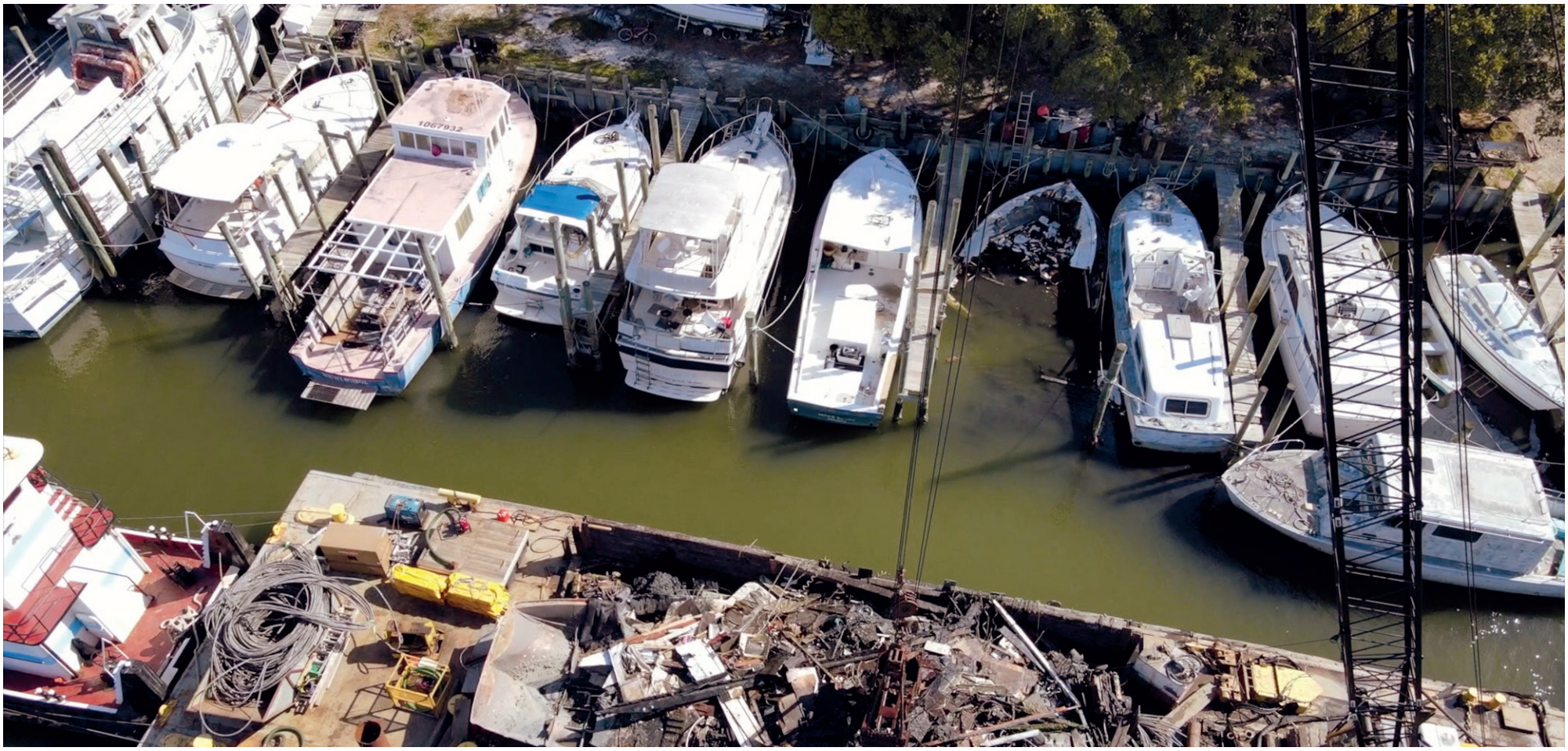

VA waters filled with debris when owners abandon ship

State considers strategies for funding more boat removals, providing better disposal options

By Whitney Pipkin

Whether lurking as hazards beneath the water's surface or becoming eyesores as they drift ashore, abandoned boats are a growing problem in Chesapeake Bay waters — especially in Virginia. And they're not as easy to get out of the water as they were to put in.

The U.S. Coast Guard has documented 170 abandoned and derelict vessels in Virginia waters since 2013, and state officials are building a list of even more that need to be removed.

