2023 Annual Programmatic Status Report on Climate Change

Maryland Department of the Environment
In accordance with §2–1305 of the Environment Article
Submitted December 28, 2023
Governor and Maryland General Assembly

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Introduction

The Maryland Department of the Environment's (MDE) Annual Climate Change Report is written in accordance with Maryland Environment Article §2-1305. This law requires certain state agencies, as well as one subdivision of the University of Maryland, to report to the Governor and the Maryland Commission on Climate Change (MCCC), as well as the General Assembly in accordance with §2–1246 of the State Government Article, on the status of programs that support climate change efforts.

This report summarizes the programs that MDE leads to make progress on Maryland's greenhouse gas (GHG) reduction efforts and adaptation efforts. It also includes updates on recent regulations, laws, and initiatives. Maryland has been a leader in the fight against climate change, with the first comprehensive Climate Action Plan published in 2008, followed shortly by the first Greenhouse Gas Reduction Act (GGRA) law in 2009, along with participation in the Regional Greenhouse Gas Initiative (RGGI).

Maryland is Vulnerable to Climate Change

With 3,100 miles of shoreline, Maryland is vulnerable to the effects of sea level rise associated with climate change. Rising sea levels and increased storm duration and intensity could have far-reaching impacts on the Atlantic coast and the Chesapeake Bay ecosystem that affect the environmental, recreational, and economic benefits enjoyed by Maryland and its visitors. Although Maryland's coastal areas are particularly vulnerable, all areas of the state are at risk. In general, climate change alters the severity, frequency, and distribution of existing issues that are directly or indirectly impacted by temperature and precipitation. This includes, but is not limited to:

- Impacts on coastal, bay, and inland water quality parameters that may change the viable uses of surface water, such as for irrigation, recreation, or human consumption;
- More frequent disruptions to urban and coastal infrastructure caused by extreme weather events and sea level rise that may indirectly impact the Maryland's economy by restricting the flow of goods and affecting days worked;
- Common stressors experienced among ecosystems, agriculture, fisheries, and forestry such as those caused by general changes in temperature and precipitation regimes, increased extreme weather events, and increased pressures from weeds, diseases, and pests;
- A higher probability of negative outcomes for disadvantaged/environmental justice (EJ) communities and individuals inherently more sensitive or with a reduced adaptive capacity for responding to the impacts of climate change; and
- Human health is affected by impacts on air quality, food and water supply, and extreme weather events.

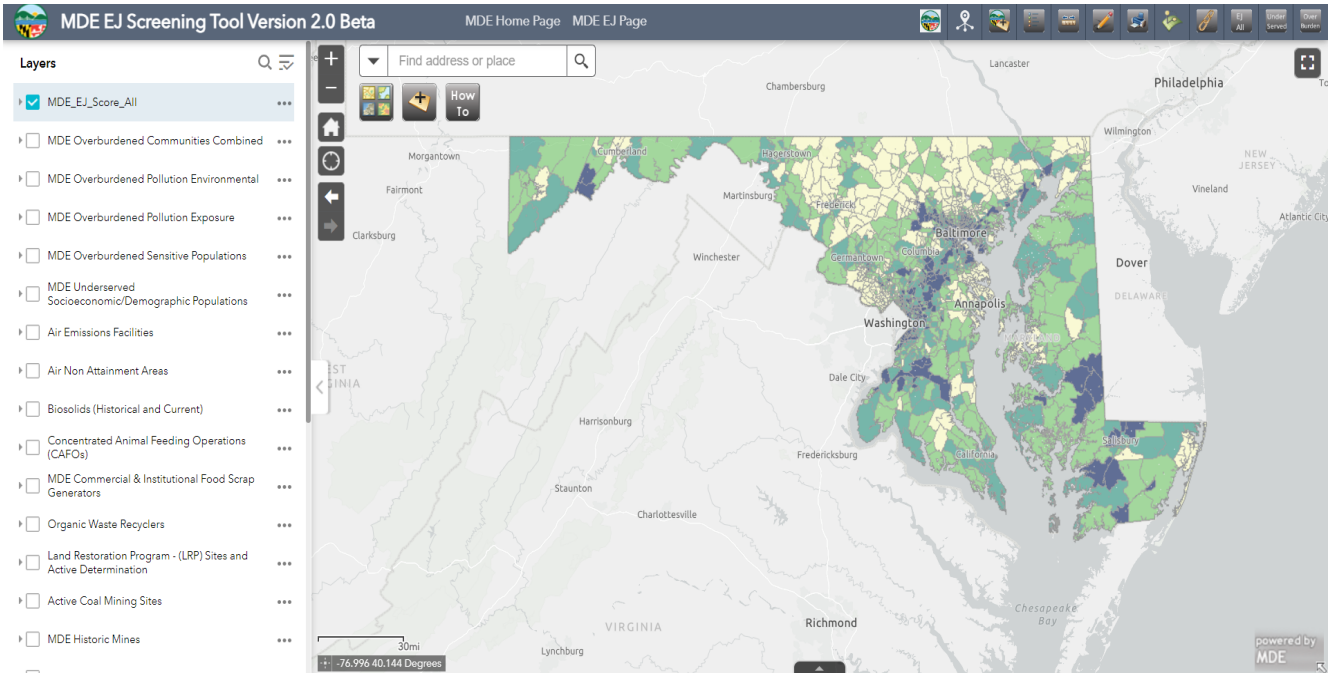
Environmental Justice

Environmental justice (EJ) is a priority for MDE, which seeks the fair treatment and meaningful involvement of all people regardless of race, color, culture, national origin, income, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. MDE implements laws and programs to protect and restore the environment for the health and well-being of Marylanders. Many studies show that EJ[1] communities bear a disproportionate share of the negative environmental consequences resulting from industrial activities, land use planning and zoning, municipal and commercial operations, or the execution of federal, state, local initiatives. MDE supports the goal of achieving environmental equity alongside climate progress for all Maryland residents through recognition, procedural, and distributional justice.

MDE Secretary McIlwain at an Environmental Justice Listening Session

MDE has initiated enhanced compliance monitoring, capacity building, enforcement, and compliance in communities with EJ concerns, such as Cheverly, Curtis Bay and Turners Station, and has developed enhanced communications and outreach for permitting actions in communities with EJ concerns. MDE also created an EJ Screening and Mapping Tool that provides data on communities with EJ concerns. In 2023, MDE updated its MDE's EJ mapping tool[2] and continued actions to devote greater attention to underserved communities. MDE will continue its multi-administration efforts to conduct additional compliance monitoring and enforcement, but also will use all these tools and strategies to provide infrastructure investments prioritized for communities with EJ concerns.

[1] Environmental Justice at MDE, https://mde.maryland.gov/Environmental_Justice/Pages/Landing%20Page.aspx
[2] MDE Environmental Justice Mapping Tool, Accessed December 1, 2023, mdewin64.mde.state.md.us/EJ/



MDE EJ Screening Tool Version 2.0

MDE's EJ Workgroup was formed on March 8, 2021 to lead the implementation of the MDE EJ Policy and Implementation Plan (MDE EJ Policy). The formation of the MDE EJ Workgroup was one of the early action items in the MDE EJ Policy. The objectives of the MDE EJ Policy are to reduce existing inequities and prevent future inequities in the environmental burdens carried by EJ communities. MDE's EJ Policy set near-term and longer-term action items for the MDE EJ Workgroup to achieve.

To date, the MDE EJ Workgroup has developed a plan for enhanced compliance monitoring and continues to develop a plan for enhanced communications and outreach for permitting actions in EJ communities. Future actions by the MDE EJ Workgroup include developing a plan to identify EJ community funding opportunities and to ensure more available funding for environmental restoration activities in EJ communities. Measures to track and evaluate the progress of MDE EJ Workgroup initiatives will also be developed and implemented to help ensure continued progress in meeting the goals of reducing existing inequities and preventing future inequities in the environmental burdens carried by EJ communities. MDE's EJ Workgroup will also be considering climate change impacts on EJ communities as it completes additional action items. This may include additional compliance monitoring and enforcement elements as well as factoring climate change impacts into EJ community funding, and other initiatives.

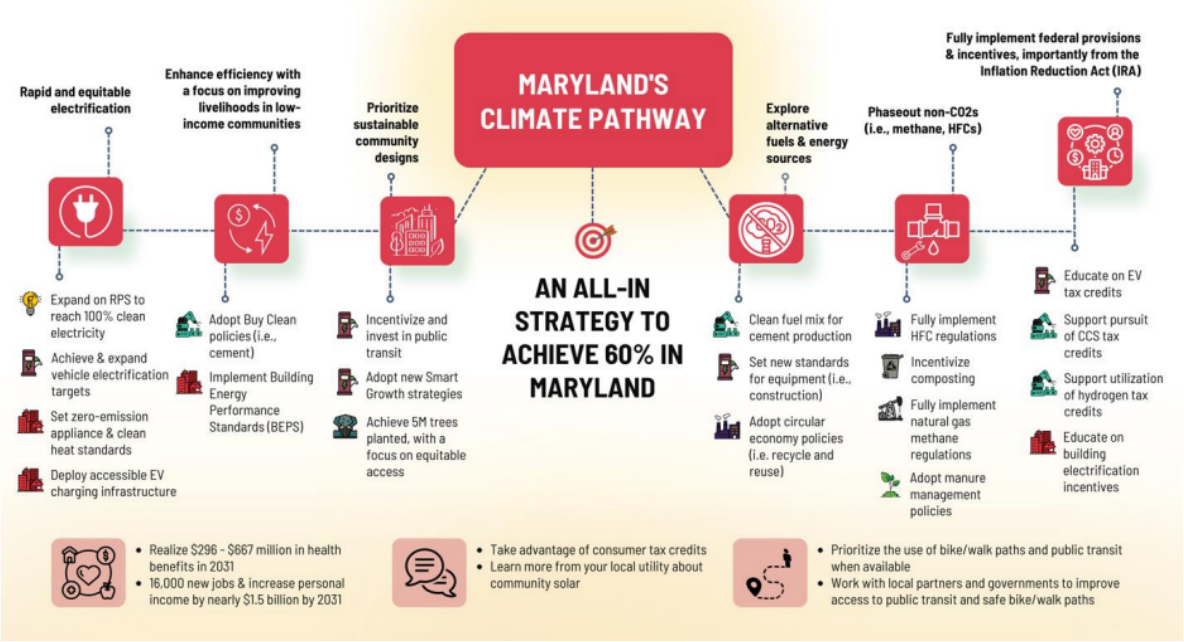
Air and Radiation Administration (ARA) Programs and Initiatives

Climate Change Program

The Climate Change Program[3] manages a wide range of activities for MDE that includes supporting a Commission, Task Force, and implementation of new measures relating to climate change mitigation.

Greenhouse Gas Reduction Planning

In 2022, the Climate Solutions Now Act (CSNA) became law, requiring MDE to develop proposals that would allow the state to reach a 60% greenhouse gas (GHG) emission reduction, compared to 2006 levels, by 2031 and net zero by 2045[4]. During 2023, the Climate Change Program had two major deadlines: a proposed plan[5] to reduce emissions 60% by 2031 by the summer, and a final plan to reduce emissions 60% by 2031 by the end of the year.



Maryland's Climate Pathway Report Figure on Achieving 60% Emissions Reduction

[3] Climate Change Program, https://mde.maryland.gov/programs/air/ClimateChange/Pages/index.aspx
[4] Greenhouse Gas Emissions Reduction Planning in Maryland, https://mde.maryland.gov/programs/air/ClimateChange/Pages/Greenhouse-Gas-Emissions-Reduction-Act-(GGRA)-Plan.aspx
[5]MDE and University of Maryland Climate Pathway Report, https://mde.maryland.gov/programs/air/ClimateChange/Documents/MARYLANDS%20PATHWAY%20REPORT%20AND%202031%20GHG%20PLAN/Maryland%27s%20Climate%20Pathway%20Report.pdf

The Maryland Commission on Climate Change (MCCC)

The MCCC[6] is a multi-stakeholder and independent body in the state that informs some of the state's climate change initiatives. MCCC was codified in law in 2015 and is composed of state government agencies, the legislature, local government, business, environmental nonprofit organizations, organized labor, philanthropic interests, and the university system. By serving to facilitate multi-agency, executive-level dialogue, the MCCC establishes a framework for collaboration on planning development. MCCC offers policy recommendations in its yearly report to the General Assembly[7].

MCCC serves as a forum for public dialogue on critical issues associated with climate change policy. Meetings are open to the public, giving all stakeholders and advocates an opportunity to participate. MCCC has four active working groups: The GHG Mitigation Workgroup, the Adaptation and Resilience Workgroup, the Scientific and Technical Workgroup, and the Education, Communication, and Outreach Workgroup. The GHG Mitigation working group develops GHG reduction recommendations. The Adaptation and Resilience working group develops resilience recommendations for dealing with the impacts of climate change. The Scientific and Technical working group follows the latest science to support MCCC's recommendations, and the Education, Communication, and Outreach working group is the public affairs arm of MCCC.

Following the CSNA, the MCCC must also develop several new reports and add four new working groups. Each of the four new working groups is required to have members of the legislature, cabinet level officers (or their designees) as well as numerous representatives of industry and environmental groups. Combined, the new working groups add 66 appointed positions to the 85 current positions on the pre-existing groups.

The four new working groups established under the CSNA are:

1. The Just Transition Employment and Retraining, which will focus on transitioning workers in fossil fuel industries to employment opportunities in a clean energy economy;
2. The Energy Industry Revitalization working group, which will focus on the possible impacts to small businesses and potential facility closures as the result of climate change policies;
3. The Energy Resilience and Efficiency working group, which will be primarily composed of representatives of electric energy companies and will focus on energy infrastructure improvements, transmission efficiency and battery backups; and
4. The Solar Photovoltaic Systems Recovery, Reuse, and Recycling working group, which will focus on options for recycling or reusing solar panels.

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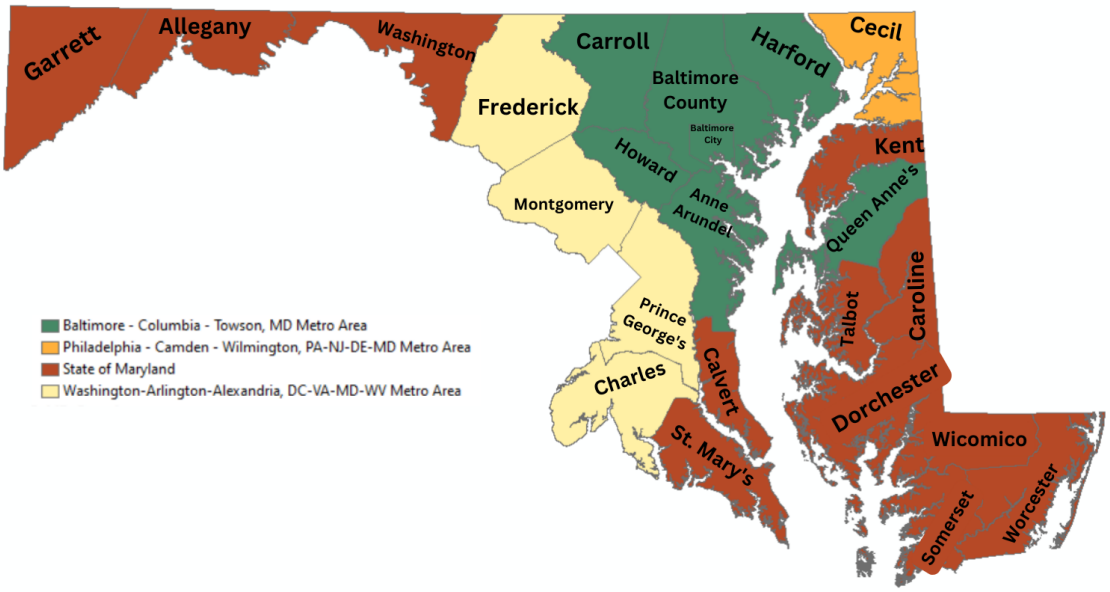
[6] Maryland Commission on Climate Change Main Page, mde.maryland.gov/programs/Air/ClimateChange/MCCC/Pages/index.aspx

[7] Maryland Commission on Climate Change Annual Report for 2023, Accessed December 20, 2023, https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Documents/MCCC%20Annual%20Report%202023/MCCC%20Annual%20Report%202023.pdf

Climate Pollution Reduction Grants (CPRG)

The U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program, authorized under the Inflation Reduction Act (IRA), provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement plans for reducing GHG emissions and other harmful air pollution. MDE is leading the state planning grant for Maryland with a state-wide focus and regional coordination. Maryland will deliver state-wide and economy-wide climate pollution reduction plans in response to the CPRG and to meet Maryland's nation-leading GHG emissions reduction goals to achieve net-zero emissions by 2045. Maryland will utilize the CPRG program to lead the nation in climate pollution reduction with intention, strategy, and data.



