

Drone Mapping and Retention of Post-Graduates

Submitted by Joe Betit, Earth Systems Management

Since 2020, Earth Systems Management, LLC (ESM), in Pungoteague, Virginia, has been focused on economic development that supports retention of young people on the Eastern Shore of Virginia (ESVA). To accomplish this, ESM has developed systems based on advanced robotic surface-water drone technologies. These technologies are the same as those used for aerial- and ground-vehicle drones. The water-focused technologies are appropriate to the Shore's shallow-water ocean and bay environments. All systems development has been carried out by ESM college interns. The core founding group consisted of 4 students from the Shore: 3 joined ESM after high school and are now rising seniors at the University of Virginia, Virginia Tech, and James Madison University; the other is currently working at NASA Wallops. I have found that with guidance, young people are capable of very advanced work in a variety of disciplines, long before they graduate from high school or college.

ESM is currently involved in 2 key projects that use robotic drone technology. The student team is now composed of 2 college interns and a homeschool team of 4 secondary-school students (plus their parents). One of the interns has moved to Ver-

mont but continues to work online.

The first project is near Wachapreague, adjacent to the barrier islands. ESM is mapping an area of very shallow waters in Burton Bay, adjacent to Hummock Channel. This mapping will support the seagrass revitalization project of Virginia Institute of Marine Science (Gloucester Point and the Wachapreague Lab) and The Nature Conservancy. The robotic water-surface drone has a very shallow draft (4"), so it is ideally suited to autonomous sonar bathymetric mapping in shallow water.

The second project will be mapping with aerial drones to support a project in Mathews County, Virginia, on the western shore of the Chesapeake Bay. The scope of the project, entitled Monitoring Plan for Haven Beach, includes documentation with the aerial drones of: beach nourishment, beachgrass planting, and a breakwater construction area; the breakwaters and extension area; the staging and project-access area; and the indirect-impact area. The ESM interns and the "Drone Club" homeschool team will use a quadcopter aerial drone equipped with precision camera technology for gathering mapping data. These flights will be at a much lower altitude and slower speeds than used in typical aerial-mapping aircraft flights, allowing for a higher level of detail to be captured in the photography, to be used for detailed change-mapping and documentation.

The aerial mapping will take place over a 3-year period. The first year will focus on pre-construction and post-construction drone aerial mapping in the areas covered by the



Earth Systems Management personnel guide students in learning about and operating drones to gather mapping data. Photo: ESM

Monitoring Plan. Years 2 and 3 each include spring and fall drone aerial-mapping flights.

The technology is amenable to surveys of waterfront properties for shoreline management, including living shoreline development; and bottom profile assessments for dredging, aquaculture, and other marine activities. Most activities involving shorelines and in-water locations require permitting, and these systems can provide the information required for developing and implementing plans, cost estimates, and construction. For aquaculture, detailed maps of bottom lease areas would provide information to more efficiently manage farm practices.

The homeschool Drone Club project, based in Machipongo at the former Northampton Middle School, has developed nicely. The project team is assisting in ESM's preparation of a very large, heavy-lift quadcopter, which will map the Haven Beach project areas in April 2024. The Drone Club team will travel to the project location with their parents to assist ESM with drone flights and mapping. In addition, they are building another

See Drone, Cont'd on page 5

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Shore Drinking Water – A Most Valuable Resource

Where Does It Come From? How Is It Managed?

Compiled by Mary Miller

*(Unless otherwise noted, information points below are excerpted from publicly available Eastern Shore of Virginia Ground Water Committee material and/or United States Geological Survey [USGS] Reports. *)*

ShoreLine Comment:

The supply of drinking water on the Eastern Shore has been a concern for decades. CBES supports allowing the experts – the geologists, hydrologists, and other scientists who help us understand our water supply – room to work with the Ground Water Committee. The piece that follows is intended to provide a brief background. Managing this is something we have to get right. Unsustainable use of groundwater would threaten the health of our sole-source aquifer; the results could be catastrophic to our rural community. We depend on the Ground Water Committee to help balance the risks of too much use of our confined aquifers versus being so restrictive that we end up blocking new businesses and homes on the Eastern Shore.