Some boats are set adrift by storms and, in the absence of a fastidious owner, stay that way for months or years. Recreators who bought a boat during the pandemic may be realizing they no longer want to or can afford to maintain one.

Photo: The Vessel Disposal and Reuse Foundation removed this abandoned boat that had been disintegrating in the marina where it was stored near Dockside Seafood & Fishing Center in Virginia Beach, VA. (Courtesy of the Vessel Disposal and Reuse Foundation)

But one of the biggest concerns involves boats built during the affordable fiberglass boat boom that began in the 1960s, which are reaching the end of their lifespans. The number being abandoned appears to be on the rise.

"When luxury is built in," reads one 1980 ad for a 37-foot cruiser with a fiberglass hull, "it doesn't wear out." Made with reinforced plastic-and-glass materials, these boats don't blend into a marshy shoreline as they decompose, like their wooden forebears. Instead, they persist in the environment, shedding microplastic particles and leaching toxic materials over time.

The boats often end up left in a marina or set adrift because the owner feels like there aren't other options for disposal. Getting rid of a defunct boat can easily cost more than the boat is worth.

Unlike old cars, whose mostly metal frames can be sold or donated for scrap materials, the fiberglass components of a boat "are practically worthless and tend to cost more to remove, prepare for disposal and dispose of than their parts are worth," says a recent report from the Virginia Coastal Policy Center at William & Mary Law School.

Abandoned boats pose navigation problems for other boaters and are hazardous to the environment. Some slowly disintegrate in the marina where an owner has left them. Others drift into marshes or are purposely sunk near a shore. Fuel, oil, paint, sewage and chemicals leaching from batteries and cleaners onboard threaten the environment as the vessel drifts or sinks.

Not to mention, "the longer it's out there, the more expensive it is to remove," said Karen Forget, executive director of Lynnhaven River NOW, who has for years received calls from residents concerned about sinking or stranded boats near Virginia Beach. "They want us to come up with some kind of solution for what to do with it."

Once a boat is dead in the water, removing it costs thousands of dollars — even tens of thousands, depending on where the boat is located and how much it has already disintegrated. And getting it back out of the water — whether by towboat, crane or claw — comes with all sorts of red tape.

The Lynnhaven group, along with Virginia's Coastal Zone Management Program and the Clean Virginia Waterways project at Longwood University, has applied for a grant from the National Oceanic and Atmospheric Association's Marine Debris Program to fund more boat removals. The federal program funneled nearly $2 million into 10 marine debris removal programs in states in 2021, helping them tackle a backlog of derelict vessels decomposing in their waters.

The Coastal Zone Management Program, operated under Virginia's Department of Environmental Quality, has largely completed a report on the status of the state's abandoned boat problem. First drafted in the fall, the document includes policy suggestions for giving boat owners better options for disposal, funding removals and addressing the underlying issues contributing to an uptick in abandoned vessels.

As of late May, the report was waiting for approval by Gov. Glenn Youngkin's administration.

Meanwhile, the agency has been working on an inventory of abandoned boats to help prioritize removals once funding becomes available.

But Laura McKay, manager of the coastal management program, said the problem continues to grow.

"We have got to turn off that faucet, or we're just in big trouble," she said.

Bootstrapping boat removals

Mike Provost had recently retired from the U.S. Navy when he got curious about an abandoned 36-foot cabin cruiser left tied to a tree in Long Bay Pointe off the Lynnhaven River.

"I made a couple calls and quickly determined no one was going to do anything about it," he said.

Virginia's current approach to the problem of abandoned vessels is piecemeal and painstakingly slow. The authority to remove vessels is divided among several agencies, depending on where the boat is located and other factors. That leaves many structures in limbo as to who's responsible for removal.

So Provost began fundraising to remove the boats himself, ultimately starting a nonprofit, the Vessel Disposal and Reuse Foundation. He raised the $11,000 needed to remove that first boat, which eventually ran aground at First Landing State Park, with a GoFundMe page.

Since late last year, the organization has removed nine boats from the Lynnhaven River area. Many of them had been there for years. Provost learned a lot from that first removal and has since worked with a marine salvage contractor to do the heavy lifting.