Maryland CPRG Planning Areas

The figure above highlights the Metropolitan Statistical Areas (MSA) within the State of Maryland and the counties not covered by a CPRG MSA Planning Grant. Maryland will coordinate regionally with the CPRG MSA Lead Organizations and engage with counties and municipalities not covered by a CPRG MSA Planning Grant as well as low-income and disadvantaged communities state-wide.

Under the CPRG for Planning, MDE's Climate Change Program will expand its GHG emission reduction planning activities and deliverables to publish the following plans and reports:

- Priority Climate Action Plan (PCAP) – due March 1, 2024
- Comprehensive Climate Action Plan (CCAP) – due 2 years from award (summer-fall 2025)
- Status Report – due 4 years from award (summer-fall 2027)

MDE will offer the Maryland CPRG Local Support Program which will assist counties and their municipalities in identifying high-priority GHG emissions reduction projects with important social,

ecological, and economic co-benefits and build capacity across all of Maryland for project planning, design, financing, implementation, and tracking. Program support may include county-specific outreach, technical support including consultation, facilitation services, and grant writing.

MDE's support program specifically assists counties and their municipalities that are not covered by a CPRG MSA planning grant. This includes:

- Western Maryland (Garrett, Allegany, Washington counties),
- Southern Maryland (Calvert, St. Mary's counties), and
- Eastern Shore (Kent, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester counties)

Maryland's objectives in the CPRG are to:

- Tackle damaging climate pollution while supporting the creation of good jobs and lowering energy costs for families.
- Accelerate work to address environmental injustice and empower community-driven solutions in overburdened neighborhoods.
- Deliver cleaner air by reducing harmful air pollution in places where people live, work, play, and go to school.
- Ensure Maryland is competitive for winning federal implementation funds from the Bipartisan Infrastructure Law and Inflation Reduction Act.
- Drive successful local-level implementation for high-priority GHG emission reduction programs and projects.

MDE has launched a webpage to engage with stakeholders and the public on the CPRG process.[8]

Building Energy Performance Standards (BEPS)

The CSNA of 2022 requires MDE to develop Building Energy Performance Standards (BEPS). MDE must develop standards for buildings that, among other requirements, achieve:

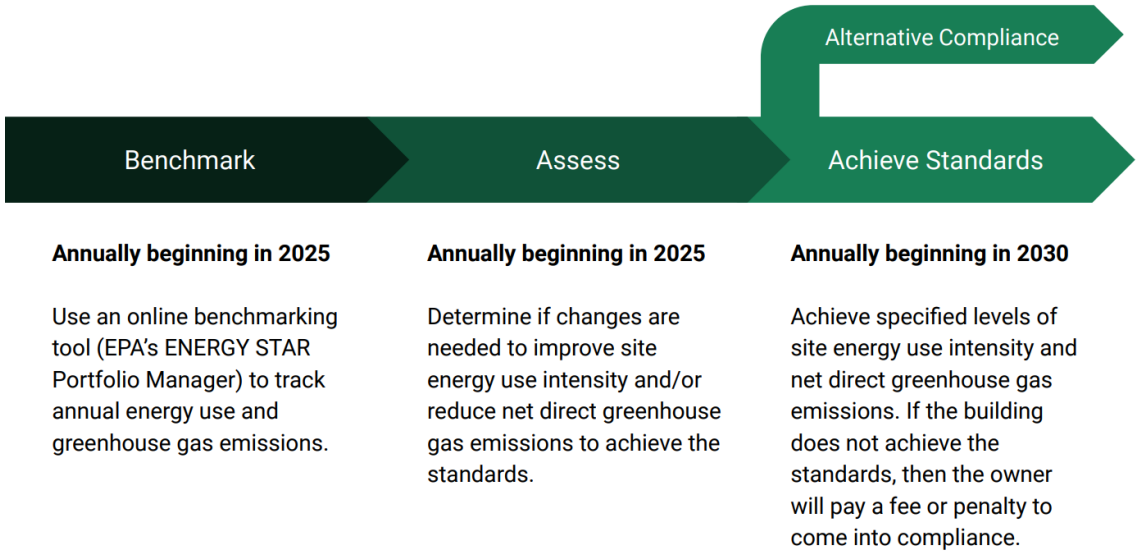
- A 20% reduction in net direct GHG emissions by January 1, 2030, as compared with 2025 levels for average buildings of similar construction and;
- Net-zero direct GHG emissions by January 1, 2040.

Covered buildings are buildings in Maryland that are 35,000 square feet or larger (excluding the parking garage area). Historic properties, public and nonpublic elementary and secondary schools, manufacturing buildings, and agricultural buildings are exempt. Owners of covered buildings will need to report data to MDE each year beginning in 2025.

[8] Maryland CPRG, mde.maryland.gov/cprg

MDE's regulatory function, such as for BEPS, occurs through a coordinated effort including internal and external reviews from stakeholders, other agencies, the public, and other units affected by the regulations. Draft regulations are presented to the Air Quality Control Advisory Council (AQCAC) for advice and adoption recommendations. Each proposed regulation is then published in the Maryland Register with details about how and when to submit comments. MDE initiated rulemaking in the summer of 2022, met with stakeholders throughout the fall of 2022, and completed a draft regulation in March 2023. From May 15 through June 5, 2023, MDE shared its draft Maryland BEPS regulation on this webpage[9] and invited stakeholders to provide comments before the draft was presented to AQCAC and the formal promulgation process began. The proposed regulation was published in the Maryland Register on December 15, 2023 with a public hearing date of January 18, 2024. In 2024, MDE will also need to hire more staff for ongoing BEPS implementation.

In July 2023, Maryland joined the White House National Building Performance Standards Coalition,[10] which is a nationwide group of state and local governments that have committed to inclusively design and implement building performance policies and programs in their jurisdictions. Maryland's development of BEPS has been supported by federal agencies, labor, and non-governmental organizations that have provided resources for workforce engagement, technical analysis, equity strategies, policy design, and stakeholder engagement.



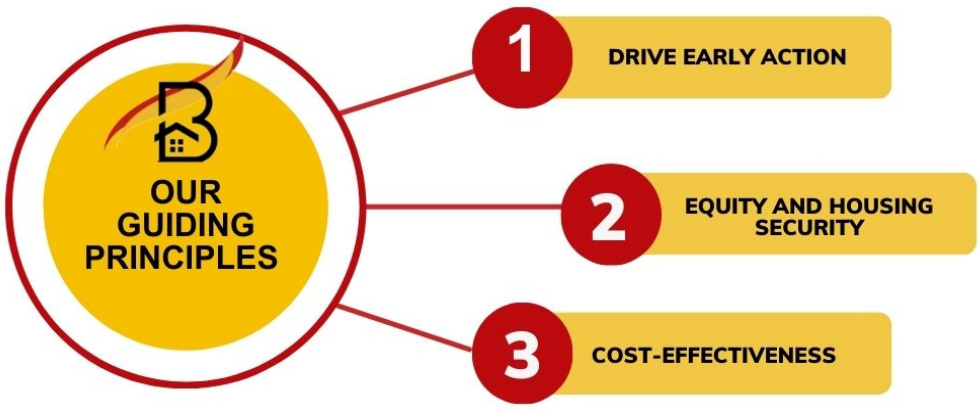
[9] MDE Building Energy Performance Standards: https://mde.maryland.gov/programs/air/ClimateChange/Pages/BEPS.aspx.
[10] National BPS Coalition (July 2023), https://nationalbpscoalition.org/.

Building Energy Transition Implementation Task Force

The CSNA created the Building Energy Transition Implementation Task Force (Buildings Task Force) with the objective of providing the Governor and General Assembly with recommendations on programs, policies, and incentives aimed at reducing GHGs from the building sector. The Buildings Task Force membership is made up of a diverse set of sectors that includes state agencies, real estate development, building trades and construction, utilities, affordable housing, tenant and public interest advocacy, and more. The Task Force decided that the top three guiding principles are as follows: drive early action, equity and housing security, and cost-effectiveness[11].

The Buildings Task Force was co-chaired by MDE Secretary, Serena McIlwain, and Maryland Energy Administration (MEA) Director, Paul Pinsky. The Buildings Task Force held eighteen public meetings between June and December 2023, with ten meetings being for subgroup meetings aimed at deeper dives into building type-specific issues. The four subgroups each had their own chair or co-chairs and were open to public participation and contributions from non-members. These subgroups tailored recommendations to different building types that will be covered or not covered by BEPS and may have different barriers and solutions. The recommendations deliberated included the following:

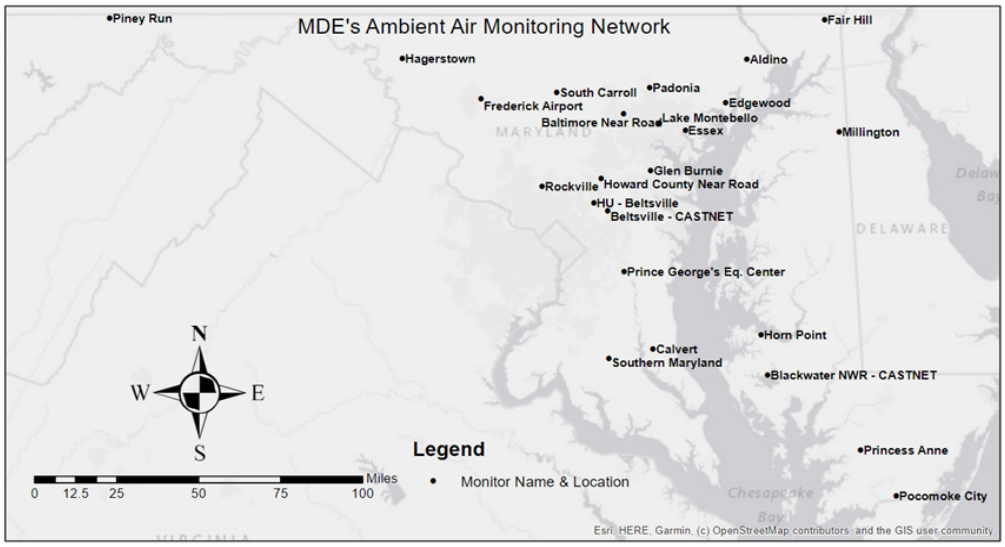
- End Investment in New Fossil Fuel Equipment and Infrastructure;
- Workforce Development;
- Study Tax Incentives;
- Fund Electrification Projects for Low- and Moderate-Income Households; and
- Provide a One Stop Shop to Support Limited Income Housing.



[11] https://mde.maryland.gov/programs/air/ClimateChange/Pages/BETITF.aspx

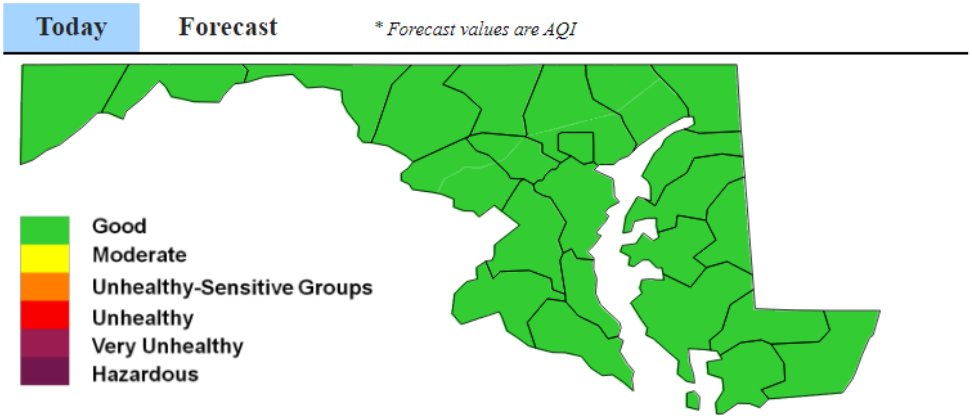
Air Monitoring Program

The Air Monitoring Program measures concentrations of air pollutants and meteorological conditions across a network of 24 monitoring stations throughout the state. There are urban, suburban, and rural sites on the Eastern Shore, in central Maryland, and the mountains of Western Maryland.



MDE's 2023 Ambient Air Quality Monitoring network.

The Program performs quality assurance, quality control, and analyses of the pollutant concentrations measured at each of the air monitoring stations. Along with these duties, the Air Monitoring Program is also responsible for reporting the Air Quality Index (AQI) and issuing daily air quality forecasts while also coordinating photochemical grid and dispersion modeling.



Example of an Air Quality Forecast, put out daily by the Air Monitoring Program.

One of the primary objectives of the Air Monitoring program is to determine if the state is attaining the National Ambient Air Quality Standards (NAAQS). The NAAQS were established by the EPA through the Clean Air Act for the six air pollutants known as criteria pollutants; carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter ($PM_{2.5}$ & PM_{10}), and sulfur dioxide. If concentrations of any criteria pollutant do not exceed the level and form of the relevant NAAQS, this is considered in attainment of the standard.

Pollutant	Primary/Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3 month average	0.15 $\mu g/m^3$	Not to be exceeded
Nitrogen Dioxide (NO_2)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb	Annual Mean
Ozone (O_3)	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution ($PM_{2.5}$)	primary	1 year	12.0 $\mu g/m^3$	annual mean, averaged over 3 years
	secondary	1 year	15.0 $\mu g/m^3$	annual mean, averaged over 3 years
	primary and secondary	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years
Particle Pollution (PM_{10})	primary and secondary	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year, on average over 3 years
Sulfur Dioxide (SO_2)	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Chart of the EPA's NAAQS for the Criteria Pollutants, established by the Clean Air Act.

The Air Monitoring Program participates in the latest air pollution research to ensure the Department's policies reflect the current state of the science. Maryland uses a variety of monitoring techniques to address interstate pollutants traveling on prevailing winds into Maryland from surrounding states and regions. Such transported pollutants contribute significantly to pollutant levels in Maryland during bad air quality episodes. On other occasions, depending on the weather, both transport and "home grown" pollution are equally important in Maryland's worst air pollution days. Local sources that can contribute to ozone include vehicle exhaust, industrial emissions, and biogenic sources, such as trees. Days with elevated $PM_{2.5}$ across the state have decreased in recent years, with higher values occasionally seen in winter due to meteorological phenomena, or in warmer months as a result of transport from wildfires. Maryland is currently measuring levels of air pollution that are in attainment of all NAAQS.

In addition, the Program collaborates with Federal agencies, local universities, and community organizations to conduct special atmospheric monitoring research projects to better characterize aloft and surface pollutant concentrations, as well as the pollution burdens in historically disadvantaged communities across the state. These research initiatives support air quality planning and regulation development.

Air Quality Regulatory and Compliance Program

Regional Greenhouse Gas Initiative (RGGI)

Program Overview

RGGI comprises 11 states in the Northeast and mid-Atlantic regions. These states adopted market-based carbon dioxide (CO2) cap-and-invest programs designed to reduce emissions of CO2 from fossil fuel-fired electricity generators with a nameplate capacity of 25 megawatts or greater. RGGI states include Maryland,[12] Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia. While Pennsylvania is considered an official RGGI state, there is litigation in court.

Participating RGGI states each require electricity generators to have acquired, through regional auction or secondary market transactions, one CO2 allowance for every ton of CO2 emitted over a 3-year compliance period. The RGGI program establishes a regional cap on CO2 emissions from eligible sources, which is then reduced in subsequent years leading to a reduction in CO2 emissions. Auction proceeds go to the Strategic Energy Investment Fund (SEIF), which is administered by the MEA and funds several state programs, including direct energy bill assistance, energy efficiency programs that reduce electricity demand, electric vehicle (EV) charging stations, and renewable energy projects that reduce CO2 emissions. Under state law, more than half of all funds collected by Maryland are invested in energy assistance for low-income households and energy efficiency in low- and moderate-income communities.

Implementation Milestones

Thanks to its success, RGGI has grown substantially in recent years, with New Jersey renewing its participation in the program in 2020, Virginia joining in 2021, and Pennsylvania proposing regulations in 2022 to begin participation.

Auctions

Maryland has successfully participated in all 62 regional auctions of CO2 allowances with RGGI. As of December 2023, Maryland has generated $1.16 billion in cumulative proceeds.

Comprehensive Program Review

RGGI participating states are committed to periodic review of their CO2 budget trading programs to consider successes, impacts, and design elements. RGGI states completed the First Program Review[13]

[12] mde.maryland.gov/programs/Air/ClimateChange/RGGI/Pages/index.aspx
[13] rggi.org/program-overview-and-design/design-archive/2012-materials

in February 2013, and completed the Second Program Review[14] in December 2017, resulting in the 2017 Model Rule.[15] The Third Program Review is currently underway with a renewed focus on environmental justice and equity, roughly on track with the updated timeline. Maryland is now advocating for the RGGI cap to be strengthened to be consistent with states' 100% clean energy goals. The participating states are expected to reach an agreement on a new program structure in 2024. If the outcome of the multistate agreement is not sufficiently stringent to meet the goals of the CSNA, MDE will consider additional complementary regulations.