Given the importance of the Shore's water supply, it is critical to get clear answers to basic questions. How much are we removing, versus the recharge of the confined aquifers? How much water is being used from each source (Columbia/surface water; Yorktown-Eastover confined aquifers)? What is the seasonal pattern? What is the geographic availability and use, mapped out on the Shore? What are the trends of use and supply? Although the experts have developed answers to many of these questions, much of the data available on the Committee's website is too technical, some relying on older data, often conflicting, or with missing links. The Ground Water Committee needs to do more to communicate adequately to the public about our water situation. They also need to work with the experts to improve the data with more monitoring. Are there gaps in our knowledge of water use, from unregulated wells that support old impoundments, to new luxury homes with full-irrigation yard systems? Are we monitoring how many wells around the Shore are being abandoned due to saltwater intrusion? And are conditions changing because of climate change, changing weather patterns, and sea level rise?

Water use is rising across the Eastern Shore. The experts have told us we are probably pushing against the sustainability of the confined aquifers. It is certainly time to approach their management with a more humble and conservative approach. It is also time we begin some serious conversations of long-term plans and regulations to accommodate the need for more water while protecting the quality of the overall supply.

Background

- In 1997, the US Environmental Protection Agency (EPA) designated the fresh groundwater that supplies all drinking water on the Eastern Shore of Virginia as the Columbia and Yorktown-Eastover Multiaquifer System Sole Source Aquifer. This means that a community is dependent on a single source of drinking water and there is no possibility of a replacement water supply to be found. Fresh drinkable groundwater is restricted to the Columbia (also called the surficial) aquifer and the confined Yorktown-Eastover aquifer system (Upper, Middle, and Lower), restricted to depths of less than 350 feet, with layers of clay separating the aquifers. Water in the confined aquifers is up to 100,000 years old.¹

All water in the aquifers comes *only* from rainwater falling directly on the Shore. Most of that rainfall never reaches the aquifers. About 88% is lost through evaporation, interception on to plants and trees, direct runoff, and evapotranspiration. Of the 44 inches of annual rainfall, only 5 to 6 inches infiltrate to the water table, the upper Columbia aquifer (625 million gallons per day; MGD). And only about 0.05 in/year (9 MGD) makes it all the way down to the confined Yorktown-Eastover aquifers.¹ The aquifer recharge area is limited to the narrow spine of the Shore, basically following Rt. 13.

Current Status

- The Virginia Eastern Shore is entirely dependent on the underlying sole-source aquifer system, which provides at least 15 MGD of water withdrawn in Accomack and Northampton Counties for public supply for about 45,000 residents and additional seasonal visitors.² A recent report to the Eastern Shore of Virginia Ground Water Committee by Arcadis consultants states that actual reported permitted, plus estimated, usage is 8.4 MGD. It also states that specific drawdowns project greatly increased potential for limited supply and saltwater intrusion.³ Concern grew at the state level that high users could deplete an aquifer faster than it is replenished by rainfall seeping underground. So in 1976, the Virginia Department of Environmental Quality (VDEQ) designated the Eastern Shore as a Ground Water Management Area, requiring a permit for withdrawals exceeding 300,000 gallons per month. Groundwater withdrawals over approximately the past 100 years have lowered water levels, altered hydraulic gradients, and created concern about saltwater intrusion

See Shore Water, Cont'd on page 4

Shore Water, Cont'd from p. 3

into freshwater aquifers. It has been recognized that the rate of withdrawals from the confined Eastern Shore aquifers may be approaching the limit for long-term, sustainable use.²

- Because the surficial (Columbia) aquifer is replenished at a much higher rate than the Yorktown-Eastover aquifer system, which is only recharged from the directly overlying Columbia aquifer, the Columbia is a far more sustainable source of water. The Columbia aquifer is successfully used by numerous domestic wells and some community water systems, including the Town of Chincoteague and YMCA Camp Silver Beach.⁴ Senator Lynwood Lewis's legislative efforts to incentivize use of the Columbia aquifer for agricultural uses contained no requirement to use the upper aquifer instead of pumping from the lower drinking water aquifers, but did streamline the permitting process if the Columbia aquifer is used.⁵
- Historically, of the permitted groundwater withdrawals on the Shore, about two-thirds have been in Accomack, for public, commercial, and industrial use. Most of the other third have been for agricultural use in both counties.⁶ Groundwater permit applications for withdrawals of groundwater in excess of 300,000 gallons per month are submitted to VDEQ for permit approval. Other wells, including private residential wells, do not require permits (and are not included in the permit withdrawal numbers).⁷ The majority of the VDEQ permits listed by A-NPDC are for withdrawals from the lower Yorktown/