If the boat were to leak oil while being removed, the person or group removing it bears the liability in many cases. If the person abandoning the boat did so illegally, they may have also removed any identification that would help find and transfer legal ownership of the vessel.

Through tracking down boat owners, Provost has developed a better understanding of the types of situations that lead them to abandon their vessels. Most, he said, are elderly, facing financial trouble, physically or mentally handicapped or addicted to illegal substances.

Provost estimates that his organization has removed more than 85,000 pounds of marine debris from waterways so far.

"That's like removing tons of beach trash, which is crazy to me," he said.

He's already begun raising an additional $75,000 to remove the next batch of vessels with plans to tackle a "boat graveyard" in the North Landing River, where an estimated 13 boats have been abandoned next to a natural area preserve.

Mike Provost, founder of the Vessel Disposal and Reuse Foundation, worked with Portsmouth, VA-based marine contractor H&H Enterprises to do the heavy lifting for recent boat removals. The crews removed five derelict vessels over two days in April. (Courtesy of the Vessel Disposal and Reuse Foundation)

Provost knows he can't keep up with the ever-growing inventory of abandoned boats if the underlying issues aren't addressed, and he hopes the state efforts will start to stem the tide.

Though Virginia considers it a Class 3 misdemeanor to abandon a vessel in a waterway, the $500 fine is much less than the potential cost of removing it. Without a clear process for safe disposal, many people abandon their boats out of desperation.

In the Chesapeake watershed, only Maryland has a steady source of funding to remove abandoned vessels, according to NOAA's Marine Debris Program. Maryland has for years funded its abandoned boat and debris program through a 5% excise tax on all boats purchased in the state. The money helps keep channels dredged for boat navigation and provides up to $500,000 per year for removing abandoned vessels, according the Virginia Coastal Policy Center report.

Florida, California and other coastal states have also developed ongoing funding mechanisms to pay for the removal of derelict vessels.

A draft of Virginia's abandoned vessels report suggests the General Assembly steer more funds toward boat removals, possibly through a new fee paid when a boat is registered. Those funds could also support programs to improve disposal options and prevent abandonments.

The Coastal Policy Center's paper suggests that Virginia legislators could also approve a "liability shield," similar to Maryland's, that protects agencies and individuals from the financial and legal risks associated with the removal of abandoned vessels.

Disposal options

Boat owners who want to dispose of a vessel properly will find it's not easy in Virginia. State websites don't offer guidance, leaving boat owners to call around and ask if local landfills will accept a large fiberglass hull they can't dispose of elsewhere.

Acknowledging that this is a problem in multiple states, one website suggests cutting a fiberglass boat into pieces with a chainsaw so a landfill will accept it. Some companies also offer boat removal services.

"An old car has scrap value of a few hundred dollars. But old fiberglass boats — there's usually nothing salvageable or salable and it costs money to dispose of them correctly," said Katie Register, executive director of Longwood's Clean Virginia Waterways.

State officials are looking into whether fiberglass from vessels can be shredded and burned as fuel or to produce usable ash for cement manufacturing. Internationally, burned fiberglass wind turbines are providing alternatives to coal ash for some cement plants.

Rhode Island has a vessel-recycling program that helps fuel cement manufacturing there. Virginia officials have begun discussions with a local cement plant to that end. The plant could need environmental permits, though, such as one for air pollution, to conduct a pilot project.

Other states offer vessel turn-in programs that, once disposal options are arranged, can save state agencies the cost and effort of removing vessels that might otherwise become abandoned.

"It's much less expensive to dispose of a boat if someone turns it in and shows they own it," Register said. "It costs one-tenth as much as a boat that's been abandoned in the environment."

Abandoned vessels are just one source of pollution addressed in Virginia's overarching Marine Debris Reduction Plan, first created in 2014 and updated in 2021. The state has made progress tackling other forms of plastic pollution such as bags, polystyrene and balloons. But the abandoned boats problem has risen as a recent priority as fiberglass vessels age out.

"I would argue that all of these are priorities," Register said. "We can stop using [plastic] straws at restaurants and prevent pollution from fiberglass boats. It's an all-hands-on-deck situation." ■

Salt levels in drinking water could be near tipping point

Virginia professor leads 5-year effort to study problem in Bay states

By Whitney Pipkin

Stanley Grant, a civil and environmental engineering professor at Virginia Tech University, is leading a National Science Foundation-funded research effort from his post as director of the Occoquan Watershed Monitoring Lab in Prince William County, VA. (Whitney Pipkin)

Salt is in the food we eat, on the pavement under our car tires in winter, and in the powdered laundry detergent we use to wash our clothes. And an ever-increasing amount of that salt is ending up in local waters — waters that, by definition, should *not* be salty.