The Cap

The RGGI cap was first established during the period from 2005-2007. The participating states decided upon a generation-based program rather than a consumption-based program because the states had authority to control electric generating sources within their jurisdiction. The initial cap was based on the average of 2000-2002 CO2 emissions and the initial cap was set at 188,076,976 short tons of CO2. After a stabilization period, the cap would be reduced starting in 2015 by 2.5% each year until 2018 for a 10% reduction. The participating states elected to revise the cap as part of the First Program Review to 91 million short tons of CO2. During the Second Program Review, the states selected a regional cap of 75,147,784 tons of CO2 in 2021, which will decline by 2.275 million tons of CO2 per year thereafter, resulting in a total 30% reduction in the regional cap from 2020 to 2030.

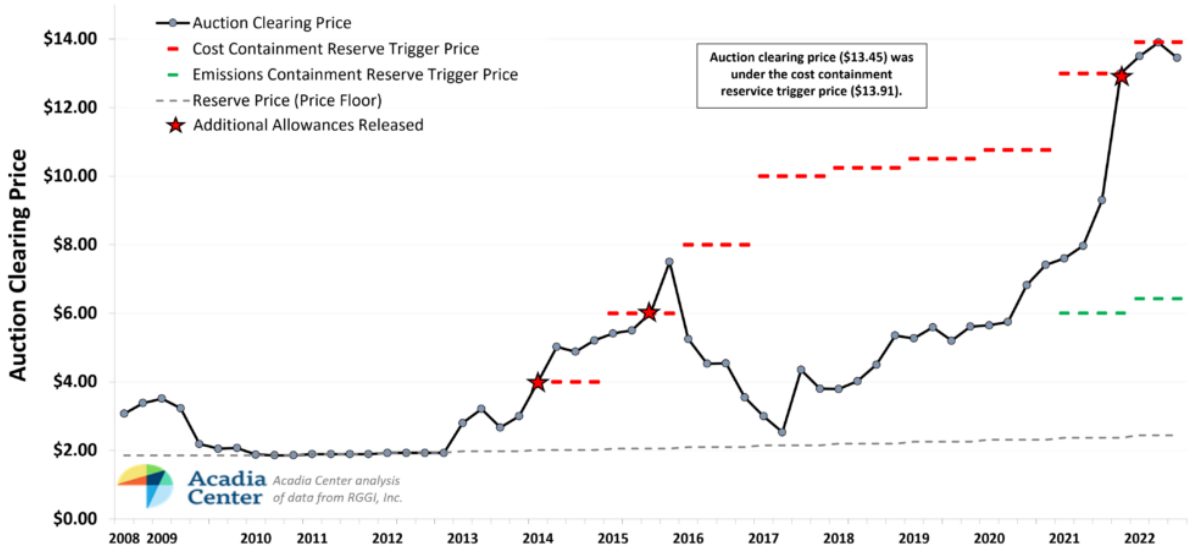
Budget Adjustments

RGGI allows sources to bank allowances in two ways. Sources can use current vintage allowances to satisfy future compliance obligations. The participating states have also auctioned future vintage allowances in the past. These allowances often sell at prices lower than they would in the future.

The participating states addressed potential large banks of allowances through the Program Review process. The newly created Third Adjustment for Banked Allowances adjusts the budget for allocation years 2021 through 2025 with the timing and algorithm details included in the regulations. This addition helps to create a binding cap in light of the opportunity sources have to accumulate low cost allowances while states implement the regulatory changes needed to establish the lower cap.

RGGI allowances in the secondary market have continued their upward trend in 2023. RJ3's, the RGGI Vintage 2023 Futures, peaked at just under $15 this year. Auction 62 of Q4 2023 triggered the Cost Containment Reserve (CCR) with a clearing price of $14.88. The CCR is a quantity of allowances in addition to the cap held in reserve that are utilized if emission reduction costs are higher than projected. The first three quarters of 2023 have not seen the CCR triggered. The Emissions Containment Reserve, the CCR's counterpart for when prices fall too low, did not trigger this year.

[14] rggi.org/program-overview-and-design/design-archive/2016-materials
[15] rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2017-Program-Review-Update/2017_Model_Rule_revised.pdf



Source: Acadia Center[16]

Offsets

Maryland currently recognizes three project categories eligible for the award of CO2 offset allowances: 1) Landfill Methane Capture and Destruction, 2) Sequestration of Carbon due to Reforestation, Improved Forest Management, or Avoided Conversion, and 3) Avoided Methane Emissions from Agricultural Manure Management Operations. As of this report, there has been only one approved offset project in the RGGI program, which is the New Beulah Landfill Methane Capture and Destruction project located in Dorchester County. Offsets are one option for compliance and are limited to a relatively small percentage (3.3%) of any compliance obligation. The RGGI offset program is intentionally quite strict to ensure the development of projects that would otherwise not exist in the absence of the program. Offset allowances are recognized across the RGGI states, regardless of the state of their origin.

RGGI with Geographic Expansion

In 2017, RGGI completed the Second Program Review and strengthened RGGI to continue steady, deeper reductions of GHG emissions by 2030. With the success of the initiative, Maryland and the other participating RGGI states are actively working to engage new participants in the program. The first in the nation carbon cap-and-invest program for power plants has been strengthened by implementing the participating states' plan to secure an additional 30% reduction in power plant emissions by 2030 and expanding the program to new participating states in the region to reduce pollution from power plants supplying electricity into Maryland.

[16] acadiacenter.org/rggi-56th-auction-and-the-consequence-for-climate-and-clean-energy-transition/

Maryland holds a leadership role on the RGGI, Inc. Board of Directors[17] and has led deliberations among the RGGI states to broaden participation to include New Jersey and Virginia. In July 2019, New Jersey finalized regulations allowing it to renew its participation in January 2020. Virginia finalized regulations and has participated since Auction 51, though it plans to exit in 2024. Pennsylvania is currently deliberating in their courts whether to participate in RGGI and has not engaged in recent auctions, though it is participating in the Third Program Review.

Short-lived Climate Pollutants (SLCPs) Overview

SLCPs are air pollutants that have a relatively short lifetime in the atmosphere and a warming influence on our climate. As opposed to CO2, which has an atmospheric lifetime of about 100 years, SLCPs atmospheric lifetime ranges from a few days to a few years. The most common SLCPs are methane, black carbon, and hydrofluorocarbons (HFCs). Methane is the second most emitted GHG in the U.S., accounting for about 10% of national emissions. Emissions of methane also contribute to ground level ozone. About 60% of all methane emissions are anthropogenic (from human activity) and are expected to increase. The primary sources are from agriculture, waste treatment, and energy sectors. Capturing methane from these sources has the potential to improve air quality, provide fuel for industries, and displace more carbon-intensive fossil fuels.

Black carbon is a component of fine particulate matter (PM), which is the result of incomplete combustion of fossil fuels and biomass, particularly from older diesel engines and forest fires. Black carbon is a risk factor for premature death. It warms the atmosphere by absorbing solar radiation, influences cloud formation, and darkens the surface of snow and ice, which accelerates heat absorption and melting.

HFCs are industrial chemicals primarily used for refrigeration and air conditioning. HFCs were created to replace extremely volatile chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) that were found to be ozone-depleting. The Montreal Protocol, a global agreement to protect the stratospheric ozone layer, phased out CFCs and HCFCs, and successfully drove industries to utilize HFCs as the prominent alternative. HFCs are not ozone depleting, but they do have a high global warming potential (GWP). Most HFC emissions[18] result from leaks in refrigeration and air-conditioning systems. These HFC emissions, though relatively low at present, are projected to increase globally at a rate of 8-15% per year.

HFC use is expected to increase disproportionately in developing countries due to population growth, rapid urbanization, electrification, and changing consumption patterns. Reducing HFCs could provide mitigation equivalent to 100 billion tons of CO2 by 2050. Improving the energy efficiency of room air

[17] Maryland's Secretary of the Environment is Vice Chair of RGGI in 2023.
[18] ccacoalition.org/en/resources/hfc-initiative-factsheet

conditioning equipment alone can provide further mitigation of up to 100 billion tons of CO2 equivalent by 2050.

Maryland adopted regulations in 2020 to prohibit the use of high-warming HFCs in certain sectors such as aerosols and refrigeration, consistent with the vacated U.S. EPA's Significant New Alternatives Policy Program rules 20 & 21. Additionally, EPA has recently promulgated two sets of regulations[19] and is proposing a third to further reduce HFCs use in sectors and subsectors, including refrigeration, air conditioning and heat pumps, foams, and aerosols. This is a greater national effort to greatly reduce HFCs in future compliance years.

Maryland has several ongoing initiatives to address fugitive methane emissions. In late 2020, new regulations were promulgated for natural gas compressor stations and other related equipment. In June of 2023 Maryland adopted regulations for the control of methane emissions at municipal solid waste (MSW) landfills.

Methane Emissions from Sources in the Oil and Gas Industry

Program Overview

In 2018, EPA proposed amendments to relax the New Source Performance Standards (NSPS) for pollutant controls in the oil and gas industry that had previously been adopted in 2016. EPA proposed to reduce the sources subject to the rule, decrease the monitoring frequency and repair schedules of fugitive emissions at wells and compressor stations, remove methane detection, and only require testing and control of volatile organic compounds (VOCs). MDE submitted written comments opposing EPA's proposed amendments. Despite opposition from several states and environmental organizations, the EPA finalized the amendments on August 13, 2020.

The natural gas energy industry can be divided into four segments: (1) production; (2) gathering and processing; (3) transmission and storage; and (4) distribution. Maryland began taking steps to restrict methane emissions from the value chain by establishing a law to ban hydraulic fracturing in the state-operations, which occur in the production segment. With no gas gathering and processing operations in the state, Maryland then turned to the transmission and storage segment. MDE used the EPA's 2016 NSPS reduction technologies and methane detection procedures as the basis for the state requirements in transmission and storage. Throughout 2018 and 2019, MDE held stakeholder meetings with industry leaders, environmental advocates, and concerned community citizens. In November 2020, Maryland finalized regulations to reduce vented and fugitive emissions of methane from both new and existing transmission and storage facilities. In May 2021, six existing facilities in Maryland began conducting surveys for methane leaks and repairs. Leaks and repairs were then reported to MDE.

Methane reductions in the natural gas distribution sector are being monitored. MDE has met with industry leaders, environmental advocates, and other surrounding state governments to discuss and

[19] https://www.epa.gov/climate-hfcs-reduction

develop technology standards and emission reduction targets. Currently, methane emission reductions are measured through the Public Service Commission (PSC) Strategic Infrastructure Development and Enhancement (STRIDE) program. The STRIDE program requires the three largest natural gas companies in Maryland to remove and replace the older leak prone piping infrastructure, thereby reducing the fugitive leaks from that infrastructure. Advanced monitoring technologies to detect leaks are undergoing research and development.

Implementation Milestones

Maryland regulations to reduce vented and fugitive emissions of methane from both new and existing natural gas transmission and storage facilities COMAR 26.11.41 were adopted on October 23, 2020, and became effective on November 16, 2020.

Federal Progress

On November 15, 2021, EPA released a national proposal for methane reduction in the oil and gas sector. This rule builds on the original 2016 rules and will surpass the adopted 2020 requirements. On December 2, 2023, EPA announced the final adoption of methane reduction regulations in the oil and gas sector[20].

Methane will be required to be monitored, measured and controlled at well sites meeting a size threshold, gathering and production sites, and compression stations. The key components include:

- a comprehensive monitoring program that focuses on sites with the largest amount of emissions;
- allowing monitoring compliance alternatives like using satellites to identify leaks; and
- addressing pneumatic controllers that account for nearly 30% of methane emissions with a zero emission standard.

Additionally, in the distribution sector of the natural gas industry, EPA announced its intent to propose leak detection and technology upgrades under the Pipeline and Hazardous Materials Safety Administration regulatory process in 2022. These national requirements would strengthen fugitive methane control.

Methane Emissions from New and Existing Landfills

A municipal solid waste (MSW) landfill is a parcel of land that accepts garbage or non-hazardous residential and commercial wastes. As the waste decomposes it produces landfill gas that is composed of several GHGs. The gasses produced at landfills include methane (CH4) — a short-lived but

[20] https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-operations/actions-and-notices-about-oil-and-0

significant GHG with a global warming potential more than 25 times that of carbon dioxide (CO2). Landfills are the second largest industrial source of methane emissions in the United States and are the single largest source for the state's methane emissions.

In June of 2023, Maryland adopted regulatory requirements for owners and operators of new and existing MSW landfills, which include surface emission monitoring, detecting and repairing landfill gas leaks, recordkeeping and reporting requirements, and installing and operating emission control systems based upon the regulatory applicability.

MSW landfills in Maryland are required to meet certain requirements and standards depending on criteria such as size, age, and methane generation rate. According to MDE's 2017 Greenhouse Gas Inventory,[21] there are several MSW landfills in Maryland with the capability of producing landfill gas, which could be subject to the new requirements and standards. There are both active landfills and closed landfills in the state. Active landfills are still accepting waste or have not filed a closure report. Closed landfills are no longer accepting waste and have filed a closure report. MDE maintains updated lists of both permitted and closed facilities.[22]

The new requirements and standards for MSW landfills are either equivalent or more stringent than current federal requirements for MSW landfills, such as component leak testing, surface emission monitoring, gas collection and control systems (GCCS), and recordkeeping and reporting schedules. The new regulations result in decreased methane emissions from MSW landfills in the state and MDE will continue to evaluate the emission reductions and benefits.

Additional climate change abatement strategies include MDE forming partnerships with state agencies, local jurisdictions, environmental advocacy groups, and the private and public sectors to limit the amount of methane generating waste that enters landfills through waste diversion.[23] Waste diversion combines both recycling and source reduction activities. These strategies have been effective in reducing methane emissions from landfills and helping to meet Maryland's climate goals.

Federal Progress

On May 21, 2021, EPA finalized federal implementation plans (FIPs) for 42 states, including Maryland, for the stalled 2016 MSW landfill emissions guidelines. The existing MSW landfills in Maryland already meet and follow the EPA requirements.

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[21] https://mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx
[22] https://mde.maryland.gov/programs/land/SolidWaste/Pages/PermittedFacilities.aspx
[23] https://mde.maryland.gov/programs/land/RecyclingandOperationsprogram/Pages/index.aspx

HFCs

Program Overview

In November 2020, Maryland adopted regulations to prohibit certain hydrofluorocarbons (HFCs) and HFC blends that have a high-global warming potential (GWP) and pose a higher overall risk to human health and the environment. The regulations adopted specific prohibitions for HFCs in air conditioning and refrigeration equipment, aerosol propellants, and foam end-uses. The phase out of HFCs encourages the use of available alternatives with lower GHG emissions.

Maryland's HFC regulations, COMAR 26.11.33, apply to any person who sells, offers for sales, installs, or introduces into commerce in Maryland any substance in end-uses identified in the regulations. The requirements focus on end-use prohibitions for the following sectors/categories: Aerosol Propellants, Air Conditioning, Refrigeration and Foams. The effective prohibition phase-in dates range from January 1, 2021 to January 1, 2024. The regulations include a sell-through provision for products and equipment manufactured prior to the prohibition date. The regulation also allows continued use of existing products and equipment that contain banned substances acquired prior to the prohibition dates.

The Maryland regulations were modeled after the EPA's Significant New Alternatives Policy (SNAP) program (specifically SNAP 20 & 21). The EPA's SNAP program implements section 612 of the amended Clean Air Act of 1990, which requires EPA to evaluate substitutes for the ozone-depleting substances to reduce overall risk to human health and the environment. Through these evaluations, SNAP generates lists of acceptable and unacceptable substitutes for each of the major industrial use sectors. The EPA has modified the SNAP lists many times, most often by expanding the list of acceptable substitutes, but in some cases by prohibiting the use of substitutes previously listed as acceptable.