Eastover aquifers – the Shore's main source of drinking water. Permits include commercial, municipal, agricultural, and industrial facilities, but not private residential wells. Millions and millions of gallons per year are permitted in each county, mostly from the Upper and Middle Yorktown-Eastover aquifers:

- ✓ **Northampton County** – 34 permits – the 3 largest permitted annual withdrawals total 313,800,000 gallons per year and are by all agricultural users
- ✓ **Accomack County** – 36 permits – the 3 largest permitted annual withdrawals total 1,278,100,000 gallons per year and include two industrial processing plants and one municipal system⁸

Recharge rate to the Yorktown has increased due to pumping. Recharge will increase as use increases – but will not keep pace with pumping.⁹

Saltwater Intrusion

- A major threat to groundwater on the Eastern Shore is saltwater intrusion into the freshwater aquifers. Saltwater intrusion occurs when changes in the groundwater system cause salty water to replace fresh water in the aquifer.¹⁰ This can be caused by wells that are too close to the freshwater/saltwater interface, or are too close to the shore, or are pumped at an excessive rate.¹¹ Saltwater intrusion decreases freshwater storage in the aquifers.¹²
- The low recharge rate to the Yorktown-Eastover aquifer and the surrounding ocean water makes the Shore far

See Shore Water, Cont'd on page 5

Schematic Diagram of Groundwater Flow of the Eastern Shore of Virginia

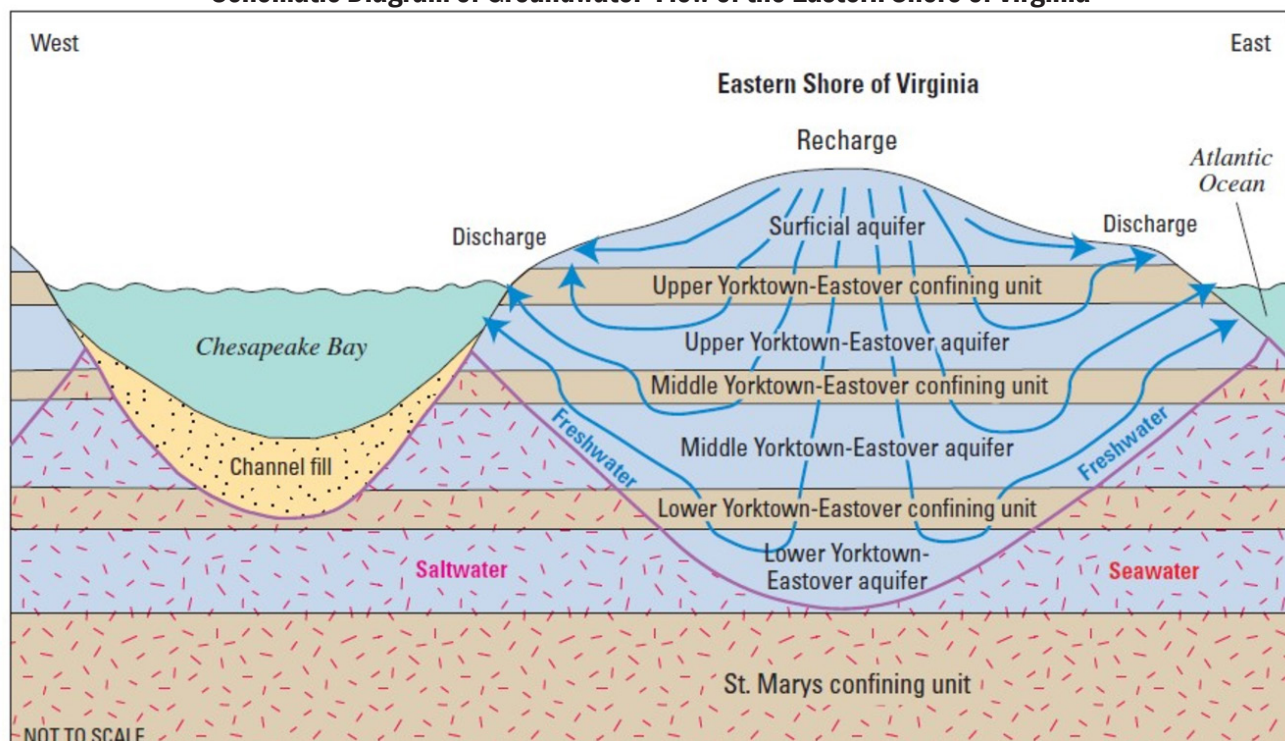


Illustration of Shore's freshwater aquifer system, enclosed on both sides by salt water.
<https://pubs.usgs.gov/sir/2009/5066/pdf/sir2009-5066.pdf>

Drone, Cont'd from p. 2

hydro-drone for ESM. During the construction process, they are learning to use 3D computer-aided design (CAD) and 3D printing to create certain drone parts.

