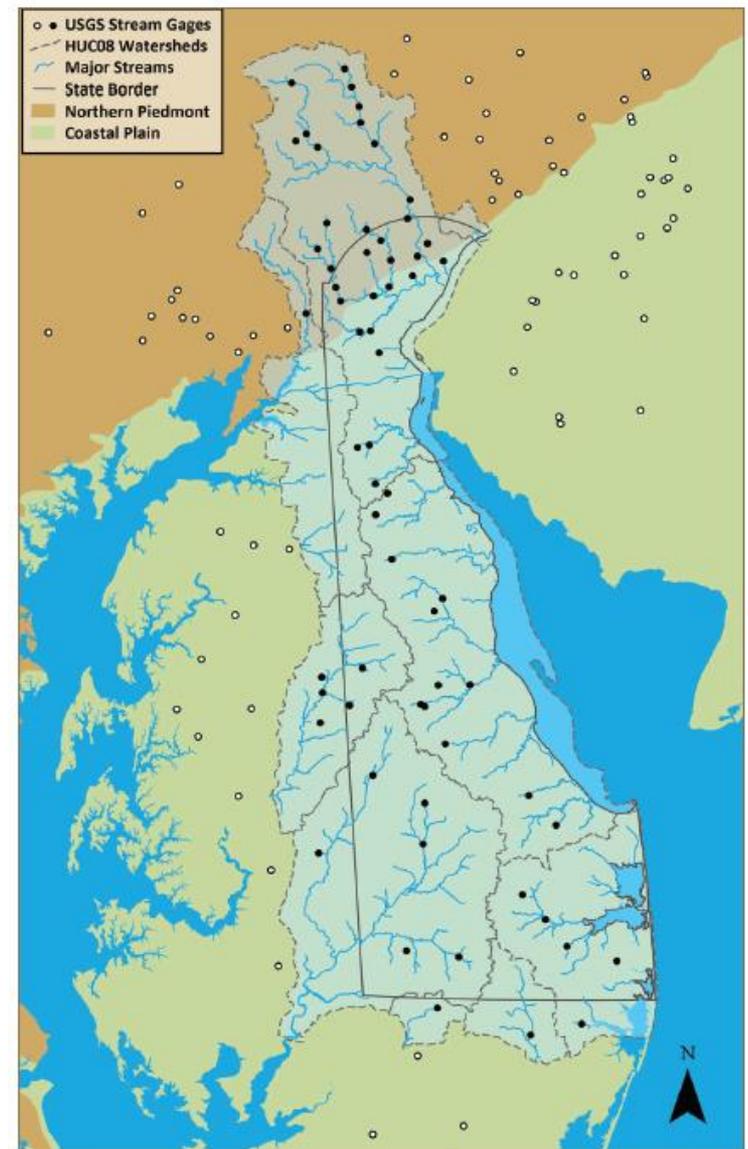


Delaware StreamStats

Project Contacts: John A. Callahan, Daniel L. Warner, and David R. Wunsch

Digital Elevation Model, GIS, and Watershed Analysis to Support Update of USGS StreamStats

- *Cooperative project with DeIDOT and USGS*
- *DGS will create accurate hydrologic models for the state's watersheds*
- *USGS will develop updated stream flow statistics*
- *Critical information for DeIDOT infrastructure planning*



Map of major streams in DGS study area and USGS gage stations inside (black circles) and outside (white circles) this area. HUC08 watershed boundaries are depicted in gray dashed lines. The Northern Piedmont and Coastal Plain physiographic regions are separated in the USGS regression analysis due to their distinctive differences in hydrology.