The EPA's SNAP program, under Section 7671(k) of the Clean Air Act, 42 U.S.C. Sec. 7401 et seq.), reviews substitutes within a comparative risk framework in the following industrial sectors:

- Adhesives, Coatings, and Inks
- Foam Blowing Agents
- Aerosols
- Refrigeration and Air Conditioning
- Cleaning Solvents
- Sterilants
- Fire Suppression and Explosion Protection
- Tobacco Expansion

The SNAP rules were stalled between 2016 – 2020 with litigation. Therefore, Maryland and 12 other US Climate Alliance states adopted HFC regulations. HFCs are the fastest growing source of GHG emissions in the U.S. and globally and are thousands of times more potent than CO_2. After efforts to phase out

HFCs stalled at the federal level prior to 2021, states began establishing their own initiatives. Throughout 2019 and 2020, MDE met with industry leaders, environmental advocates, and other U.S. Climate Alliance (USCA) states to develop regulations. Maryland finalized their HFC regulations in November 2020 that are consistent with the rules and laws enacted by USCA states, such California, Washington, Vermont, New Jersey, and Colorado. The regulations also model the stalled EPA Significant New Alternatives Policy (SNAP) Rules 20 and 21, which phase out the use of certain HFCs in various end-uses — specifically in foam, aerosol propellants, refrigeration, and air-conditioning products and equipment — and encourage the use of substances with lower GHG emissions that are widely available on the market. Other states in the USCA are expected to take similar steps.

In 2021, Maryland and other USCA states to petition EPA to:

- reinstate the HFC prohibitions established by SNAP Rules 20 and 21;
- adopt requirements similar to those that the California Air Resources Board (CARB) has proposed for specific high GWP end uses; and
- restore the HFC leak inspection, leak repair, retrofitting, reporting and maintenance requirements at least to the extent that EPA had established under its CAA Section 608 authority.

Implementation Milestones

Maryland HFC regulations COMAR 26.11.33 were adopted on October 6, 2020 and are effective as of November 2, 2020. Compliance deadlines began on January 1, 2021 for certain end-uses and will continue through January 1, 2024.

Challenges

In 2020, several companies approached MDE requesting an extension on compliance deadlines due to COVID-19 impacts on business operations. In response, MDE included a regulatory relief statement in the technical support document that accompanied the regulations. The statement directs companies facing COVID-19-related compliance challenges to submit a plan for compliance for review in accordance with Section 2-611 of the Environment Article. Supply chain issues continued throughout 2021, and the Department has been corresponding with businesses on a case-by-case basis.

Federal Progress

Since 2020, EPA has been aggressively addressing the reduction of high-GWP HFCs beyond SNAP rules. The American Innovation and Manufacturing Act (AIM Act) (under 42 U.S.C. 7675) was enacted on December 27, 2020 and authorizes EPA to address HFCs in three main ways: phasing down their production and consumption, maximizing reclamation and minimizing releases from equipment, and facilitating the transition to next-generation technologies through sector-based restrictions.

EPA has moved beyond the SNAP rules and has adopted three new rules for HFC uses and production: the Allowance Allocation and Trading Program Under the American Innovation and Manufacturing Act, the Technologies Transition rule, and the Management of Regulated Substances rule to address existing sources through reclamation.

In July 2023, the EPA finalized the Phasedown of Hydrofluorocarbons: Allowance Allocation Methodology for 2024 and Later Years, which spins off of the regulation that was finalized by the EPA in 2022 that created a framework to phasedown HFC production and consumption by 85% by year 2036 through establishing the Allowance Allocation and Trading Program Under the AIM Act. On October 19, 2023, a Notice was published for the 2024 Allowance Allocation for Production and Consumption of Regulated Substances Under the AIM Act of 2020, and Notice of Final Consequences. By October 1 of each calendar year, the EPA must determine the quantity of allowances for the production and consumption of regulated substances that may be used for the following calendar year.

In October 2023, EPA finalized the Technologies Transition rule which restricts the use of certain higher-GWP HFCs in aerosols, foams, refrigeration and air conditioning, heat pump products and equipment. The restrictions are to transition to alternatives listed by sector and subsector and would prohibit manufacture and import of products containing restricted HFCs by January 1, 2025, in most cases, and would prohibit the sale, distribution, and export of products containing restricted HFCs a year later, which in most cases would be January 1, 2026. To support compliance with the prohibitions on the use of HFCs in specific sectors and subsectors, EPA requires labeling, reporting, and recordkeeping requirements for companies that import, manufacture, sell, or offer for sale products using HFCs.

The EPA's AIM Act HFC Technologies Transition rule covers more end use categories than Maryland's HFC regulations and lowers the GWP allowable limit significantly from Maryland's HFC regulations. Maryland's regulations help to reduce HFCs with compliance deadlines between 2021 – 2024. The EPA's new rules establish additional reductions from 2025 and beyond. Additionally the EPA has just proposed a rulemaking addressing existing sources, the Management of Regulated Substances, under subsection (h) of the AIM Act in order to maximize reclamation and reduce emissions of HFCs and their substitutes.

The EPA has received funding through the IRA to be used for a variety of different projects, programs, and to gain expertise. Of the projects, EPA plans to use funding on projects addressing HFCs and the AIM Act. The EPA received $38.5 million from the IRA to use towards the implementation and compliance of the AIM Act. $15 million of the funding will be used for grants on reclaim and innovative destruction technologies. Maryland supports these national rules to achieve HFC reductions throughout the Country.

Mobile Sources Control Program

Multi-State Zero Emission Vehicle (ZEV) Task Force

On June 20, 2018, nine Northeast and west coast states reaffirmed their strong commitment to a clean, low-carbon transportation sector with the release of a new Multi-State Zero Emission Vehicle (ZEV) Action Plan (Action Plan) for 2018-2021 to support the successful implementation of the states' ZEV programs. Maryland was a leader in this effort.

This Action Plan, built on the successes and lessons learned from implementation of an earlier 2014 ZEV Action Plan, presented 80 market-enabling recommendations for states, automakers, dealers, utilities, charging and fueling companies, and other key partners to rapidly accelerate mainstream consumer adoption of ZEVs, including plug-in hybrid, battery electric, and hydrogen fuel cell vehicles.

The updated Action Plan was the work of the Multi-State ZEV Task Force, which was formed in 2013 under a Memorandum of Understanding (MOU) signed by the governors of California and seven other states that have adopted California's ZEV program – Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont. New Jersey became the ninth ZEV state to join the coalition when they signed the MOU in May 2018. This Action Plan continues to serve as a guidance document for states as they continue to develop and implement policies and programs to increase the purchase and use of EVs.

The transportation sector is now the largest single source of GHG emissions across the nation. Light duty vehicles alone contribute almost 25% of total emissions. The state ZEV programs, which require automakers to deliver increasing numbers of ZEVs between now and 2025, are a key strategy in state climate plans.

On July 14, 2020, 15 states and Washington, D.C. announced a joint MOU committing to work collaboratively to advance and accelerate the market for electric medium and heavy-duty vehicles (MHDVs), including large pickup trucks. The goal is to ensure that 100% of all new MHDV sales are zero emission vehicles by 2050, with an interim target of 30% ZEV sales by 2030. Signatories of the MOU include the states of Maryland, California, Colorado, Connecticut, Hawaii, Maine, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington; the District of Columbia; and the province of Quebec, Canada. A regional effort is an effective way to target emissions from larger vehicles that commonly cross state lines.

To provide a framework and help coordinate state efforts to meet these goals, Maryland and the other signatory jurisdictions worked through the existing multi-state ZEV Task Force to develop and implement a ZEV Action Plan for trucks and buses. The Northeast States for Coordinated Air Use Management (NESCAUM) released the final Action Plan[24] in late July 2022. The action plan is built

[24] nescaum.org/documents/multi-state-medium-and-heavy-duty-zev-action-plan.pdf/

around the jurisdictions' commitments to make at least 30% of new MHD sales ZEVs by 2030, and 100% of sales by 2050 or sooner. The 2030 target ensures early progress to hasten vehicle fleet turnover, and was made more attractive by favorable market developments.

Maryland and allied states continue to work together to pave the way for ZEV's to grow and flourish in the near future.

A New Market Phase

The ZEV market is entering a new phase of development. In the 4 years since the release of this updated ZEV Action Plan, the cumulative number of ZEV sales in the United States has grown from 750,000 cars to more than 2 million vehicles. During that same time in Maryland, sales of ZEVs have almost quadrupled. Market changes and technology developments have laid a strong foundation for rapid growth of the emerging EV market. Battery costs are continuing to decline and the electric range of lower-cost battery EVs has increased significantly since 2018. Consumers can now choose from more than 60 different plug-in and fuel cell models, and all the major automakers have announced not only plans to significantly expand EV offerings across multiple market segments.

Key Action Plan Recommendations

The updated Action Plan represented a redoubling of state efforts to accelerate electrification of the light-duty vehicle market, and a recognition of the important role that public-private partnerships involving the automakers, dealers, utilities, and others play in the effort. Recommendations for states and other key partners in the updated Action Plan are focused on five priority areas:

- Raising consumer awareness and interest in EV technology;
- Building out a reliable and convenient residential, workplace and public charging infrastructure;
- Continuing and improving access to consumer purchase and non-financial incentives;
- Expanding public and private sector fleet adoption; and
- Supporting dealership efforts to increase ZEV sales.

Read the Multi-State ZEV Action Plan.[25]

Maryland has been working to implement the ZEV Action Plan recommendations. For years, the state has offered buyers various incentives for purchasing EVs. The Clean Cars Act of 2022, through MEA and the Maryland Department of Transportation (MDOT), established the Zero-Emission Vehicle Excise Tax Credit and the Medium-Duty and Heavy-Duty Zero-Emission Vehicle Grant Program. The Zero-Emission Vehicle Excise Tax Credit provides $3,000 in incentives for each plug-in EV or fuel cell vehicle purchased, as well as $2,000 or $1,000 in incentives for three-wheeled or two-wheeled electric

[25] nescaum.org/documents/2018-zev-action-plan.pdf

motorcycles or autocycles. The maximum price of the eligible vehicle is $50,000, and the eligible year of purchase must be between July 2023 and June 2027. The Medium-Duty and Heavy-Duty Zero-Emission Vehicle Grant Program established a grant that would cover up to 20% of the cost for qualified medium-duty or heavy-duty zero-emission vehicles, vehicle supply equipment, and heavy equipment property. Qualifying vehicles must be at least 8,500 pounds and powered by electricity that is stored in a battery or produced by a hydrogen fuel cell. Overall, the state remains active in promoting EVs and promoting their emission-reducing benefits.

Volkswagen Mitigation Plan

On September 18, 2015, the EPA and CARB issued a Notice of Violation of the CAA to Volkswagen AG (VW), Audi AG, and Volkswagen Group of America, Inc. alleging that model year 2009-2015 Volkswagen and Audi diesel cars equipped with 2 liter and 3 liter engines included software that circumvented EPA and CARB emissions standards for nitrogen oxide (No). Approximately 550,000 vehicles in the U.S. had "defeat devices" installed and approximately 16,000 were delivered to Maryland.

On October 25, 2016, the U.S. District Court for the Northern District of California approved a Partial Consent Decree between the U.S. Justice Department and VW regarding excess emissions of NO due to the installation of "defeat devices" on 2 liter diesel engines. The use of "defeat devices" has increased vehicle emissions of NO, resulting in adverse effects on air quality. The Consent Decree established an Environmental Mitigation Trust of $2.7 billion to fully remediate the excess NO emissions from the affected 2 and 3 liter vehicles. The State of Maryland is eligible to authorize spending $75.7 million from the VW Trust to use for specifically defined eligible mitigation projects. To guide the use of funds over the Trust's 10-year lifetime, Maryland has developed a Mitigation Plan that outlines the eligible projects Maryland will use to reduce excess NO emissions.[26]

Benefit

Strategies for reducing NO emissions could also result in reductions of GHG emissions, including CO2 emissions and black carbon emissions. Applicants seeking funds from the VW Trust must submit a proposal to MDE that specifies, among other things, emission reductions from the planned project. The evaluation criteria for awarding funds includes benefits from reducing other pollutants such as CO2. As projects receiving funds from the VW Trust are implemented, MDE will track avoided or reduced CO2 emissions resulting from these projects. The evaluation criteria for proposed projects also includes identifying benefits to EJ and underserved communities.

Implementation Milestones

[26] mde.maryland.gov/programs/Air/MobileSources/Pages/MarylandVolkswagenMitigationPlan.aspx

Under the Environmental Mitigation Trust established in the 2016 settlement, Maryland is eligible to receive $75.7 million for use on specifically defined mitigation projects to remediate the excess NO emissions. MDE was the lead agency tasked with developing Maryland's mitigation plan in accordance with the list of eligible projects and matching fund requirements required under Appendix D-2 of the Settlement. The draft plan placed priority on EV charging infrastructure, allocating the full 15% that is allowed for this category, and the replacement of older diesel engines with cleaner technologies. Electric buses and heavy-duty equipment such as trucks, boats and locomotives are potential projects that are eligible for funding.

MDE requested public comments on the draft plan and held public meetings in August 2018. Changes made to the draft plan in response to public comments include an increase in funding for local government projects and the addition of a pilot program of electric school buses. The plan has been finalized and approved by the Trustee. Vehicle replacement project proposals were accepted until May 6, 2019, at which time MDE submitted approximately 40 proposals to the Trustee for final approval. MDE has received Trustee approval on all proposals and has finalized agreements with most of the grantees; several of the projects have been completed.

In 2021 and 2022, MDE and MEA awarded funds through two charging infrastructure programs, the Electric Corridor Grant Program (ECGP) and the Charge Ahead Grant Program (CAGP). These programs distribute funds to projects that install Level 2 EV stations and Level 3 EV DC Fast charging stations throughout Maryland. A list of selected sites is available on MDE's website (see above link). These awards were made during round one and round two funding under the VW Settlement for charging infrastructure. The third round of funding is being planned.

Partners

MDE has conducted extensive outreach with citizens, advocacy groups, local and state government, and the private sector, with a focus on communities that bear a disproportionate share of the air pollution burden. Citizen and advocacy group engagement is a priority for Maryland. MDE has met with citizens at community meetings to discuss funding opportunities, as well as to obtain input on project opportunities. MDE has also worked closely with MEA and MDOT, and its business units such as the Port and Transit administrations, as well as the Baltimore Port Alliance to identify projects to implement at Port facilities and in Baltimore communities. The use of funds from the VW Trust to implement projects will provide air quality benefits, including reductions in GHG emissions, which contribute to meeting the policy goals in the 2030 GGRA.

Clean Cars

The Maryland Clean Cars Act required MDE to adopt regulations to apply California's Low-Emission Vehicle (LEV) standards to vehicles purchased in Maryland. In 2023, Maryland updated its Clean Car

regulations to incorporate California's latest Clean Car Program known as Advanced Clean Cars II or ACC II. The ACC II program sets new and more stringent emissions standards for light-duty vehicles. These standards will become effective beginning with the 2027 model year, with stringency increasing through the 2035 model year. The focus of ACC II is to increase the requirement of zero emission vehicles or ZEVs to reduce the mobile source emissions of criteria pollutants and GHGs. By 2035, these requirements culminate in a 100 percent ZEV sales requirement for vehicle manufacturers.

ZEVs consist of pure electric vehicles with a minimum certified range of 200 miles and hydrogen fuel cell vehicles. Up to 20 percent of the yearly requirement can be met with plug-in hybrid vehicles that have a minimum certified all-electric range of 70 miles. There is additional flexibility built into the program to ease compliance for manufacturers and ensure a smooth transition to a zero-emission fleet. To ensure that vehicles sold under the program are reliable and perform as well or better than their internal combustion engine counterparts, stringent requirements related to vehicle, and battery, durability, vehicle charging capability, on-board diagnostic, warranty, and reporting are established to ensure that ZEVs perform as designed throughout their useful life.

On September 18, 2023, the Maryland Advanced Clean Cars (ACCII) regulations COMAR 26.11.34.02 were finalized. These amendments apply to automobile manufacturers that produce new motor vehicles for sale in Maryland. All vehicle types that have a gross vehicle weight rating of less than 14,000 pounds are affected. Maryland's implementation of the ACC II program will begin with the 2027 model year.

Advanced Clean Trucks Regulations

By December 2023, the Maryland Advance Clean Trucks (ACT) regulations COMAR 26.11.43 were finalized. The harmful emissions from Medium- and Heavy-Duty Trucks (MHD) pose a serious threat to both public health and climate change. Recognizing this, California has adopted the ACT regulation that aims to reduce on-road emissions from the MHD truck sector to a greater extent than the current EPA standards. Section 177 of the Clean Air Act authorizes other states to adopt the California standards if they are identical.

The Clean Trucks Act of 2023 (c. 96/c. 97, §1, eff. June 1, 2023) requires MDE to adopt regulations implementing the California ACT regulation in Maryland. The Clean Trucks Act of 2023 also reinforces the State's ongoing commitment to reducing climate pollutants to reach the nation-leading goal of achieving a 60 percent reduction in greenhouse gas (GHG) emissions by 2031. Transportation accounts for over 40 percent of the GHG emissions in Maryland and MHD trucks account for about a third of those emissions. The emissions from MHD trucks continue to increase even as other sectors decrease. On-road diesel trucks are the largest contributor to nitrogen oxide (NO_x) emissions in Maryland. Maryland has been a California Clean Car state since 2011. Under the Clean Cars Program, Maryland has required light-duty manufacturers to deliver more zero emission vehicles (ZEVs) as a growing

percentage of their overall fleet. This rule proposes to adopt California's ZEV emission standards that apply to vehicles greater than 8,500 pounds gross vehicle weight rating (GVWR). This rulemaking will reduce the emissions of carbon dioxide (CO_2) and other climate pollutants from the transportation sector by adopting California's ACT. As required by the Clean Trucks Act of 2023, the Department is proposing to incorporate by reference the portions of the ACT regulation pertaining to the requirements that manufacturers increase their sales of zero-emission MHD vehicles.