ESM is also developing a team of Subject Matter Experts (SMEs), who possess a deep understanding of a particular subject, e.g., a job, department, function, process, piece of equipment, software solution, material, historical information, etc. SMEs may have collected their knowledge through intensive levels of schooling, or through years of professional experience on the subject. The SME has an understanding of their subject that is not common knowledge, making the person quite valuable to an organization.

SMEs are especially important in process-improvement efforts. They often have a great deal of undocumented process-knowledge. They also can save time by identifying inadequate solutions proposed by other members of the team during the solution-selection stage of the project.

SMEs can also make ideal trainers. Thanks to their intimate understanding of the subject, they can explain and demonstrate the process in ways that can minimize the training curve for those without the years of experience. In-depth levels of practical training help cut down on the number of mistakes new hires make during the onboarding process, flattening the learning curve.

One of the skills this term refers to is welding: Michael Steelman, owner of Seaduce in Cheriton, has currently been teaching this valuable skill to the homeschool team. One student will complete high school this year and is so fascinated with welding that he plans to train more at Steelman's, with the goal of working as a welder on the Shore.

I have also started assembling a team of SMEs to assist with education and training in design, development, and manufacturing/production of hydro-drone systems. In addition to Steelman and myself, an advanced technology company in Chesapeake is already on board.



Earth Systems Management asks ESVA creek communities (including aquaculture) to request and attend presentations about robotic hydro-drone systems – and

to encourage young people to attend. The new hydro-drone system is affordable, and ESM can train young people on the creeks to assemble and/or operate the drones. This process will initiate the creation of an environmental database for each creek in the program, with data acquired and maintained by each creek community. Each database would then be integrated into an overall ESVA database. As the program grows, these data will provide a basis for empirical, long-term research into our ever-changing water environment. It is also a vocation for the Shore's young people, providing useful data services and products as well as providing them meaningful local employment. For more information, contact Joe Betit at jwbetit@gmail.com. 

Shore Water, Cont'd from p. 4

more vulnerable to saltwater intrusion than the Coastal Plain west of the Chesapeake Bay. The deep lower Yorktown-Eastover aquifer receives the least recharge and is closest to underlying brackish groundwater, and is therefore more susceptible to saltwater intrusion. The shallow Columbia aquifer receives the greatest recharge, has the most separation from brackish groundwater, and is less susceptible to saltwater intrusion.¹³

Beginning in about 1965, increases in groundwater withdrawals for agricultural, commercial, urban, and industrial uses have caused water-level declines that, by 1993, had created conelike depressions in the water-level surface around major pumping centers near the Towns of Accomac, Cape Charles, Cheriton, Chincoteague, Exmore, and Hallwood, Virginia. Increased water withdrawals could adversely affect the supply of fresh ground water on the Eastern Shore.¹⁰ The Virginia Administration Code 9 VAC 25-780 (Planning Regulations) states that localities: must "...encourage, promote, and develop incentives for alternative water sources, included but not limited to desalinization." Despite decreasing production costs, desalinization *remains expensive*, as it requires enormous amounts of energy.¹⁴

Conclusion

The Eastern Shore of Virginia Ground Water Committee** is the Shore's advisory body and monitor of water conditions. USGS, DEQ and the Committee's own 2021 Project Priorities document emphasize the need for increased Shore-wide data, more information sharing, more testing, and more monitoring of drawdown impacts and of saltwater intrusion. Consequently, the DEQ recently reduced the amount of a withdrawal permit (*see February 2024 ShoreLine*) for a poultry processing plant. The Committee ought to be the Shore's voice to persistently seek policy changes, both with DEQ and the General Assembly, to protect water resources—including use of the upper Columbia aquifer for agricultural and industrial operations. And the Committee can regularly report to the community on the status of its work. 

*For USGS modeling: Interactive Map: Monitoring Virginia Eastern Shore Groundwater Conditions | U.S. Geological Survey (usgs.gov)

**The Ground Water Committee was formed in 1990 to study and plan for groundwater protection and to serve as an educational and informational resource to local governments and residents of the Eastern Shore. The 11-member committee, made up of elected officials, Staff and private citizens, meets on the third Tuesday of each month from 10:00 AM to noon at the Chamber of Commerce Building, Rt. 13, Melfa. No meetings in July or December. Some A-NPDC/Ground Water Committee sources not currently online are available by request.