Sea-Level Rise Report Wins John C. Frye Memorial Award

Project Contacts: John A. Callahan, Thomas E. McKenna, and David R. Wunsch

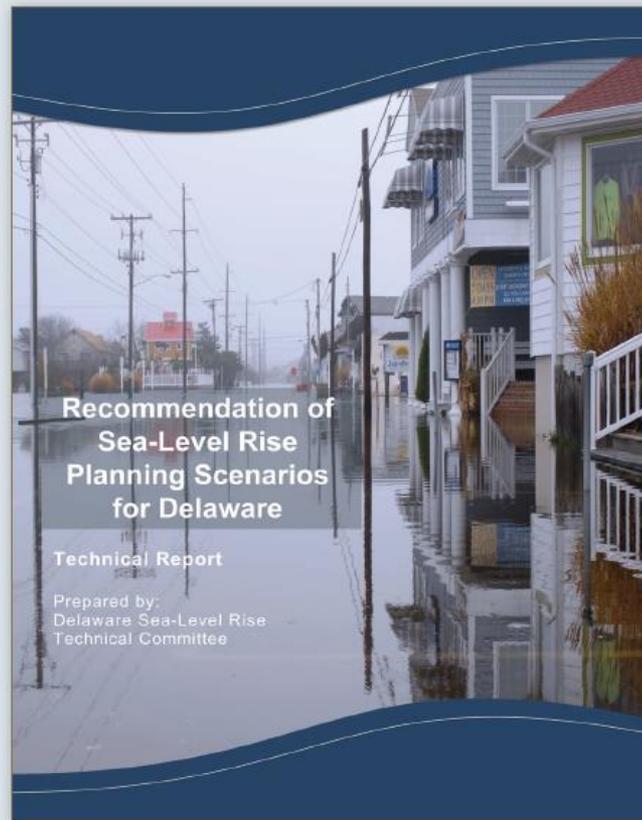
Report on sea-level rise scenarios wins prestigious award

The report *Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report* was selected as the winner of the 2019 John C. Frye Memorial Award. Supported by DNREC Delaware Coastal Programs, the report summarizes work performed by the Sea-Level Rise (SLR) Technical Committee and was released at the Delaware Resilient And Sustainable Communities League (RASCL) Environmental Summit in November 2017. The SLR Technical Committee was composed of regional and state scientific experts, planners, and resource managers. Staff at the Delaware Geological Survey played significant roles in this effort: John Callahan was lead author and chair of the committee, Thomas McKenna was a co-author and a member of the committee, and David Wunsch was a member of the committee.

Information on future projections of sea-level rise in Delaware to the year 2100 as well as information on past sea level estimates from proxy records and current observations from tide gages and satellites are detailed in the report. It also provides some basic guidelines on how best to use these projections in state planning activities, information that is currently being used and making an impact at several layers of government.

The John C. Frye Memorial Award is co-sponsored by the Geological Society of America (GSA) and the Association of American State Geologists (AASG), and is given to the best paper on environmental geology published by either GSA or by a state geological survey during the past three years. The SLR Report met the criteria for the award, which include that the report clearly establishes an environmental problem or need, provides substantive information on the geologic and climatic processes pertinent to the problem, provides recommendations for appropriate land use considerations, and presents the information in a manner that is understandable and directly usable by planners, engineers, policy makers, and the educated general public.

More details on the project and a PDF version of the report can be found on the DGS website at dgs.udel.edu.



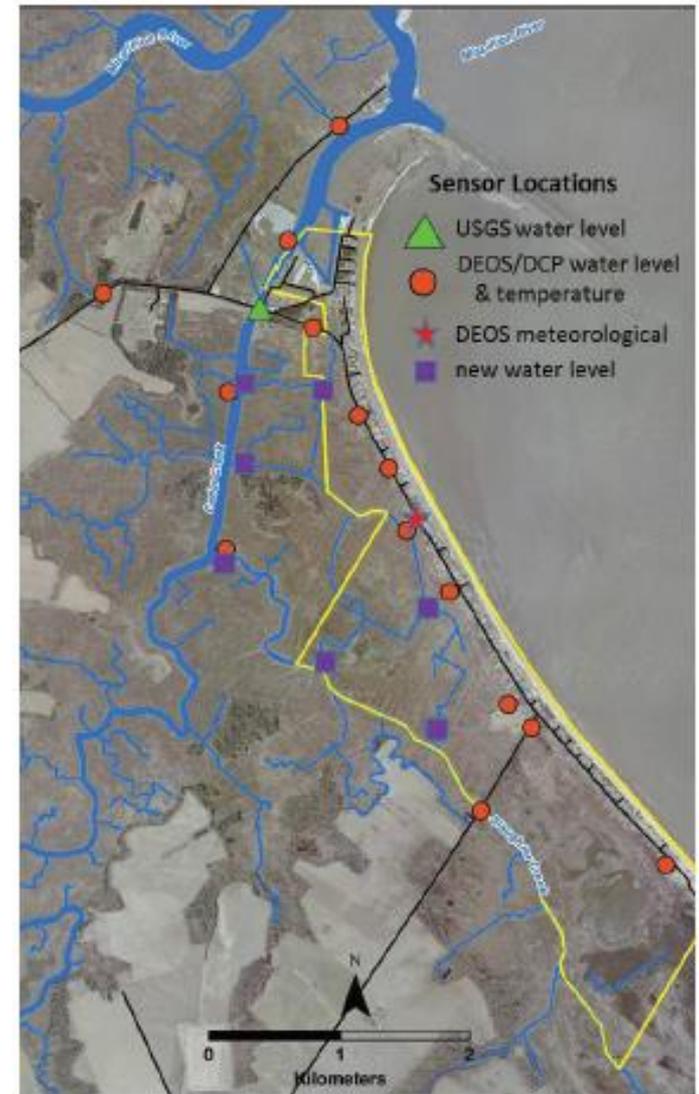
Determining Flow Paths for Flooding and Draining in Slaughter Beach, Delaware