The Port Partnership

Program Overview

MDE, MDOT, MEA and the MDOT Maryland Port Administration (MPA) continue their cooperative partnership to work to identify, develop, and, when appropriate, implement voluntary projects that will reduce GHG emissions and increase energy efficiency at the Port of Baltimore (POB). The Port Partnership work group is primarily focused on reducing emissions at the Port to help the state meet air quality and climate change goals, but also acknowledges the role that the Port plays in driving economic growth and creating jobs. The work group, made up of representatives from the participating agencies, has been meeting monthly to efficiently and effectively leverage resources and pool their knowledge to implement the agreement's goals.

The year saw the signatory agencies continue to strengthen their relationships with environmental justice communities around the POB as called for in the Voluntary Agreement. The workgroup members renewed their efforts to partner with communities on projects, support tours of POB terminals, participate in virtual and in-person meetings, and otherwise engage environmental justice stakeholders in information sharing activities that promote transparency, communication and understanding.

Air quality benefited from the Inter-Agency Workgroup's continued efforts to identify and help secure funding for emissions reduction projects, with the total US EPA grants awarded now reaching $20 million since 2008. The funds helped upgrade or purchase cleaner equipment and vehicles servicing the POB.

Projects

- National recognition of Maryland's air quality improvements occurred during a media event where the US EPA congratulated Maryland on its DERA grant award of $1.8 million. The funds are being used to replace diesel powered yard trucks, forklifts, and cargo handling equipment (CHE) with less polluting equipment, including new zero-emission vehicle, battery-powered units. Three older, diesel powered drayage trucks will be replaced with the first zero-emission electric battery powered dray trucks servicing the POB. In addition, the funding will help replace four older diesel powered CHE units with electric-powered units.

- The Port's "Dollars for Drays" program provided up to $30,000 to replace older, diesel powered drayage trucks with newer, less polluting trucks. The program has replaced over 280 trucks.
- The Baltimore Compost Collective, using Volkswagen funds, is purchasing an electric-powered vehicle to collect food scraps from local businesses and residents to be used in its composting facility in Curtis Bay.
- Canton Railroad bought a second new diesel-electric switcher locomotive, replacing a 1950's era model.
- Ports America Chesapeake's (PAC) Marine Terminal is now able to berth two Ultra-Large Container Vessels with Super-Post Panamax cranes that were added to service these vessels. As part of its Climate Change Strategic Plan, and partially funded with Maryland's Volkswagen funds, fifteen electric rubber-tired gantry cranes were purchased and installed.
- US DOT's Consolidated Rail Infrastructure and Safety Improvements (CRISI) program awarded PAC funds to modernize rail capacity by readying for double stack container transport when the Howard Street Tunnel Project is completed.

Stakeholder Engagement and Research Opportunities

The parties seek to engage and solicit input from stakeholders, including those that have been underserved and overburdened, and the private sector, when evaluating projects and programs to explore and implement. The parties are committed to working cooperatively to implement projects and programs that reduce air pollutants such as nitrogen oxides (NOx) and PM, and that further the policy objectives of the GGRA. This work should include projects and programs to increase climate resiliency, reduce air pollution, and lessen climate change impacts in communities. Examples of the work group's efforts include:

- The Baltimore Port Alliance provided Port tours attended by representatives of local Port communities, local businesses, environmental advocates, non-profit organizations, local elected officials, and local planning agencies.
- Workgroup agencies attended community group meetings to provide presentations on air quality and agency efforts to reduce air emissions, as well as learn of community concerns.
- Private Port tenants joined meetings to exchange information and ideas. CSX briefed the workgroup on their climate efforts, which includes electric switcher locomotives.
- ConnectedDMV briefed the workgroup on the National Capital Hydrogen Center and the potential use of hydrogen in the maritime sector.
- BGE presented their Path to Clean strategy which includes an analysis of decarbonization options within its service territory.

Partners

In addition to the primary state agency partners, the work group's projects and initiatives have benefited from the active involvement of others, including Environmental Defense Fund (EDF), the

Maryland Clean Energy Center, the U.S. Maritime Administration, and private port businesses. The work group also continues to place a high priority on involving key stakeholders, especially those in underserved areas, and has received direct input from residents of the Turner Station, Curtis Bay, and Brooklyn communities.

Conclusion

Maryland has made great strides in implementing Port-related projects that have supported emissions reduction grant-supported initiatives. The work group will keep building on its successes by pursuing ways for the POB to grow sustainably. Over the past 20 years, the state, through MDOT MPA, has worked diligently to identify and implement a variety of environmental programs, with a focus on climate initiatives for MDOT MPA and its tenants' operations and the collaborative Port partnership will play a key role in this process. The GHG emission reductions from the partnership are included in the GGRA Plan. By 2030, this partnership could achieve an additional reduction in GHG emissions approaching the 500,000 metric tons of CO2e (carbon dioxide equivalent) level. The Port initiatives will not only help reduce emissions of CO2, but it will also help reduce emission of black carbon. As this effort continues to grow, MDE plans to include GHG reductions in future plan updates.

Land and Materials Administration (LMA) Programs and Initiatives

Oil Control Program

Program Overview

The Oil Control Program (OCP) regulates oil handling activities in the state, including aboveground and underground oil storage facilities and oil-contaminated soil treatment facilities. Through a combination of staff and certified individuals, OCP oversees the installation, maintenance, operation, and removal of oil storage tanks. OCP also oversees the remediation of oil releases into the environment, ensuring that the cleanup protects health and the environment. OCP's oversight includes permitting activities and enforcement and compliance.

Current Activities

In its regulations (see COMAR 26.10.01.04E), OCP requires new aboveground storage tank facilities and other oil handling facilities meet all federal, state, and local requirements for construction and use of lands near or in sensitive areas prone to floods (i.e., wetlands, 100-year flood zones).

Future Activities

Mapping of OCP Sites in Flood-Prone Areas; Identification of Additional Safeguards

OCP will assist with mapping efforts as requested to capture certain oil remediation sites, and underground storage tank and aboveground storage tank sites relative to flood prone areas. Based upon this information, OCP will work with other MDE programs to evaluate whether and what additional safeguards may be appropriate to avoid releases of oil that may be at higher risk of occurring in the event of extreme weather or flooding. These safeguards could include additional permit requirements or enhanced/targeted compliance efforts.

Land Restoration Program

Program Overview

The Land Restoration Program (LRP) oversees the cleanup of sites impacted by hazardous substances throughout the state. It does this through the Voluntary Cleanup Program (VCP), the Controlled Hazardous Substances (CHS) Enforcement Program, and its coordination with federal agencies on Superfund and federal facility sites. Generally, LRP protects public health and the environment at sites historically contaminated by hazardous waste. Cleanups abate immediate uncontrolled discharges, ensure that contaminated soil does not pose a risk to public health and the environment, address

groundwater contamination that may affect drinking water supplies or otherwise pose a risk to public health and the environment, and address surface water discharges. LRP also documents and enforces long-term land use controls put in place to protect public health at sites with completed cleanups.

Current Activities

Encouraging Renewable Energy Projects on Brownfield Sites

LRP encourages renewable energy projects on brownfield cleanup sites through several initiatives. MDE adopted regulations establishing a waiver of the application fee, generally $6,000, for Voluntary Cleanup Program applications that certify they will be used for renewable energy projects generating at least 2 MW per year of clean or renewable energy. The regulations became effective on January 1, 2022. LRP continues to assist developers researching Brownfield sites for renewable energy, most notably solar projects. Additionally, LRP created a new website about renewable energy on brownfields to compile information and links to resources on siting renewable energy projects at brownfield sites[27].

Remediation of contamination on Brownfield Sites

LRP oversees the assessment, remediation, and redevelopment of Brownfield sites through the VCP and CHS Enforcement Programs, either through voluntary participation by developers or through regulatory requirements for protection of human health and the environment. In 2023, LRP provided formal closure of assessments and remediations of 49 sites, almost 20% of which were in the 100 year floodplain across the state. These investigations and contaminant removal or capping to prevent impacts to human health and the environment reduced potential negative effects of further contamination due to climate change. Many of the sites redeveloped within these flood prone areas increased clean fill levels, increasing the height above sea level, which improves protections against climate change.

Protecting Cleanup Sites with Land Use Controls from Flooding and Extreme Weather

Often, cleanup sites under LRP's purview use land use controls (LUCs) to reduce or eliminate the risk of exposure to contaminants in the long term. These LUCs may include engineering controls such as caps and vapor mitigation systems, which must be maintained in order to ensure their effectiveness over time. LRP has created a map and a searchable table of flood prone sites with LUCs. The listing can be used as a tool to prioritize inspections of LUCs before or after a flooding event to ensure protection of human health and the environment. In 2023, LRP upgraded its publicly available map of Brownfield Master Inventory sites to include EJ scores. Additionally, LRP implemented a proactive approach to prioritize and increase the availability of information for the public record through large scale digitization of files. LRP also developed a plan to increase inspection and potential enforcement on remediated Brownfields sites in overburdened or underserved or EJ communities and an increased number of LUC inspections to ensure protection of remediation and legacy pollution.

[27] mde.maryland.gov/programs/LAND/MarylandBrownfieldVCP/Pages/bf_info.aspx

Pilot Study of Climate Resilience at Naval Support Facility (NSF), Indianhead

The LRP Federal Facilities division is participating in a Climate Resilience Pilot Study conducted at NSF Indianhead by the Navy with review and input by EPA and MDE. The study is evaluating various models and data related to sea level rise, extreme weather events, and critical resource protection to determine next steps for critical infrastructure needs related to climate resilience.

Solid Waste Program

Program Overview

The Solid Waste Program (SWP) regulates solid waste and hazardous facilities throughout Maryland through permitting and enforcement activities, investigates and oversees the cleanup of open dumping cases, and regulates generators and transporters of hazardous waste and special medical waste. Solid waste facilities regulated by the SWP include municipal, construction and demolition debris, and land clearing debris landfills; municipal and medical waste incinerators; processing facilities; transfer stations; natural wood waste recycling facilities; and controlled hazardous substance facilities.

Current Activities

Mapping and Identification of Solid Waste Facilities Potentially Susceptible to Flooding

Much of the SWP's climate efforts have focused on ensuring that regulated solid waste facilities are prepared for flooding and other extreme weather impacts. SWP has examined flood prone areas proximal to permitted solid waste facilities in Maryland based on National Oceanic and Atmospheric Administration sea level rise projections, and possible increases in 100-year flood elevations. SWP identified a few facilities that might be impacted, notably the Somerset County Landfill and a closed Dorchester County landfill; and a Baltimore County transfer station from increased precipitation-caused flooding in the Patapsco River basin. Additionally, many landfills are proximal to non-tidal streams, and while not subject to flooding, may encounter increased erosion or access issues due to flooding on public roads nearby due to larger precipitation events.

Outreach and Technical Assistance on Flooding and Extreme Weather Preparation and Recovery

The SWP has and will continue outreach and technical assistance to solid waste facilities on preparing for and recovering from extreme weather impacts. SWP has previously contacted local departments of public works (DPWs) to discuss risks due to weather events, including a presentation at a statewide Solid Waste Managers Meeting, and participates in the Baltimore regional disaster debris task force composed of county and state officials, approximately quarterly, most recently on October 11, 2023.

The SWP routinely communicates with DPWs and solid waste officials prior to and after tropical storms and other heavy weather events to offer assistance with disposal advice, extend hours of operation so facilities can deal with above-normal volumes of disaster debris, or emergency disposal orders under Environment Article Sections 9-221 or 9-222 to manage disaster debris on an emergency basis. These are required to legalize temporary solid waste transfer stations and processing facilities that are set up after major storms to handle debris, so that local governments and the state can seek reimbursement from the Federal Emergency Management Administration (FEMA). For example, an emergency consent order was implemented with Somerset County to help the county address the storm debris generated from the tornado that struck Smith Island on August 4, 2022.

Facilitating Development of Renewable Energy on Closed Landfills

The SWP has created two fact sheets to facilitate the environmentally responsible development of solar projects on closed landfills. One fact sheet outlines the process and considerations for obtaining SWP approval. The other fact sheet lists current and potential solar projects at landfills throughout the state, including some successful case studies. Both fact sheets are included on SWP's web page at Solid Waste Management in Maryland, and on LRP's website on renewable energy development on brownfields[28]. Over a dozen solar installations on landfills have been approved and installed.

Future Activities

COMAR 26.04.07 already requires flood plan assessments during the application process for all refuse disposal facilities. SWP will be requiring flood risk assessment plans for active facilities, via permit changes, which can be implemented as the permits come up for renewal.

Resource Management Program

Program Overview

The Resource Management Program (RMP)[29] regulates several activities to ensure the protection of public health and the environment. These include, but are not limited to:

- Regulating the discharges from animal feeding operations (AFO);
- Responsible for the implementation of Maryland's waste diversion programs, including recycling, source reduction, and the review and evaluation of county solid waste and recycling management plans; Regulating composting facilities;

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[28] mde.maryland.gov/programs/LAND/MarylandBrownfieldVCP/Pages/Renewable-Energy-Siting-and-Development.asp

[29] https://mde.maryland.gov/programs/land/rmp/pages/index.aspx

- Regulating the utilization of sewage sludge (Biosolids); and
- Regulating the clean-up, storage, collection, transferring, hauling, recycling, and processing of scrap tires.

Sustainable Materials Management

Initiative Overview

On June 27, 2017, Governor Hogan signed Executive Order 01.01.2017.13, Waste Reduction and Resource Recovery Plan for Maryland. The order adopts a first-ever sustainable materials management (SMM) policy for Maryland that aims to minimize the environmental impacts of the materials' use throughout the entire lifecycle. The policy emphasizes environmentally and economically sustainable methods to capture and reinvest resources into our economy, including everything from metals and plastics to energy, nutrients, and soil. It initiated a stakeholder consultation process to establish goals and to ensure tracking of complete materials management data. It also empowers new partnerships across state and local agencies, the agricultural, energy, and transportation sectors, environmental organizations, and recycling innovators.

MDE's Office of Recycling, within the RMP, implements MDE's SMM policy and initiatives. As part of this broader effort, RMP administers the Maryland Recycling Act, under which it reviews and approves county recycling plans that must demonstrate a recycling rate of at least 20 or 35%, depending on the county's population. RMP conducts a variety of other planning, outreach, and technical assistance work to support MDE's overall SMM policies.

Current Activities

Evaluating Progress Toward SMM Goals

In April 2019, MDE published a set of SMM metrics and goals. These metrics go beyond the weight-based recycling rate that has traditionally been calculated under the Maryland Recycling Act, in an effort to better track the environmental outcomes of Maryland's SMM efforts. Among these metrics are reductions in the quantity of waste generated per person, per day, reductions in GHG emissions and reductions in energy usage as a result of the state's waste diversion activities. The GHG emissions and energy usage metrics use the EPA's WARM model. Beginning in 2019, RMP tracks these metrics through its annual Maryland Solid Waste Management and Diversion Report[30].

Promoting Food Waste Diversion

RMP continues to focus on food waste as a priority area; food scraps make up almost 18% of all MSW that is disposed of in landfills and other disposal facilities in Maryland, where it generates GHGs. In addition to reducing GHG emissions at landfills, food scraps that are turned into compost also

[30] https://mde.maryland.gov/programs/land/RMP/Documents/MSWMaDR%20%2722.pdf

sequester carbon and enriches the soil. Compost, and other organic sources of fertilizer, improve soil health in ways that synthetic fertilizers do not. In recent years, RMP has worked with a variety of stakeholders to promote waste prevention, food donation, composting, and anaerobic digestion of food scraps. For example in 2023, MDE has been an active participant in the Maryland Food System Resiliency Council.

In 2021, MDE held its third Maryland Food Recovery Summit in December, which highlighted food scraps diversion as a climate change strategy with a panel of presentations on the topic. In 2021, Solid Waste Management - Organics Recycling and Waste Diversion - Food Residuals was enacted, which phases in a requirement for certain businesses and institutions that generate large quantities of food residuals to divert those materials from disposal, through waste prevention, food donation, recycling (composting or anaerobic digestion), or animal feed. The requirement covers entities that generate more than a threshold quantity of food residuals per week (two tons starting in 2023; decreasing to one ton in 2024), and are located within 30 miles of an organics recycling facility that has capacity to and is willing to accept the entity's food residuals for recycling. The types of entities covered include but are not limited to: individual schools, supermarkets, convenience stores, mini-marts, business or institutional cafeterias, and cafeterias operated on behalf of state or local government, if these entities meet the quantity and location criteria described above. MDE has conducted some inspections in 2023 to verify compliance.