NB: Footnoted sources for this article can be found on the CBES website, or can be sent by email upon request.



RECYCLING CORNER

By Sue Mastyl

Paper – and Glass

Paper Products

As was discussed in the June 2020 *ShoreLine*, it's important to reduce and reuse paper products. Use clean rags or old towels instead of paper towels. Use cloth napkins instead of paper. And there are alternatives to toilet paper as well, including bidets.

These products have a large environmental footprint. The Canadian boreal forest, the world's largest intact forest, is being cut down for our paper products – the United States accounts for 65% of Canada's pulp and paper exports. And in the 20 years up to 2015, 28 million acres – roughly the size of Ohio – were clearcut for these products. This logging destroys wildlife habitat and releases massive amounts of carbon, equivalent to 5.5 million cars on the road annually.

Natural Resources Defense Council (NRDC) recently issued the 5th edition of their "Issue With Tissue" scorecard, rating toilet paper, paper towels, and facial tissue on their environmental impact (<https://www.nrdc.org/stories/best-worst-tissue-brands>). The good news is that in the last 5 years, many new products are available, including those with 100% recycled content or bamboo fibers. Brands rated with a D or F include those from the "Big Three" – Georgia-Pacific, Kimberly-Clark, and Procter & Gamble – which still rely almost exclusively on forest fiber, resulting in 3 times the carbon footprint compared with those made from recycled paper.

Update on Glass Recycling

As mentioned in the January 2024 *ShoreLine*, Northampton County has been collecting glass separately at all 6 convenience centers, which was used to fill pot-holes and as landfill lining. When there was no need, it was disposed of as trash.

Recently, the County announced they have entered into an agreement with Davis Disposal, to collect the glass and transport it to O-I Glass in Toano for recycling. The arrangement is on a trial basis, to confirm the logistics and the cost.

We are encouraged that both counties are now moving forward with glass recycling.

Clarification

The Peregrine Falcon-level donation (\$200-\$499) from Brian Hickman should have read: Brian Hickman & Lisa Moore. Thank you to all who donated to the 2023 Annual Appeal. CBES is grateful for your support.



Rosemary Shortbread

Is there anything still green in the garden as winter struggles toward the sun warmth of spring? Parsley is usually still valiantly thriving – and the workhorse of the herb pots, rosemary, season after season, is dependably providing flavor and fragrance for the kitchen. Shortbread brings to mind sugary, rich cookies – holiday treats. But savory shortbread is every bit as delicious, adding a luxurious indulgence to the aperitivo hour. And a special bonus for the chef are the wonderful aromas as these shortbreads are prepared – the toasting almonds and the fresh rosemary. This recipe makes 2 to 3 dozen, but is easily doubled. Shortbreads freeze well.

- 1 stick butter, sliced
- ¼ cup toasted, ground almonds
- 1 cup flour
- 1 1/2 tbsp sugar
- 1 heaping tbsp finely chopped rosemary
- 2 tbsp grated Parmesan cheese
- 1 egg

Toast and grind the almonds (sliced almonds work fine), and finely chop the rosemary. Rub the sugar and chopped rosemary between your fingers until very aromatic and moist. In a food processor, combine all but the egg, and pulse until mixture is combined and looks crumbly. Add egg and pulse just until dough forms. On a lightly floured board, gather dough into ball, wrap in wax paper, and refrigerate for an hour or so. Working with half the dough at a time, roll about 1 tsp dough into balls between your palms, and set on parchment-covered baking tray. Press flat with sugar covered bottom of glass – leave space between shortbreads. Bake in pre-heated 350° oven for 15 to 20 minutes, until golden.

Mary Miller – The Kitchen Hive

Reprinted with permission: <https://www.talkrealnow.com/tortellini-with-roasted-mushroom-sauce/>

Shore Mentors Aid in Student Achievement

Submitted by Susan Burger, Northampton County Shore Mentors Coordinator
and Barbara C. O'Hare, CBES Board Member

In the spring of 2022, Ami Butta, who worked as a school social worker for 2 years in Northampton County Public Schools; Susan Burger, also a social worker, who had led several volunteer-driven programs in Maryland; and Clare Nowakowski, who worked in education-related nonprofits, recognized that the aftermath of COVID left students with significant achievement deficits, as well as struggles with attendance and mental health. In a school district that already had challenges, these women saw that volunteers in the schools to mentor and tutor students would be a valuable resource. As a result, Northampton County *Shore Mentors* was started.