Yet across the world, sodium levels in freshwater rivers, lakes and reservoirs have been trending upward. The causes are difficult to pinpoint and will likely be even harder to reverse.

Recognizing how intractable the problem can be, the National Science Foundation in 2020 awarded a group of Chesapeake Bay area researchers a $3.6 million grant to tackle the issue as one of society's "grand challenges." Funded through the foundation's Growing Convergence Research program, the effort, now in its second of five years, has brought scientists and leaders from a range of backgrounds to the table to solve complex issues.

Freshwater salinization, as it's called, is certainly one of them. There are many sources of salt in a waterbody, ranging from salt and salt brine spread on wintry roads to home water softener systems. Wastewater treatment plants are designed to reduce levels of nitrogen, phosphorous and other pollutants from the water before discharging it, but rarely do they remove salt.

Although there are scientific methods for removing salt from water, such as reverse osmosis, they are energy-intensive and far too expensive for most water authorities to seriously consider using them in treatment plants.

Keeping salt out of the water in the first place, the experts say, is by far the best approach — though it's not an easy one. The Virginia Department of Environmental Quality spent years developing a management strategy to reduce levels of salt that were polluting Accotink Creek in Fairfax County. The effort aims to balance the safety benefits of road de-icing with the harmful impact of excess salt on living resources. It spells out steps that government, businesses and citizens can take to that end.

But winter road salt isn't the only source of the problem. Powdered laundry detergents, from those on supermarket shelves to homemade alternatives, often contain salt, which is then flushed with the wastewater to the nearest treatment plant or through a septic system. Industrial cooling systems, like those used at large data centers, include salt as a disinfectant in water. Wastewater treatment doesn't remove salt, so it eventually makes its way to the nearest creek, river or bay.

From aquatic life to drinking water

Stanley Grant, a civil and environmental engineering professor at Virginia Tech University, is leading the National Science Foundation effort from his post as director of the Occoquan Watershed Monitoring Lab in Prince William County, VA. The lab has been tracking rising sodium levels in the Occoquan Reservoir for decades.

Among the questions Grant hopes to address with the project is not just which methods work to reduce salt, but also which ones policymakers and the broader population will consider both palatable and achievable. And can the various stakeholders agree?

"We are a microcosm," he said from his office in the lab's nondescript building in Manassas, VA. "[But] the solutions that we develop here are absolutely translatable to many other water supplies and watersheds around the country and the world."

Also involved in the project is University of Maryland professor Sujay Kaushal, who first wrote about saltier waters in Maryland in a 2005 paper. He later began referring to the phenomenon, which he saw increasing across the country and the world, as "freshwater salinization syndrome," identifying a range of symptoms that accompany the condition. More have been discovered since.

"It's like a systemic illness the watershed is facing as it is fed a high-salt diet," he said.

Just as too much salt in a human diet can contribute to high blood pressure, heart disease and stroke, too much salt in a waterbody can have similarly damaging effects. Higher salt levels in freshwater can reduce biodiversity, increase the presence of certain salt-loving species and cause infrastructure such as pipes to corrode more quickly, for example.

And in waterbodies that supply drinking water, too much salt poses risks to human health as well as to the environment. While unnatural levels of salt might gradually impact freshwater systems, the impact on drinking water can be immediate. One day the water might not be too salty to drink, but the next day it will be. Researchers say it can be difficult and incredibly costly to return a waterbody to health once it's reached such a tipping point.

In the United States, the U.S. Environmental Protection Agency does not have a

Researchers at Virginia Tech are analyzing soil samples to see if certain plants can absorb salt. (Whitney Pipkin)

regulatory limit on sodium as a pollutant in drinking water. But the agency's guidance documents recommend that drinking water sodium levels remain less than 20 milligrams per liter for people on low-sodium diets and less than 30-60 milligrams per liter as a threshold for taste.

When water exceeds those thresholds, "you wouldn't necessarily call it salty, but it just starts to taste bad," Grant said.