RMP is conducting outreach to affected entities and has developed technical assistance resources that include, among other things, an online map that displays the location and contact information for organics recycling facilities and each facility's 30-mile radius. MDE also developed regulations to implement the food residuals diversion requirements of the law. These regulations were developed using feedback collected in July 2022 from food residuals generators, food recovery and recycling organizations, and other interested parties. Outreach materials, technical assistance, and additional information regarding the law can be found here.

Improving Markets for Recyclable Materials

An estimated 24% of all MSW disposed in Maryland is made up of materials that could have been recycled through traditional curbside recycling programs, and another 14% could have been recycled through channels outside the traditional curbside programs (e.g., electronics). Diverting more of this material from disposal will require not just enhanced collection of recyclables, but may create markets for those recyclable materials once collected.

To this end, MDE is launching a new recycling markets development initiative. During the 2021 legislative session, HB 164 - Recycling Market Development[31] was signed into law by Governor Hogan. Under the new law, MDE evaluates the availability of markets for recyclables, identifies businesses in the state that use recycled materials, and promotes the development of markets for recycled materials

[31] https://mde.maryland.gov/programs/LAND/Pages/LMA-Legislation.aspx

and recycled products in the state. As part of this effort, MDE will consult with relevant stakeholders, including the Maryland Department of Commerce and other state agencies, local governments, recycling organizations, and representatives of industries that generate and use recyclable materials. More information on activities carried out under this law, a fact sheet, and information on recycling resources can be found on the Recycling Market Development webpage[32].

In 2023, MDE joined the Maryland Department of Commerce's Regional Resource Teams to help promote the business case for recycling, as well as to identify opportunities for developing recycling businesses. In addition to this, MDE is establishing connections within the Economic Development Departments in counties that are not meeting their recycling targets. The goal of this exercise is to help ID barriers of entry for recycling businesses, connect businesses with recyclers, and to identify opportunities for recycling businesses that want to set up shop in those counties.

Solid Waste Infrastructure for Recycling (SWIFR) Grant

In 2023, MDE received a three year grant from the EPA. The grant's activities have two focus areas: organics and the circular economy.

Under the Organics Assessment activity within the grant, MDE will be researching, evaluating and considering local and state data to identify where potential organics recycling infrastructure could be located with the greatest benefit. Benefits align with both the Food Loss and Waste Reduction Goal and the Justice40 Initiative as MDE strengthens both waste diversion and food resilience. During the evaluation of existing data sources, MDE expects to interpret and resolve the information for validity to determine high potential locations. MDE then will perform virtual and in-person presentations to a variety of stakeholders to identify confidence or roadblocks in perception associated with the potential infrastructure locations. Based on discussions, MDE will provide necessary education and outreach to stakeholders. MDE will revise the current mapping of high potential infrastructure locations with an associated confidence rating. Once the visual tool is live, MDE will coordinate a state-wide event to promote the tool and host follow-up meetings and presentations to support organics diversion efforts. MDE will collaborate with other state and local agencies to develop a plan for providing equitable opportunity to attend education and outreach on topics including compost operator training, community compost programs, co-digestion considerations and feedstock, and sustainable workforce development.

Under the circular economy activity, MDE will do a comprehensive review of current tonnage, processors and markets. MDE then will analyze to determine where there are consistent gaps and identify how those markets can grow. Depending on the materials being evaluated, MDE may suggest policy revisions to local or state statutes or work with regional businesses and institutions to drive supply and marketing. MDE will generate online tools that promote publicly available data to continue

[32] https://mde.maryland.gov/programs/land/RecyclingandOperationsprogram/Pages/Recycling-Market-Development.aspx

to drive the circular economy. MDE will identify existing reuse markets, and analyze fiscal and waste impacts for utilization of reuse programs in publicly operated facilities specifically focused on food serviceware. MDE will evaluate the impact reuse will have on local workforce development and reduction in environmental impacts associated with transportation and disposal.

Polystyrene Ban

MDE is tasked by the legislature to conduct outreach about the ban. The county departments of health or environmental protection oversee the enforcement and have the authority to assess fines for noncompliance. Details on the law, including links to the law, a copy of the Public Notice, and a FAQ page are available on MDE's EPS Food Service Products Ban webpage[33].

Future Activities

Promoting Solar Panel and Lithium Ion Battery Recycling

Renewable energy and EV adoption are important components of the state's overall climate change goals. In order to support these efforts, RMP will work to facilitate the proper recycling of waste streams generated by these beneficial technologies. Both solar panels and lithium ion batteries can be challenging to manage because both contain constituents that are potentially hazardous, solar panels are bulky, and lithium ion batteries can pose a risk of fire if not properly managed. Lithium ion batteries contain resources that are in critical need to create new batteries and are in scarce supply globally.

First, RMP will work with the SWP to create a fact sheet on solar panel recycling considerations. It will also follow developments in federal guidance on solar panel recycling and update its own information as needed. Second, RMP will create a website to act as a clearinghouse on lithium battery recycling opportunities, including existing opportunities through local household hazardous waste collection programs and industry led programs. Finally, markets for lithium ion batteries and solar panels, including reuse opportunities, will be evaluated as part of the recycling markets initiative described above.

RMP is also taking the lead facilitating the Solar Photovoltaic Systems Recovery, Reuse, and Recycling Working Group under the MCCC created by the CSNA.

Further Food Waste Reduction and Recycling

EPA and the Enhance U.S. Department of Agriculture have a joint food loss and waste goal of 50% by 2030. EPA recently announced that it has reinterpreted that 50% goal to mean a reduction in the pounds of food per person that are sent to landfill, controlled combustion, sewer, co/anaerobic digestion, compost/aerobic digestion, and land application. This highlights the relative importance that

[33] mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Pages/Expanded-Polystyrene-Food-S ervice-Products-Ban.aspx

EPA places on source reduction and food donation relative to other forms of food diversion (composting and anaerobic digestion). This is relevant from a climate change standpoint in that GHG emissions are reduced more from food waste prevention efforts and food donation than from other forms of food waste division. RMP will review EPA's recent interpretation and determine how to better prioritize and encourage source reduction and food donation efforts.

Biosolids Land Application Activities

A significant quantity of biosolids generated in Maryland are managed through land application on agricultural land in-state, or export to other states for land application. Timing for land application is important, because there are restrictions on the time of year that biosolids may be land applied, as well as restrictions on application to saturated ground. Flooding or extreme weather can therefore impact the availability of land application as a means of managing biosolids. As a result, RMP has been in contact with wastewater treatment plants and land application companies to encourage them to plan ahead for adequate regular and emergency storage, taking into account potential weather impacts. Land-applying biosolids can be an important step to sequester carbon, improve soil health, and reduce GHGs emissions from biosolids that would have otherwise been landfilled. In 2022, more than 51,649 wet tons of biosolids were land-applied in the state of Maryland.

Animal Feeding Operations

Program Overview

The RMP regulates over 500 animal feeding operations (AFOs) under a General Discharge Permit for Animal Feeding Operations. The permit requires each operation to have an approved Comprehensive Nutrient Management Plan and comply with certain BMPs designed to effectively protect water quality by containing animal manure, poultry litter and processed wastewater, separating the material from clean stormwater, and properly managing the material through on-site land application or export offsite. AFOs must have waste storage structures with adequate storage capacity to fully contain animal manure, poultry litter and process wastewater generated on site prior to land application or export. Flooding or extreme weather events have the potential to compromise the containment of wastes within these structures and could result in potential impacts to waters of the state.

Current Activities

RMP has conducted a review of AFOs to determine those that may be affected by flooding or sea level rise. To date, RMP has identified 33 existing AFOs that are located in 100- and 500-year tidal and non-tidal floodplains. Specifically, RMP has created a map identifying 22 farms in the 100-year floodplain and 11 farms in the 500-year floodplain. These are facilities confirmed to be producing animals as of

February 2022. When an extreme weather event that could impact AFOs is anticipated, RMP has sent guidance and reminders to AFO operators about emergency preparedness at AFOs.

In FY 2023, MDE started using the Coast Smart CRAB Data Model to identify how many of its inspections at CAFOs were also in areas that were susceptible to coastal and river flooding. MDE determined that 65 of the 168 inspections that were conducted at CAFOs were also in areas that were susceptible to coastal and river flooding. MDE expects to increase the total number of inspections in these areas in FY24.

Future Activities

RMP will establish a system of prioritizing AFO inspections that considers, in addition to existing inspection priorities, enhanced inspections for AFOs that may be more susceptible to flooding, including those identified above. RMP will work on updating and improving the map of potentially flood-prone AFOs to assist in this effort.

RMP will partner with the Natural Resources Conservation Service, Maryland Department of Agriculture (MDA), and local soil conservation districts to identify effective BMPs for existing AFOs located in tidal and non-tidal flood-prone areas. This partnership will also involve a process for evaluating new AFOs for permit coverage, taking into account areas currently or projected to be subject to flooding as well as the structural condition and storage capacity of waste storage structures.

Finally, RMP will work with MDA to update and publish guidance on preparing for natural disasters on commercial poultry farms.

Water and Science Administration (WSA) Programs and Initiatives

Strategic and Management Actions

Climate change is water change. The Water and Science Administration (WSA) achieves MDE's vision of healthy, vibrant and sustainable communities and ecosystems for all Marylanders by implementing laws that protect and restore water quantity and quality in our built and natural environments. The increased temperatures associated with climate change are changing Maryland's water balance by increasing precipitation, ground and surface water levels, and flood risks, while also accelerating evaporation from the land and water surfaces that increase the risks of drought and extreme weather.

WSA scientists, engineers and planners in seven programs are enhancing our water programs to adapt to these climate-driven water changes. We do this by integrating current science, technology and best practices into our water planning and programs, permit approvals and related oversight authority. We also require modernization and maintenance of traditional water infrastructure, like wastewater and drinking water plants, as well as promote nature-based green and blue infrastructure, such as forests and wetlands, to protect and restore Maryland's waters and build resilience to changing conditions. When environmental emergencies and extreme weather occur, we deploy staff who are trained and prepared to minimize threats to public health, safety and the environment.

MDE's WSA has identified four priority Climate Change Action Areas:

1. Leveraging Science and Planning
2. Enhancing Regulatory Actions
3. Promoting Climate Resilient Water Resources and Infrastructure
4. Ensuring Emergency Preparedness and Response

To accelerate action on WSA's climate priority areas, WSA leadership initiated a cross-program Climate Team to expedite action on these priority areas. During 2022-23 WSA Climate Sub-teams focused on the following topics:

1. Permit Climate Reviews
2. Emergency Preparedness, and
3. Development of a Climate Adaptation Dashboard

Featured WSA Initiatives

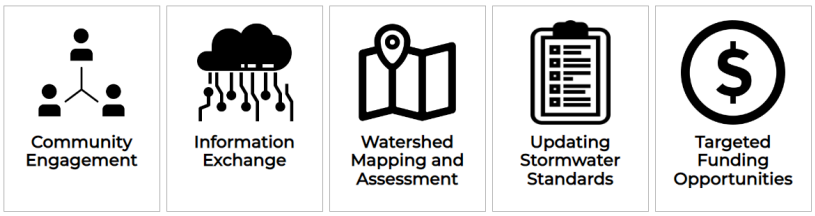
Urban Flooding and Stormwater Management

When land is developed, stormwater that had previously soaked into the natural land is often prevented from doing so by paved streets and sidewalks, buildings, even by soils that have been compacted during the development process. The increased surface runoff of stormwater must be controlled so that it doesn't cause localized or downstream flooding.

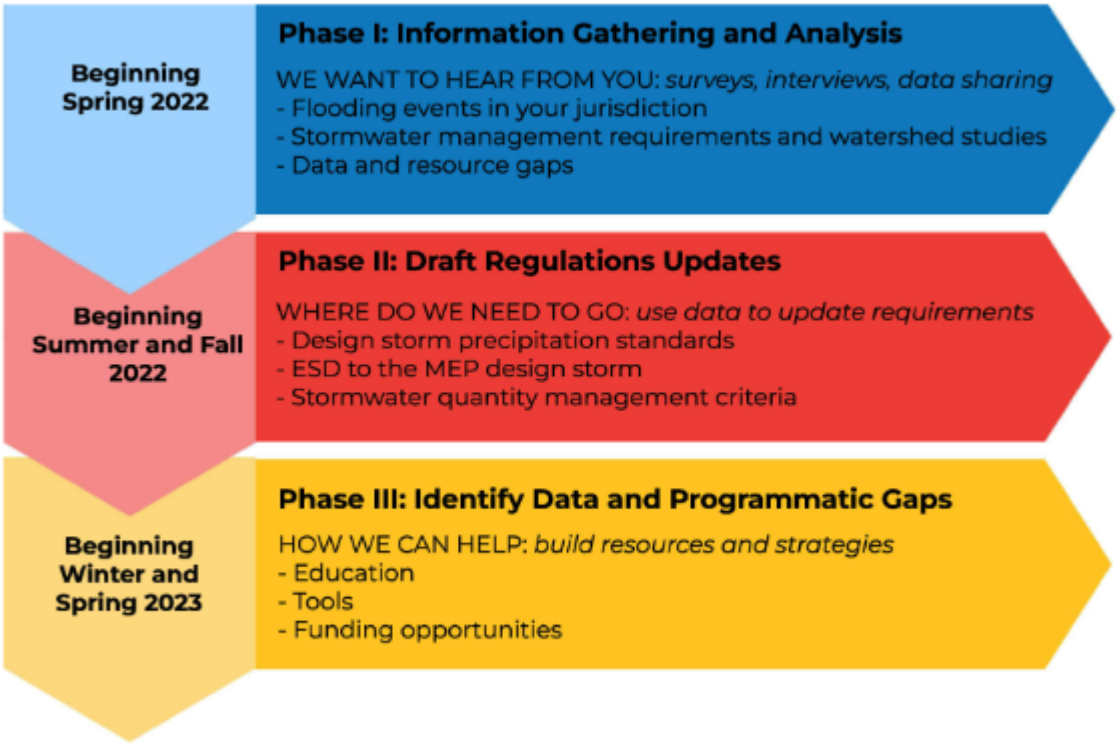
Stormwater drainage systems are typically designed to convey stormwater volumes up to the 10-year storm, that is, storms with a 10-percent chance of occurring in any year. When the rainfall exceeds the 10-year storm threshold, many drainage systems are designed to direct excess flow into the streets with curbs and gutters as the next level of water conveyance. This design is intended to balance drainage system cost with an acceptable level of modest street flooding. In rare cases, perhaps once every 25 years (4% chance in any year), severe flooding occurs that exceeds the street curb capacity to contain the water. Stormwater drainage infrastructure needs to be designed to ensure it can withstand the stresses of such extreme rain events.

In our region, climate change threatens to cause more intense rain events, overwhelming this stormwater drainage design framework and increasing the risk of urban flooding. In recognition of this, MDE WSA created its A-StoRM strategy: Advancing Stormwater Resiliency in Maryland (A-StoRM): Maryland's Stormwater Management Climate Change Action Plan.[34] This strategy was published in November 2021 as required by amendments to Maryland's stormwater management statue (SB 227 of the 2021 legislative session[35]).

Central to the A-StoRM strategy is the revision of stormwater management design standards, which are part of Maryland's stormwater regulations. The key benefits of the A-StoRM strategy are to maintain an acceptable level of flooding like those described above despite increased future rainfall. This will be done for new land development, redevelopment of previously developed areas, and the restoration of areas that were developed in the past using old or no design standards. In addition to managing urban/suburban flooding, the new stormwater design standards will have environmental benefits. They will help prevent the erosion of local streams, and promote groundwater infiltration, which filters out pollutants and feeds streams with cool water in the hot, dry seasons. This will benefit downstream waters like drinking water reservoirs and the Chesapeake Bay.



[34] mde.maryland.gov/Documents/A-StorRMreport.pdf
[35] mgaleg.maryland.gov/2021RS/Chapters_noln/CH_641_sb0227e.pdf



You can check-in on the activities of this important climate resilience building activity at the A-StoRM HUB.[36] Additional details about A-StoRM activities are described in the section entitled, "WSA Accomplishments and New Initiative Highlights" below.

Dam Safety in the Age of Climate Change

Dams pose a risk of failure that society accepts in exchange for the water supply, recreational, flood control and other benefits they provide. Many dams are of earthen construction. They can be weakened if dried out and then stressed by heavy rains. Consequently, extreme swings between drought and heavy rainfall, characteristic of climate change, increases the threat posed by these common types of dams.