The first year of operation was challenging for *Shore Mentors*, as everyone involved figured out how it would work. Mentoring programs had been initiated in the past in Northampton County without long-term success. It was the persistence of Ami, Susan, and Clare; the patience and commitment of the volunteers; and new school-district leadership that made it happen.

Information sessions are held in Northampton County periodically to inform people about the program. Those who are interested in pursuing the opportunity further are provided with 2 hours of training plus ongoing support. They undergo a standard vetting process through the school division. Once the volunteers are trained, cleared, and individually interviewed by Ami, Susan, or Clare, *Shore Mentors* provides the schools with information about the volunteers' background, expertise, credentials, and preferences, so that a successful assignment can be made that contributes to the program's success; a happy volunteer who feels useful and appreciated for what they have to offer benefits everyone.

In the 2022-23 school year, 12 volunteers were placed in the schools to work individually, in small groups, and in classrooms with students at Kiptopeke Elementary School, the Middle School, and the High School. Some of these volunteers, former teachers themselves, helped to mentor new teachers; and some helped students who had missed school and needed to do make-up work. Each volunteer made a commitment to volunteer for 1 to 3 hours per week, on the same day and time each week, so that the students and teachers could expect to see the volunteer; the fulfillment of that expectation enabled students to look forward to seeing the volunteer and to build an ongoing relationship.

In the 2023-24 school year, the program has shifted to a more classroom-based model, but volunteers continue to make the same commitment. Rather than students being pulled out of class, volunteers are more likely to work with

small groups in the classroom. This school year, *Shore Mentors* has expanded to all the schools in the Northampton District, placing volunteers at Occohannock Elementary School and as tutors to student athletes at the high school after school hours.

A majority of last year's volunteers returned this school year, and a total of 25 volunteers are either assigned or in the process of getting background clearances. The volunteers report feeling personally satisfied and feel that they are making a difference. Research shows that this kind of volunteer program and the forming of relationships with students and staff have a positive impact on students' attendance and performance (<https://youth.gov/youth-topics/mentoring/benefits-mentoring-young-people>).



Anyone wanting more information or who is interested in volunteering can contact Susan at sfriedbur@gmail.com for more information. Men and women are welcome; all must be over 21 years of age and have reliable transportation. 🐦

Late Mail? Here's Why

By Mary Miller

A combination of staffing issues, postal service "operational complications," a Federal overhaul of the service, transportation vendor problems, and the increased winter holiday mail load led Virginia Senator Tim Kaine to declare, "The Postal Service in Richmond is broken" (<https://www.wtvr.com/news/local-news/problems-with-postal-service-richmond-virginia-feb-2-2024>).

CBES members may have noted that their mailed *ShoreLine* issues, renewal notices, donation acknowledgements, and tax letters have been delayed. Across the region, postal patrons have received delayed or non-delivery of everything from jury duty notices to holiday cards, to utility bills, to medical test results.

In the face of non-response and inaction by Richmond Postal Service management, Senator Kaine and Richmond's Commonwealth's Attorney, Colette McEachin, organized public Town Hall meetings – with or without the Postal Service – in an attempt to bring attention to the wide-ranging problem of unacceptably slow mail deliveries. Foot-dragging and non-response from the Richmond Postal Service management has led Senator Kaine to conclude: "...we're going to make it more and more public until: a) we get answers; and b) we get improvement."

Senator Kaine's office can be contacted with comments about postal issues and encouragement for his efforts: <https://www.kaine.senate.gov/contact/share-your-opinion>. You may also contact him at (202) 224-4024. 🐦

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WE HAVE WINNERS!

Many wanted to be the winner of the Between the Waters 2023 Painting by Bethany Simpson Durham, but it was Christy Smith of Machipongo, VA, who took home the prized artwork.

Thanks to all who supported the raffle – which raised over \$2,000 – for the artwork that Bethany donated to CBES.



Christy Smith with her son, Wade

Jaime T. Barnett of Roanoke, VA, won the drawing for 2 free Bike Tour Registrations. All 2023 Between the Waters Bike Tour cyclists who participated in the post-tour survey were entered. Survey results help CBES enhance the event and sometimes secure grant funding.

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