Reservoir research

The Occoquan Reservoir is no stranger to such careful monitoring. It was already a source of drinking water when, in the 1960s and '70s, it became so polluted by development runoff and poor sewage treatment that the state stepped in to address the problems. As a result, several smaller sewage treatment plants in the area were consolidated to create the more advanced Upper Occoquan Service Authority, which could treat the water to a higher degree before discharging it into the waters feeding the reservoir.

"This was one huge experiment," said Tom Faha, director of the Virginia Department of Environmental Quality's Northern Regional Office, at a public meeting in June. "We were taking all of our wastewater for the area and treating it and discharging it into one of our primary water supplies."

To oversee the outcomes of that experiment — which at the time included a suite of new water quality regulations — the state created the Occoquan Watershed Monitoring Lab in 1972, the same year that legislators passed the federal Clean Water Act. The lab has been collecting water quality data ever since, recording the success of the early effort to use wastewater to help recharge a reservoir.

Wastewater treatment and runoff control practices have helped the reservoir maintain water quality over the years. But increased sodium levels have emerged as a threat, steadily rising since the lab's inception.

In recent years, sodium levels in the reservoir have begun to "routinely exceed" the federal drinking water advisory levels for both low-salt diets and occasionally for taste. The Fairfax County Water Authority, which serves more than 2 million people in the region, gets 30–40% of its drinking water from the reservoir.

The authority's other source of drinking water is the Potomac River, which is also getting saltier, though the impact is diluted for now by greater volumes of water. The Washington Suburban Sanitary Commission has recorded a 230% increase in salt levels in the river over the past 30 years.

Above: The Occoquan Reservoir supplies 30–40% of the drinking water to the Fairfax County Water Authority, which serves more than 2 million people. (Stanley Grant)

Right: A truck spreads salt during a winter storm. Road deicing is a major source of salt pollution in waterways, but not the only one. (Dave Harp)

"We have an urbanizing watershed that we're also using as a water supply, and that is inherently a conflicting situation," Grant said during a presentation this summer to the Prince William County Board of Supervisors. "How close are we to getting to the point where we have one more needle on the camel's back, and we have a problem?"

Meanwhile, the county board has been on the cusp of making zoning changes that would allow more intense development on a 2,100-acre swath of the watershed for the Occoquan Reservoir and Bull Run, a tributary of the Potomac. Those changes could pave the way for dozens of warehouse-like data centers where there used to be farmland, forests and widely scattered homes.

Environmental groups have opposed the projects for several reasons, but chief among them is their potential impact on water quality. The correlation between development and saltier waters is well-established.

The more parking lots, buildings and roads, the higher the amount of sodium chloride in the water — and not just in winter, Kaushal said. As a chemical element that can take many forms, sodium can seep with groundwater over time, interacting with other chemicals along the way.

Some of the more promising solutions for removing salt from the environment are natural ones. One of Kaushal's students is publishing a paper on how forests decrease sodium levels in the water as it filters through the ecosystem. This is similar to the way trees absorb nutrients, but the process is more complex, with electrical interactions between certain elements.

Megan Rippy, an assistant professor of civil and environmental engineering at Virginia Tech University and a co-principal investigator on the National Science Foundation salt project, is studying whether certain plants can absorb excess salt in stormwater retention ponds. Based on soil and water samples so far, cattails could be among the best native salt accumulators, she said.

But even environmental functions like these can be negatively impacted if there is too much salt in the system. Just as salty foods make humans thirsty, too much salt can dehydrate some plants, reducing their ability to survive and filter other pollutants. In the water, salt can be detrimental to aquatic organisms that live in systems that are supposed to be either freshwater, saltwater or a mix of both.

Researchers who are still grappling with the issues say there are no simple solutions. The main goal of the Science Foundation project is to learn whether — in the absence of regulations that restrict salt in runoff and wastewater — stakeholders can agree on what constitutes too much and at what point they're willing to do something about it. That includes all the humans who live in a watershed.