Many dams are privately owned. Some of these are classified as high- or significant-hazard, meaning their failure would lead to loss of life and major property loss. It is common for private owners to face financial challenges that render them unable to maintain the safety of their dams. MDE WSA recognizes that climate change threats necessitate more robust dam safety management. The key benefit of these efforts is a reduced risk of dam failure and resultant loss of life and property. Additional benefits include lower long-term costs that come with regular maintenance of infrastructure. By being proactive,

[36] https://sb-227-maryland.hub.arcgis.com/

Maryland is better positioning itself to benefit from the federal Infrastructure Investment and Jobs Act (IIJA) funding. The following are some recent steps taken to buttress dam safety resilience.

Savage River Dam, Garrett County Maryland

Dam Repair & Removal Fund

In 2023, WSA developed proposed legislation to establish a fund and revenue generating mechanisms to fund emergency dam repair or removal actions. WSA also produced the "Report on Dam Safety Program Funding Needed for Oversight of Privately Owned Dams" in response to a request by the Chairmen of the Senate Budget and Taxation Committee and House Appropriations Committee during the 2023 Session. Departmental legislation, adopted in 2020, strengthened MDE's authority to require the repair or removal of unsafe dams (HB 177). This follows 2017 legislation making dam owner emergency action plans (EAPs). And the exercise of EAPs, mandatory (HB 125). These legislative steps are building greater physical and institutional resilience to climate stresses on dam infrastructure.

Dam Removal Guidance

During 2022 - 2023, WSA, in collaboration with DNR, developed new guidance for the removal of dams. The removal of certain dams reduces risk posed by increased climate change stresses. The dam removal guidance development is also motivated by the anticipation of a greater permitting demand due to the availability of increased federal IIJA infrastructure funding.

Tabletop Exercise for Dam Safety

In spring 2022, WSA participated in a Western Maryland Collaborative Technical Assistance initiative conducted by FEMA. Among other things, the initiative included a tabletop exercise centered on the town of Oakland involving the scenario of an extreme rainfall event, of the type being driven by climate change, that placed several dams at risk of failure.

Probable Maximum Precipitation Study for Maryland Dams

A probable maximum precipitation (PMP) event is the greatest depth of precipitation at a particular location for a given duration that is meteorologically possible. This theoretical maximum is likely changing due to climate change. High- and significant-hazard dams must be structurally sound enough to safely pass a PMP storm event or 50% of the PMP storm event (respectively). In 2020, WSA secured funding to update Maryland PMP estimates via a three-phased process. The first phase was completed in 2021, and phase 2 was largely completed in 2022. PMP depths have been derived by storm type (local, general, and tropical) and at durations required for proper hydrologic modeling analyses for any location and any basin within the state. Findings have been peer reviewed. Work on Phase 3 was conducted in 2023 to produce a final report, a GIS PMP database, and data access tool. These products will support Maryland's outreach and make the PMP research actionable by dam owners and their engineering consultants for designing dam embankments, control structures, and axillary spillways.

Dam Inundation Hazard Mapping

Beginning in 2020, in collaboration with Maryland Environmental Service (MES), WSA's Dam Safety Program secured funding from the FEMA Hazard Mitigation Grant Program for a dam breach inundation analysis and mapping project. As of 2023, WSA dam safety staff are in the final stages completing the project, which has produced maps for 500 dams in Maryland using FEMA's advanced DSS-Wise Lite modeling and mapping tool. The mapping layers will be shared with other state agencies, local emergency managers, local floodplain managers, and local planners. The mapping layers will be integrated into MDE's publicly available Flood Risk Mapping Tool to help assess and mitigate flood risks.

Water Resource Element Land Use Plan Climate Change Guidance Update

In 2022, WSA partnered with MDP to release climate-enhanced guidance for the Water Resources Element (WRE) of local comprehensive land use plans. The WRE ensures that planned land development accounts for the area's water resources. Specifically, the WRE must 1) identify drinking water and other water resources that will be adequate for the needs of existing and proposed future development, and 2) Identify suitable receiving waters and land areas to meet the stormwater management and wastewater treatment and disposal needs of existing and proposed future development.

The revised guidance alerts local planners to the increasing risks that climate change is having on water resources and water related hazards. Planners are directed to assess existing flood risk areas that are likely to worsen, stormwater conveyance capacity limits to avoid creating new flood risks, siting of development relative to dam inundation areas, and the potential that climate extremes could trigger deeper drought conditions that warrant greater margins of safety for water supplies.

The guidance also uses the FEMA concept of "life lines." Planners are urged to consider how more frequent and severe water hazards relate to other planning functions. More attention must be given to ensuring safe travel corridors between critical services and those who need them. Analyses should be

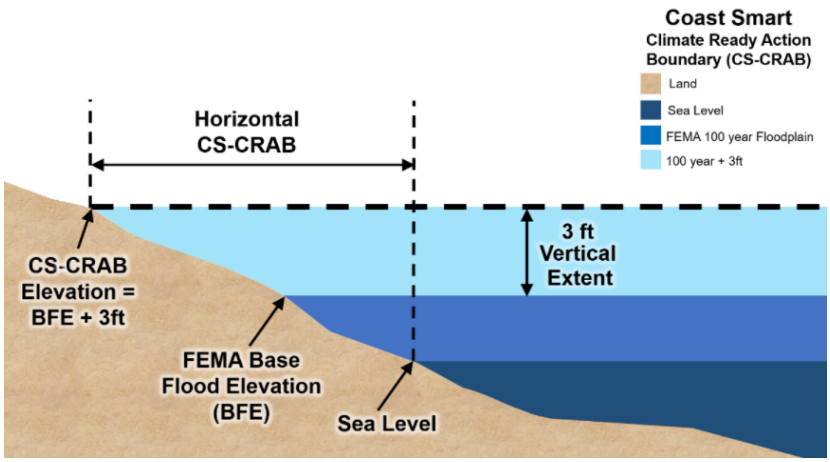
conducted to ensure wildfire and hurricane evacuation corridors have sufficient capacity and are as redundant as possible. The location of industrial land use areas, which are often associated with hazardous materials, warrant special consideration relative to potential flooding, water supplies and other risks of human and natural environmental exposure.

The key benefit of this guidance is that it gives all local land use planners consistent information on which to base decisions that can build climate resilience for future generations. As indicated by the consideration of "life lines" noted above, their decisions can prevent development that contributes to or is at risk of climate change impacts.

The original 2007 WRE guidance remains unchanged and is available as a Models and Guidelines[37] document. The 2022 WRE Guidance Updates,[38] which include climate change guidance, are now available online.

CoastSmart Climate Ready Action Boundary (Tidal & Riverine):

Climate change is increasing the threat of flooding. These threats are exacerbated by the legacy of development in flood prone areas and by aging infrastructure.

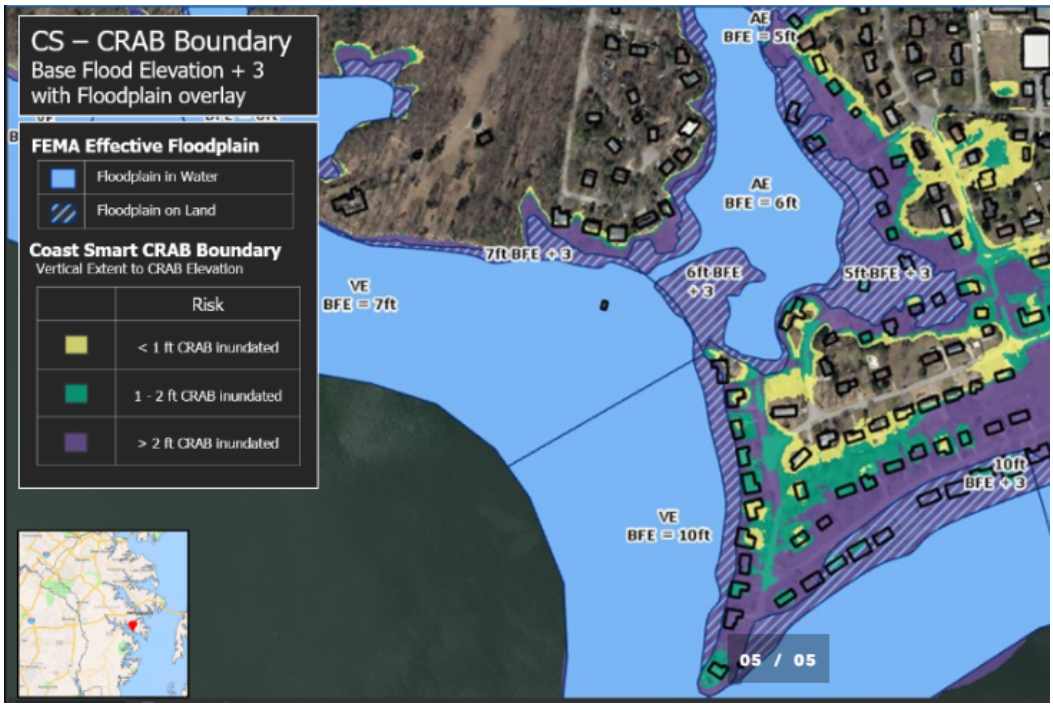


Coastal flooding occurs due to cyclical high tides, wind-driven storm surges, and climate change induced sea level rise. Riverine flooding occurs when a stream or river overflows its banks, usually due to intense rainfall, but also caused by water backing up behind a dam or other stream/river constriction.

Based on historical records, hydrologists are able to estimate the likelihood of flooding events. A common metric is defined for a flood that has a one-percent chance of occurring in any year (often called the 100-year flood). However, climate change is predicted to increase the likelihood of extreme flooding. With this in mind, Maryland wanted to know what land area is at risk of inundation for floods rising higher than the 100-year flood level. To answer this question, MDE's Water and Science Administration used funding from FEMA to conduct geographic information system (GIS) analysis to map flooding above the 100-year flood level.

[37] planning.maryland.gov/Documents/OurProducts/Archive/72195/mg26-Water-Resources-Element.pdf
[38] planning.maryland.gov/Pages/OurWork/envr-planning/water-resources-mg/2022/2022-guidance-update.aspx

When the water level rises, it also spreads out across the land as depicted by the "horizontal" extent of water in the figure above. That figure depicts a coastal area subject to tides. However, the nontidal and riverine case is analogous. The tidal coastline mapping tool shows flooded areas for a hypothetical situation in which the water level rises up to 3-feet above the FEMA base flood elevation (BFE)[39], which is three additional feet above the 100-year flood. This tidal flooding scenario is depicted below.



The hashed areas in the figure above show the current 100-year tidal floodplain, which would be inundated by water with a likelihood of one-percent in any given year (pre-climate change). The solid purple, green and yellow show areas with inundation depths of as much as 3, 2, and 1 feet respectively for water levels that exceed the 100-year BFE by 3 feet. This mapping tool of coastal flooding was completed in 2020 and is called CoastSmart Climate Ready Action Boundary (CS CRAB).

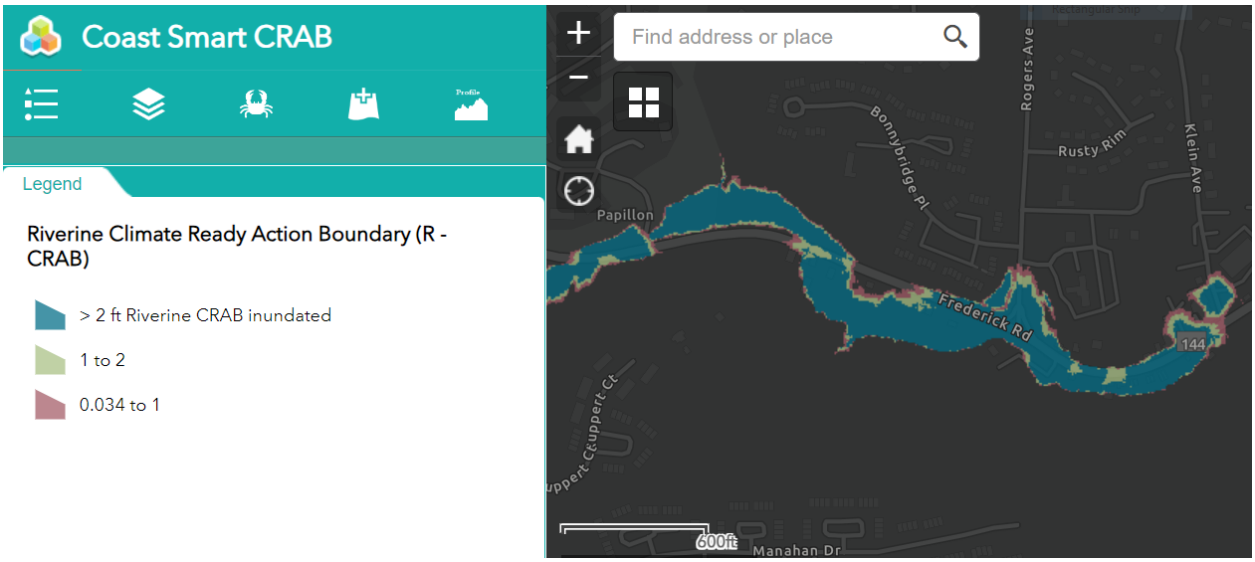
CS CRAB, for tidal areas, supports Maryland's Coast Smart [CoastSmart Construction Program](). [40] This program sets siting and design criteria for State and local infrastructure projects of $500,000 or greater that use 50% or more in State funds, which lie within the tidal flooding area defined by the CS CRAB.

[39] The base flood elevation is the high-water level of the 1% annual chance flood (also known as the 100-year flood). This is relevant to climate change, because the high-water level associated with a 1% chance flood is rising. A key cause of inland riverine flooding is increasing rainfall amounts. The cause of coastal area flooding is sea level rise and higher coastal surges associated with more intense storms.

[40] dnr.maryland.gov/climateresilience/Documents/2020-Coast-Smart-Program-Document-FINAL.pdf

The riverine version of the mapping tool, R-CRAB, was released in 2023. The Riverine CRAB depicts inundated areas for water depths that exceed the 100-year flood by as much as 2 feet. It is not part of the CoastSmart Construction Program and is only used for informational purposes.

The figure below depicts an image from the Riverine CRAB for Frederick Road in Baltimore, MD. The water flow is from left to right, and the mapped inundation areas indicate choke points where water backs up, like that next to Papillon Drive on the left side of the image, among other flooding phenomena.



The key benefit of these tools is that they provide a standard set of information for climate resilience planning by local governments and the private sector across Maryland. This vital information will help justify decisions that reduce climate change flooding impacts with associated cost savings including human life. These CRAB Mapping Tools[41] are available online.

WSA Accomplishments and New Initiative Highlights

The following are highlights of accomplishments and new initiatives[42]. Many of these efforts were supported by the WSA Climate Team.

[41] arcgis.com/home/item.html?id=93218f38c5014853bb308dacdaf23a9c

[42] See MDE's 2022 Annual Programmatic Status Report on Climate Change for accomplishments that date back to 2019. https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Pages/Annual-Climate-Change-Reports.aspx

Laws and Regulations

A-StoRM (Advancing Stormwater Resiliency in Maryland)

In 2021, the Maryland General Assembly adopted amendments to the state's stormwater management statute (2021 SB 227[43]). In response, WSA submitted a report to the General Assembly in November 2021 entitled, "Advancing Stormwater Resiliency in Maryland (A-StoRM): Maryland's Stormwater Management Climate Change Action Plan". It includes MDE's strategy for immediately updating water quantity control standards for watersheds where flooding events have occurred on or after January 1, 2000, and MDE's plans for updating all other stormwater management regulations. (Also see, "Featured WSA Initiatives", above, and "Communications, Policies and Procedures", and "Monitoring, Research and Analysis" below).

Erosion and Sediment Control

In 2023, the Maryland General Assembly adopted amendments to the state's erosion and sediment control statute. The amendments require the Department to review and update specifications for sediment control plans in a certain manner on or before December 1, 2025, and every 5 years thereafter accounting for updated precipitation data. On or before November 1, 2023, the Department shall report to the General Assembly on the Department's plans and resources needed for reviewing and updating specifications for sediment control plans.

Cool and Cold Water Protection

In 2022, WSA adopted clarifications to Maryland's regulatory antidegradation procedures for Tier 1 waters that have coldwater existing uses, redesignating some streams as Class III coldwater and identifying others as having unique coldwater existing uses (See Antidegradation Policy[44]). As part of these regulatory changes, WSA incorporated by reference (COMAR 26.08.02.04-1) a set of procedures and policy for identifying coldwater existing uses[45] so as to protect the unique biota (e.g., trout) that depend on these waters and the water quality required to support them. This action, plus the Department's collaboration with DNR and other stakeholders to monitor for previously undiscovered and undesignated coldwater streams, helps to enhance current and future protections for this important resource. In addition to these efforts to improve Maryland's water quality standards protections for cool and coldwater, WSA is also evaluating its coldwater protection mechanisms for its permitting programs. This effort has already resulted in improved screening for sensitive coldwater resources, which have led to more protective permit conditions, but has also highlighted the need to make revisions to the Stormwater Design Manual and the Standards and Specifications for Soil E&SC.