Project Contact: Thomas E. McKenna

Providing hydrologic information to develop and implement strategies for a bayside community

- *Project to determine flooding and draining pathways during storms and nuisance flooding*
- *Real-time data collection using drones, thermal cameras, and sensors*
- *Project cooperators include DNREC and DEMA*

(Page 13)



Locations of existing and proposed monitoring stations. Town boundary shown by yellow line.

Performance Measures

IPU	Performance Measure Name	Fiscal Year 2019 Actual	Fiscal Year 2020 Budget	Fiscal Year 2021 Governor's Recommended
90-01-02	<i>Delaware Geological Survey</i>			
	# of geologic mapping square miles (cumulative)	2,459	2,526	2,698
	# of DGS well records in database	36,478	37,371	38,425
	# of water level records in database (millions)	21.3	22.2	23.2
	# of water salinity observations to look for sea level rise & salt water intrusion (millions)	1.5	2.2	3.3
	# of stream gages	10	10	10
	# of tide gages	7	7	7
	# of website page views (annual)	163,859	171,921	171,742

DGS PUBLICATIONS COMPLETED

OPEN FILE REPORTS

OFR 53 Kent County Groundwater Monitoring Project: Results of Subsurface Exploration

DGS PUBLICATIONS IN PROGRESS

REPORT OF INVESTIGATIONS

RI 83 Aquifers and Groundwater Withdrawals, Kent and Sussex Counties, Delaware

RI 84 Evaluating Impacts of Sea-Level Rise on Groundwater Resources in the Delaware Coastal Plain

RI 85 Mapping Evapotranspiration for 2016 Growing Season Using Landsat 8 Images and Metric Model, Sussex County, Delaware

RI 86 The Potomac Formation in Five Core Sites in New Castle County, Delaware

RI 87 Stratigraphic Geometry and Facies Characteristics of the Potomac Formation near the Chesapeake and Delaware Canal, Delaware, on the basis of a Reflection Seismic Survey and Well Data

GEOLOGIC MAPS

GM 25 Geologic Map of Offshore Delaware

GM 26 Geologic Map of the Cecilton and Middletown Quadrangles, Delaware



Photo credit: Mike Ciosek, photographer for the Wilmington and Western Railroad.

EXTERNAL PUBLICATIONS BY DGS STAFF

Andres, A.S., Main, C.R., Pettay, D.T., and Ullman, W.J., 2018, Hydrophysical and hydrochemical controls of cyanobacterial blooms in Coursey Pond, Delaware (USA): *Journal of Environmental Quality*, vol. 48, no. 1. doi: 10.2134/jeq2018.03.0108.

Andres, A.S., Main, C.R., Pettay, D.T., and Ullman, W.J., 2018, Biogeochemical responses of a Coastal Plain pond to hydrologic and nutrient loading variability – implications for long-term management and mitigation: Abstract H53N-1779 presented at 2018 American Geophysical Union Fall Meeting, Washington, D.C., 10-14 Dec.

Brothers, L., Foster, D.S., Pendleton, E.A., Baldwin, W.E., Ramsey, K.W., Wehmiller, J., and Mattheus, C.R., 2019, Late Quaternary evolution of the continental shelf and coastal system of the Delmarva Peninsula: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, abstract 35-6, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

Callahan, J.A., McKenna, T.E., and Medlock, C.L., 2018, LiDAR vertical error estimation and DEM correction in a tidal salt marsh: Annual Meeting of the American Association of State Geologists, Rehoboth Beach, Delaware.

Childs, B.D., Balascio, N.L., and Ramsey, K.W., 2019, Late Quaternary paleoenvironmental analysis of the Cypress Swamp Formation, Delaware: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, abstract 31-17, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

Cumming, L., Fukai, I., Burchwell, A., Sminchak, J., McLaughlin, P.P., KunleDare, M.A., and Gupta, N., 2018, Performing carbon storage resource assessments for offshore Mid-Atlantic United States: 14th International Conference on Greenhouse Gas Control Technologies, Melbourne, Australia.