"We're salty creatures," Kaushal said. "We require salt when we build things, eat things, dispose of things, so we all play a role in this." ■

For tips on reducing your salty contributions to the environment:

- *Visit the Izaak Walton League at iwla.org/water/stream-monitoring/salt-watch.*
- *Visit the Northern Virginia Regional Commission at novaregion.org/1489/Residential-BMPs.*

Protecting the water while harvesting the sunshine

Researchers say stormwater runoff from large solar arrays needs careful management

By Whitney Pipkin

Above: This solar facility, built by Utah-based Sustainable Power Group, or sPower, in Spotsylvania County, VA, covers more than 6,000 acres.

Right: Exposed soil was pervasive at the site in early 2021, before vegetation was planted to reduce runoff. (Photos by Hugh Kenny/Piedmont Environmental Council)

Solar panels are going up across the Chesapeake Bay watershed to help states reach their renewable energy targets. But, while working to achieve climate-related goals, solar fields have the potential to generate water pollution — through increased stormwater runoff.

And, until recently, little work was being done to understand the impact of solar fields on the way stormwater runs off the landscape and into local waterways.

As the science begins to come in, policymakers in Virginia are grappling with a dilemma: How much should solar fields be subject to stormwater controls? It's a pressing question because solar development in the state is charging ahead. The state ranked fourth in the nation in 2021 for its pace of new solar installations, and hundreds of thousands of acres there could be given over to solar projects in the coming years.

The crux of the problem lies with whether solar panel arrays should be considered pervious or impervious land cover. Pervious areas allow water to soak into the ground. Impervious areas, like roads, rooftops and parking lots, do not. Polluted runoff from those hard surfaces causes problems for waterways across the Bay region — making them subject to regulation.

Solar fields have both pervious and impervious elements: often enormous acreage covered by the panels and a range of soil conditions and groundcover below them.

Many states consider solar fields pervious, which cuts regulatory red tape. Also, the volume and velocity of runoff from the panels falls somewhere between that caused by farmland and parking lots, depending on the type of groundcover under the panels. That makes solar facilities difficult to regulate under existing models.

"There is a whole lot of science around stormwater regulation, but not for the kind of land use that is a 'solar farm,'" said Brian Ross, vice president of renewable energy for the Great Plains Institute for Sustainable Development, a Minnesota-based firm researching ways to improve renewable energy.

In the Chesapeake watershed, Maryland and Pennsylvania have policies that either consider the panels pervious under most conditions or exempt them from being considered impervious for the purpose of stormwater management.

Until March, Virginia did, too. That's when the state's Department of Environmental Quality Director Mike Rolband announced that solar projects there would be subject to stronger post-development stormwater regulations, effective immediately.

In a memo announcing the change, Rolband said that treating solar installations as pervious cover could "underestimate the post-development runoff volume or runoff rate from solar panel arrays, which in turn has the potential to negatively impact downstream waterways or properties." He noted that the Chesapeake Bay Program considers solar fields "unconnected impervious" when calculating the impact of land use on water quality in the Bay and its rivers.

Industry concerns rose quickly. Two weeks later, the agency said it would allow more time for projects to comply and indicated that stakeholder feedback would be considered in shaping how the policy will be applied.

The agency guidance document is awaiting approval.

As it stands, David Murray, director of solar policy for American Clean Power, said the changes Virginia regulators proposed for dealing with stormwater could require solar facilities to acquire 20% more land for projects to offset the impervious areas. That would have "a significant impact," he said.

Research that could help inform such decisions is just beginning to come out.

Seeking science

Decisionmakers are looking to the scientific community for more research that could help balance the need for cleaner energy with commitments to improve water quality.

So far, studies indicate that one of the biggest factors in reducing the impact of solar panels on runoff could be the types of soil and groundcover under them. But places that may be ideal for solar development from a big-picture perspective — using former industrial sites, for example — are often not the most economically attractive. Also, the regulatory landscape leaves solar placement decisions to individual land owners, zoning boards and county officials, all of whom stand to benefit from leasing to solar suppliers, if only indirectly in the case of county officials.

Seeing the smattering of different regulations facing solar development, the U.S. Department of Energy contracted the Great Plains Institute to study how stormwater runs off solar panels on a variety of landscapes. Their study measured how water runs off solar installations in five states, each with soil types ranging from rocky to sandy to clay-based.

In their nearly complete three-year effort, researchers found that one of the best ways to reduce problems with stormwater runoff from solar sites is to avoid compacting the soil during construction. Driving heavy equipment across a site or grading it has an outsized impact on the volume of runoff both during and after construction.