Fulton, M., and McLaughlin, P.P., 2018, Stratigraphic correlation of the heterogeneous Cretaceous aged sediments of the Potomac Formation in New Castle County, Delaware through examination of core, well logs, and palynology: *Geological Society of America Abstracts with Programs*, vol. 50 no. 6, doi: 10.1130/abs/2018AM-320641.

DGS Publication Summary:

Completed:

1 Open-File Report

In Progress:

5 Report of Investigations

2 Geological maps

Kim, W., Gold, M., Ramsay, J., Meltzer, A., Wunsch, D., Baxter, S., Lekic, V., Pearson, K., Wagner, L., Roman, D., Golden, S., and Pratt, T., 2018, Mw 4.2 Delaware Earthquake of 30 November 2017: *Seismological Research Letters*, doi: 10.1785/0220180124.

Mattheus, C.R., Ramsey, K.W., and Santoro, J.A., in press, Evaluating continental shelf seabed-elevation changes from archived sediment-core records: issues with vertical positioning and implications for integration with subsurface geophysics: *Journal of Coastal Research*, (in press).

Mattheus, C.R., Ramsey, K.W., and Tomlinson, J.L., 2019, Sedimentary dynamics of the inner continental shelf of Delaware: Do offshore vibrocore records provide insight into shelf geomorphology?: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, abstract 35-5, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

McKenna, T.E., Callahan, J.A., Brinson, K., Huntley, D., and Slawik, D., 2019, Determining flow paths for flooding and draining in Slaughter Beach, Delaware: Delaware Estuary Science and Environmental Summit, Cape May, New Jersey.

McKenna, T.E., Medlock, C.L., and Callahan, J.A., 2019, Towards a hydrological characterization of Delaware Bay tidal wetlands – elevation and tidal channels: Delaware Applied Coastal Research Symposium, Newark, Delaware.

McQuiggan, R.W., and Andres, A.S., 2018, Groundwater level decline in the Piney Point aquifer of Delmarva and New Jersey: Proceedings of the Maryland Groundwater Symposium, Baltimore, Maryland.

Medlock, C.L., Bates, N.S., McKenna, T.E., and Callahan, J.A., 2018, Fieldwork and dataset preparation to create an improved Digital Elevation Model for St. Jones and Blackbird Creek Reserves: 2018 Delaware Wetlands Conference, Wilmington, Delaware.

Medlock, C.L., McKenna, T.E., and Callahan, J.A., 2018, LiDAR vertical bias assessment and digital elevation model correction in Delaware's tidal salt marshes: Abstract EP23C-2340 presented at 2018 American Geophysical Union Fall Meeting, Washington, D.C., 10-14 Dec.

Schaefer, R.B., Lamer, M.J., Puleo, J.A., and McKenna, T.E., 2018, Morphological impacts and vegetation-induced attenuation of wind and vessel generated waves: Abstract

OS23G-1712 presented at 2018 American Geophysical Union Fall Meeting, Washington, D.C., 10-14 Dec.

Smith, M.T., Hinnov, L.A., and McLaughlin, P.P., 2019, Preliminary examination of the Paleocene-Eocene record of a Mid-Atlantic shallow-marine section: The Woodland Beach Core, Delaware: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, doi: 10.1130/abs/2019SE-327545, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

Thompson, C.M., Lockwood, R., Worthington, E.N. and Ramsey, K.W., 2018, Taxon diversity and community structure of fossil molluscan assemblages from the mid-Atlantic continental shelf (USA): *Geological Society of America Abstracts with Programs*, vol. 50, no. 6., abstract 38-9.

Warner, D.L., O'Hara, B., and Callahan, J.A., 2019, A hybrid approach for incorporating high-resolution LiDAR DEMs into USGS StreamStats at the state level: poster presented at American Association of Geographers Annual Meeting, April 2019, Washington, D.C.

Wehmiller, J.F., Brothers, L., Foster, D.S., and Ramsey, K.W., 2019, Southern Delmarva barrier island beaches: linking onshore and offshore units using racemization geochronology to infer sediment sources during shoreline migration: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, abstract 39-1, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

Wehmiller, J.F., Ramsey, K.W., Howard, S., Mattheus, C.R., and Harris, M.S., 2019, New perspectives on US Atlantic Coastal Plain aminostratigraphy gleaned from extensive analyses of shell specimens from inner continental shelf vibrocores: *Geological Society of America Abstracts with Programs*, vol. 51, no. 3, abstract 39-1, presented at the Southeastern Section Meeting, Charleston, South Carolina, 28-29 Mar.