The soil type also matters a great deal. Sandy soils, like those of Minnesota where one research site was located, can quickly absorb rainfall coming off solar panels. Clay soils, like those studied in New York, struggle to absorb runoff if they are compacted or lack vegetation.

One of the best practices that nearly every site can apply is to grow the right kind of vegetative cover under the panels, preferably native grasses with deep roots that can reduce soil compaction. Spacing solar panels farther apart to provide more land to absorb the stormwater also helps, but less so than researchers originally thought. And it's one

In this 2020 photo, Steve Levitsky, then Perdue's Vice President for Sustainability, walks through the pollinator garden that surrounds the company's solar array in Salisbury, MD. (Dave Harp)

of the more-expensive mitigation tools.

The research did not study sites with bare earth under the panels "because we already know from stormwater research what that will give us," Ross said, a nod to sediment easily running off such properties.

But when vegetation covers the landscape under and around solar panels, "in almost every case, you are better off [from a stormwater perspective] with well-managed solar than with agriculture," Ross said. "Converting forest to solar is a very different circumstance. From a stormwater standpoint, the best groundcover you can have is forest."

The researchers have produced a best practices document and will soon release equations to calculate runoff from different solar practices. An instruction manual for implementing the findings at various locations is due out this fall.

There's little a solar developer can do about the soil type once a property is leased for solar construction, so more stormwater mitigation could be needed on some sites. National soil maps could help guide decisions about where to locate solar in the first place, Ross said.

Research like this "places more emphasis on finding sites that are suitable — not just considering where it is on the [energy] grid, but also taking water quality into account," Ross said.

If solar developers don't consider soils, previous land use and stormwater dynamics when selecting a site, "are [they] going to create costs for someone else who's regulating water quality?"

The solar industry also has a taskforce researching best practices for reducing stormwater impacts. Most of the measures considered best practices by researchers, though, are not required by localities.

Bay perspective

Meanwhile, the Chesapeake Bay Program, the state-federal partnership leading the Bay restoration effort, is studying how the conversion of land to solar fields will impact the region's ability to reach water quality goals.

Officials confirmed that, for calculations in the Bay Program computer model, solar sites are defined as "unconnected" impervious surfaces to account for spacing between panels. But the specifics of how solar acreage is incorporated into the model could change after additional research.

"There is the guidance on how solar should be installed and managed, but then there is the actuality of it. There may be a wide variety of compliance to those recommendations," said Peter Claggett, a researcher with the U.S. Geological Survey who coordinates the Bay Program's Land Use Workgroup. "And it's not clear to us which of these solar facilities are done well and which aren't."

The Bay Program will offer a workshop this fall to answer some of these questions and better inform the model that demonstrates how these types of changes impact water quality.

Virginia legislators are conducting another set of meetings on the subject this fall with what one senator called "the mother of all stakeholder groups." House bill 206 required the DEQ to assess the impact of smaller renewable projects on prime agricultural and forested lands, then propose mitigation measures.

Some organizations wonder if the effort will be too little, too late to keep pace with solar development while efforts are under way to meet Virginia's share of the 2025 Bay cleanup goals.

The nonprofit Piedmont Environmental Council is particularly concerned about the impact of solar development on what they consider Virginia's prime soils.

If those soils are compacted or graded, "you forever alter the runoff characteristics of that property, because you're changing the absorption rate of that soil as well," said Dan Holmes, a consultant on solar issues for PEC.

Holmes points to the largest solar installation recently built in Virginia on 6,000 acres in Spotsylvania County as an example of such projects bring sweeping change to land use. The site was previously used for rotational timber harvesting, so the land use change was considered significant. Virginia's State Corporation Commission had to sign off on it, and large stormwater retention ponds were required to filter runoff from the site.

Solar development in the state, if it continues at this pace, would represent "the biggest land use change we've ever seen," PEC President Chris Miller said.

Although technological innovations make energy generation more efficient, Miller said current projections (based on 1 megawatt of power being generated from seven to 10 acres of solar) indicate that 200,000–300,000 acres could be converted to solar fields in Virginia.

"That's bigger than Shenandoah National Park," Miller said. "So, for us, that's a land use problem that we have to consider in aggregate, not just on a site-specific basis. Like everything else, it's the sum of the acres." ■