Worthington, E.N., Ramsey, K.W., and Berquist Jr., C.R., 2018, Evaluation of terrestrial and offshore heavy mineral assemblages in Delaware formations: *Geological Society of America Abstracts with Programs*, vol. 50, no. 6, abstract 266-8.

Wunsch, D.R., 2018, Book review: Timefulness – How thinking like a geologist can help save the world, 290 p., Bjornerud, M., Princeton University Press. *Science*, vol. 361, issue 6406.

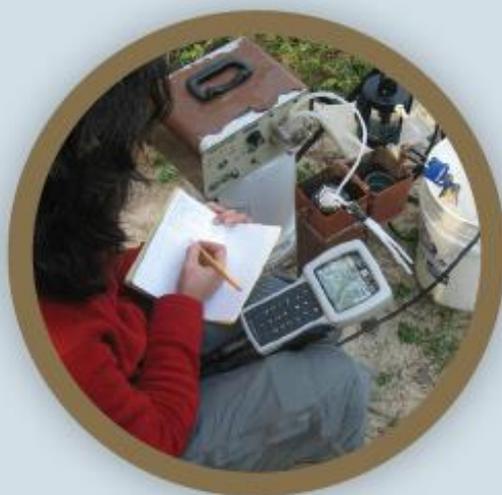
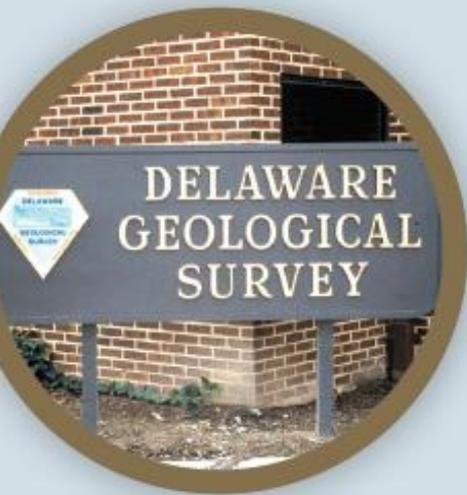
24 External Publications by DGS Scientists:

- 3 Peer-reviewed journal articles
- 3 Conference proceedings
- 18 Abstracts
- 1 Book review

DGS Professional Service Activities

- 39 Boards and committees

DGS Service to Professional Societies, Boards, and Committees	
American Association of Petroleum Geologists Committee on Preservation of Geoscience Data	Delaware Water Resources Center Advisory Panel
American Association of Stratigraphic Palynologists	Delaware Water Supply Coordinating Council
American Geophysical Union	Delaware Water Well Licensing Board
American Geosciences Institute, Executive Committee	Federal Advisory Committee on Water Information
Association of American State Geologists	Federal Geologic Mapping Advisory Committee
Association of American State Geologists Foundation	Federal Subcommittee on Groundwater
Center for the Inland Bays Board of Directors	Geological Society of America, Academic and Applied Geoscience Relations Committee
Center for the Inland Bays Scientific and Technical Advisory Committee	Murderkill River Monitoring and Modeling Workgroup
Delaware Department of Natural Resources Source Water Protection Program Citizen and Technical Advisory Committee	National Association of State Boards of Geology
Delaware Emergency Management Agency State Hazard Mitigation Council	National Association of State Boards of Geology Council of Examiners
Delaware Emergency Management Agency Technical Assessment Center Group	National Geologic Map Database, Geologic Map Schema Working Group
Delaware Geographic Data Committee	National Ground Water Association, Water Management Subcommittee
Delaware Geologic Mapping Advisory Committee	New Castle County Resource Protection Area Technical Advisory Committee
Delaware Leaking Underground Storage Tank Committee	Ph.D. and M.S. Student Committees (University of Delaware)
Delaware Resilient and Sustainable Communities League	Regulated Flow Advisory Committee of the Delaware River Basin Commission
Delaware Sea Level Rise Technical Workgroup	River Master Advisory Committee
Delaware State Board of Geologists	River Master Decree Party Workgroup
Delaware State Names Authority	Sussex County Source Water Protection Technical Advisory Committee
DelawareView (Delaware Chapter of AmericaView)	University of Delaware Council of Public Engagement
Delaware Water Infrastructure Advisory Council, Wastewater Subcommittee	



Delaware Geological Survey

DGS Building
257 Academy Street
University of Delaware
Newark, DE 19716-7501
Phone: 302-831-2833

www.dgs.udel.edu

Questions?