[43] mgaleg.maryland.gov/2021RS/Chapters_noln/CH_641_sb0227e.pdf

[44] mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Pages/Maryland-2019-Triennial-Review-of-Water-Quality-Standards.aspx

[45] mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Documents/Cold%20Water%20Existing%20Use%20Determinations%20Policy%20and%20Procedures.pdf

Wetlands and Waterways Ecological Restoration

In 2023, WSA's Wetlands and Waterways program continued a study required by legislation adopted in 2022 (Wetlands and Waterways Program Division – Authorizations Permitting for Ecological Restoration Projects – Required Study, HB 869[46]). The study, involving a series of stakeholder group meetings, is a comprehensive analysis of the permitting ecological restoration projects and recommendations for permitting and/or regulatory updates found during the study. Although the legislation is not explicit about climate change, WSA intends to account for climate change considerations. The study findings are due June 1, 2024.

Climate Resilience & the Bay Restoration Fund

In 2020, amendments to Chapter 44 of the Maryland Constitution expanded the criteria used to determine how to allocate funding from the Bay Restoration Fund (BRF) by including climate resiliency and flood control as issues for MDE to consider when determining the priority of funding for projects (Bay Restoration Fund – Authorized Uses, HB 78 2020[47]). These changes involve programs administered by WSA, including:

- Stormwater projects that provide flood control and assist in mitigating repeated flooding events;
- Treatment works projects that increase the resilience to manmade or natural disasters such as extreme weather events and sea level rise;
- Projects undertaken by communities that are participants in the National Flood Insurance Community Rating System; and
- Projects that reduce risk of flood or coastal hazards in communities identified as "at risk" in the State Hazard Mitigation Plan.

Permits and Other Approvals

Enhancing regulatory actions to build climate resilience and adaptation is a top priority for WSA. Permits and other approval instruments are central to this priority. WSA is using a 3-level review process to systematically assess permits for enhancement opportunities. These range from changes that can be made with existing knowledge and authority to changes that necessitate research or regulatory changes. In 2023, WSA committed to conducting a screening level review of 95% of all regulatory instruments by the end of calendar year 2024 (level-1 reviews). This will be followed, or paralleled in some cases, by the two additional levels of review.

The following are specific steps taken in this process.

Permit Climate Review Support

[46] mgaleg.maryland.gov/2022RS/Chapters_noln/CH_465_hb0869t.pdf
[47] mgaleg.maryland.gov/2020RS/bills/hb/hb0078t.pdf

In 2023, WSA solicited and received support from EPA Region 3 to help conduct reviews of the many instruments used to make regulatory decisions, such as permits, licenses, certifications, and letters of approval ("permits" for shorthand). WSA has committed to conducting a screening level review of over thirty categories of permits for climate resilience opportunities. The outcome of the reviews will be many fold. When feasible, the reviews will identify changes to permit templates and internal permit writing guidance in the near-term. The reviews will also document further study needed, and recommendations for changes to regulations or statutes that would enable climate resilience improvements to permits in the future.

Permit Climate Reviews: NPDES Municipal Wastewater Discharge Permit and General Permits

In 2021, WSA staff developed special condition permit language to increase climate resilience for individual National Pollutant Discharge Elimination System (NPDES) municipal wastewater discharge permits based on existing knowledge and authority, and began incorporating the language in 2022 as permits came up for renewal.

Screening reviews for number of general permits have been conducted between 2021 and 2023 including Stormwater Associated with Construction Activity (20CP), Industrial Stormwater (20SW), Coal Mine Discharge; Mineral Mine, Quarries, Concrete and Asphalt Discharge; Seafood Processing Discharge, Swimming Pool, Spa Discharge GP, Pesticides Discharge GP, and Marinas Discharges GP.

Water Appropriations Permits

In 2023, WSA completed a draft screening level review of MDE's water appropriation and use permit that focuses on drought risks. The assessment offers recommendations for improving future permits and suggests additional studies.

Bermed Infiltration Ponds

In July 2021, MDE issued a 15-month suspension on the construction of Bermed Infiltration Ponds (BIPs). BIPs have been used as a means of sewage disposal in Talbot, Somerset and Dorchester counties in locations where traditional septic systems do not readily function. Site inspections indicate aging BIPs are beginning to fail or at risk of failure. The location of these systems tend to be in sensitive coastal areas subject to anticipated climate change impacts, including sea level rise, water table rise, and increased rainfall volume and intensity.

WSA conducted an in-depth assessment of BIPs, which was finalized in a report in November 2022[48] that lays out steps for moving forward on managing BIPs. One step completed is a ranking of BIP failure risk, which is part of a road map for county action. The road map includes a system of tracking that involves tiers of monitoring over time. Another step underway is a pilot project to connect a BIP to a public sewer system, which will serve as a model for additional connections.

[48] https://mde.maryland.gov/Documents/BIP%20REPORT.pdf

Water and Sewer Plan Amendment Reviews

Maryland requires local governments to adopt formal plans when expanding water and sewer service. WSA water and sewer plan reviews and approvals are now screened for various climate change vulnerabilities. This is intended to ensure local planners and engineers are aware of their professional responsibilities to incorporate climate change and resilience into their planning.

Wetlands Approvals

The Wetlands and Waterways Program is taking steps to phase in accountability for climate change. During 2021, WSA's Wetland and Waterways Program enhanced its stream restoration permit application package checklist[49] to better protect mature riparian trees during stream restoration projects. The checklist enhances avoidance and minimization guidance that benefits climate change resilience. In 2022, the Program enhanced its Pre-Application Meeting[50] webpage to include a section on climate change impacts with links to resources for the evaluation of climate change risks.

In 2023, MDE finalized the project to update its structural shoreline stabilizations maps last updated in 2009. The refined model output delineates areas where living shorelines are a suitable treatment option for erosion control, and where waivers should be permissible given current shoreline conditions and energy regimes. It Includes conditions like fetch, water depth, width of channel and existing conditions (i.e. beach, marsh, structural, width of channel). It improves planning for applicants and waiver decisions by MDE. MDE also developed a proposed living shoreline supplemental permit checklist for applicants seeking a living shoreline permit. These new tools will promote the easier adoption and permitting of living shorelines in Maryland, a more climate and ecologically resilient feature over a hardened (bulkhead or revetment) shoreline.

Communications

This section covers communications activities to advance WSA's climate change resilience-building goals. This includes guidance, training, and technical assistance in addition to other modes of communications.

WSA Climate Adaptation Website

Adapting and building resilience to climate change is the primary focus of WSA. In 2021, WSA launched its Climate Adaptation and Resilience Website.[51] During 2022, WSA began developing a Climate Change Dashboard, which will feature a set of top climate action priority areas. When completed, the

[49] mde.maryland.gov/programs/Water/WetlandsandWaterways/PermitsandApplications/Pages/nontidal_permits.aspx

[50] https://mde.maryland.gov/programs/Water/WetlandsandWaterways/Pages/PreApplicationIntroduction.aspx

[51] mde.maryland.gov/programs/Water/Pages/WSA_Climate_Change.aspx

dashboard will highlight key climate adaptation activity areas and track progress. In late 2023, WSA was on the cusp of implementing its Dashboard.

Water Resources Element (WRE) of Local Comprehensive Plan: Climate Change Guidance

In 2022, the WRE Climate Change guidance was released via an MDP website.[52] This followed work in 2021 when WSA partnered with MDP to develop guidance on climate change considerations for the existing WRE guidance. The purpose of the WRE is to identify: "(1) drinking water and other water resources that will be adequate for the needs of existing and future development proposed in the land use element of the plan; and, (2) suitable receiving waters and land areas to meet stormwater management and wastewater treatment and disposal needs of existing and future development proposed in the land use element of the plan."

A-StoRM (Advancing Stormwater Resiliency in Maryland)

The A-StoRM initiative, discussed above, has recently involved the following communications and outreach actions (Also See "Laws and Regulations", and "Monitoring and Analyses"):

- A-StoRM HUB: This complex initiative, started in 2021, is supported by an information center called AStoRM HUB[53] launched in 2022.
- A-StoRM Regional Kickoff: In spring 2022, WSA's Stormwater, Dam Safety and Flood Management Program initiated its stakeholder engagement process with three regional meetings. A recording of one of these kickoff meetings is available here.[54]
- A-StoRM Stakeholder Consultation Group: In summer 2022, WSA's Stormwater, Dam Safety and Flood Management Program initiated engagement with a Stakeholder Consultation Group. The group is made up of experts across the regulatory, academic, and private sectors who are being asked to advise on proposals that are being vetted by a number of technical advisory groups (TAGs).
- Stormwater Regulation TAG: WSA staff started a series of meetings with a newly formed Stormwater Regulation TAG in 2022, which will help develop and vet proposed regulatory changes. In 2023, this stakeholder advisory group provided comments to MDE regarding initial proposed updates to State regulations and the Stormwater Design Manual.[55]

Flood Awareness Month

WSA staff participate in the planning and events of Maryland's Flood Awareness Month (FAM) each April. The FAM is coordinated by the Maryland Resiliency Partnership.[56] In addition to a wide variety of educational outreach activities, WSA has produced several short flood awareness videos with key messages (the Frederick City video was produced by MDE's Office of Communications):

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[52] planning.maryland.gov/Pages/OurWork/envr-planning/water-resources-mg/2022/2022-guidance-update.aspx
[53] sb-227-maryland.hub.arcgis.com/
[54] youtube.com/watch?v=CEvLovRg0i0&list=PLlgoHh4Po1J1aVVwT-EnWlFrttMKSRZyk&index=1
[55] https://sb-227-maryland.hub.arcgis.com/pages/updated-stormwater-standards
[56] md-resiliency-partnership-maryland.hub.arcgis.com/

- Chaptico and Charlotte Hall - Water Rescue: youtu.be/uXG1EdHkgcs
- Leonardtown - Be the Help Until Help Arrives: youtu.be/YTzfmy7v4pA
- Frederick - Three Step Plan: youtu.be/GFu8l1GSA9E

Drought Risk Communications

In 2023, MDE activated its drought notification process in response to lower-than-normal groundwater levels and stream flows in Central and Western Maryland. WSA elevated the drought status to "watch" (and later to "warning" status for Central Maryland). WSA convened a meeting of county drought coordinators to ensure clear communications and understanding of drought response procedures.

Water Supply Utilities and Climate Change

MDE's guidance brochure[57] on climate adaptation for drinking water utilities was updated in 2021. Originally developed in 2016, the guidance addresses water availability and water quality issues. It provides links to a variety of resources.

Climate Awareness Regulatory Correspondence

Routine regulatory correspondence provides WSA an opportunity to communicate key climate change messages. In 2021, WSA's Wetlands Program began adding climate awareness language to permit application acknowledgement letters. The language advises permittees and their consultants to consider the effects of climate change when planning projects that require wetland or waterway construction permits.

Living Shoreline Outreach

In August 2023, WSA's Tidal Wetlands Division began hosting a Chesapeake & Climate Change Conservation Corps member for one year. The Corps member will be developing public outreach material to help promote the adoption of living shoreline protection techniques by coastal land owners. This work will include economic evaluations. Living shoreline protection techniques are recognized for their ecological and climate resilience benefits.

Compliance Training for New Erosion and Sediment Control General Permit

In 2023, extensive notifications and training were conducted regarding issuance of an updated general permit for Discharges of Stormwater Associated With Construction Activity (General Permit No. 20-CP), which became effective in April 2023. This permit includes enhancements intended to mitigate climate change risks. Training included at least nine online sessions and other presentations to stakeholder organizations throughout 2023 all supported by extensive advanced promotion.

Emergency Preparedness Training

[57] mde.maryland.gov/programs/Water/water_supply/Documents/120516_CCbrochure_Web.pdf

In 2023, WSA's Climate Team initiated the Climate Emergency Preparedness (CEP) Training initiative. This initiative is intended to ensure staff have a general understanding of MDE's emergency preparedness and response functions across WSA programs and beyond. This awareness will enable staff to align with, contribute to, and draw upon these capabilities thereby making the state more resilient to climate emergencies. Trainings in 2023 covered situations encountered by the Water Supply Program, and WSA's after hours emergency response procedures.

Research, Planning, and Analyses

Maryland Climate Change Adaptation Framework

WSA co-chaired the development of the Water Resources section of Maryland's draft Climate Adaptation Framework, under the MCCC's Adaptation and Resiliency Work Group (2020-2021). In 2023, WSA collaborated with DNR to translate the Framework into Maryland's Next Generation Climate Adaptation Plan, which includes near- and long-term action milestones.

Chesapeake Bay Restoration

- Climate Addendum for Nutrient Reductions: In 2021, WSA conducted technical analyses to support enhancements to the Chesapeake Bay WIP[58] that offset predicted increases in annual average nitrogen and phosphorus loading rates estimated to occur in 2025 due to climate change. In 2022, staff produced an Addendum[59] to Maryland's Phase III WIP that commits Maryland to reduce its annual nutrient pollutant loading rates by 2025.
- Maryland's 2022-2023 WIP 2-Year Milestones[60] are managed by MDE WSA. The 2-Year Milestone commitments were updated in 2023 to reflect progress on a variety of climate change adaptation actions in addition to the many other commitments.

Heat Pollution: Water Temperature Total Maximum Daily Loads (TMDLs)

During 2023, WSA's Watershed Protection, Restoration, and Planning Program continued developing water temperature models for streams that exceed their temperature water criteria. These models will be used to develop TMDLs in specific geographical areas of concern, which is required by the federal Clean Water Act. The TMDLs will set protective regulatory limits on heat loads to the streams, and establish a quantitative framework for reducing water temperatures.

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[58] mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx

[59] mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Documents/Phase-III-WIP-Report/MD_Climate_Change_Addendum_2022.pdf

[60] mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Documents/Milestones/2022_2023.Maryland.CB.Milestones_2.1.22.pdf

In 2022, the Prettyboy Reservoir Watershed was selected as the pilot watershed for the development of a TMDL. In 2023, Program staff calibrated the Prettyboy Reservoir Watershed model for hydrology and started analyzing high-resolution air and water temperature information collected between 2016 and 2022. In 2024, staff will finalize the temperature calibration of Prettyboy Reservoir Watershed model and develop a draft temperature TMDL.

Ocean/Coastal Acidification

When elevated CO2 enters the atmosphere, large amounts dissolve into water bodies. This causes the water chemistry to shift in the direction of acidity, which among other things makes the formation of calcium-rich shells more difficult. To better understand and prepare for impacts from this phenomenon, during 2021 and 2022 WSA staff, in collaboration with DNR and UMCES, have been developing a set of draft carbonate system monitoring plans for the Chesapeake Bay. Ocean Acidification monitoring instrumentation for the partial pressure of CO2 (pCO2) has been made available to MDE as part of a partnership with the National Aeronautics and Space Administration to ground-truth new remote sensing technology. The remote sensing technology could also enable more efficient and rapid detection of potentially harmful bacteria and hazardous algal blooms.

Harmful Algal Blooms

Climate change induced warming of waters and more nutrient runoff from increased rainfall is predicted to cause more harmful algal blooms (HABs). In 2020, WSA invested in updated laboratory analysis equipment to automate enzyme-linked immunosorbent assay analyses used to identify waterborne toxins associated with HABs. By cutting the testing time for multiple HAB toxins by days, WSA can now more rapidly respond to multiple simultaneous emergency events that might require issuing hazard advisories to water supplies, shellfish harvesting areas and water contact recreation areas. In June 2023, MDE's Water Supply Program was involved in responding to an unseasonal algal bloom on the Potomac River attributed to an unusually dry period.

Flood Management

In 2022, WSA began a collaborative effort with local governments to identify and characterize flood-prone areas. This is a complex undertaking in part because there are many types of flooding, e.g., coastal, riverine, and pluvial flooding, and because flooding occurs at a variety of geographic scales ranging from a street intersection to entire river valleys. The causes of the flooding are similarly complex. MDE has focussed this effort on pluvial and riverine flooding.

In 2023, this effort continued as MDE worked with local jurisdictions to understand the availability of data, data gaps, and the needs of local jurisdictions to collect, store, share, and analyze this data. Some jurisdictions collect and store information on flooding related complaints and the NOAA National Center for Environmental Information publishes data on emergency response related to flooding incidents. Understanding and characterizing flood risk will not only require information on where flooding has occurred, but will also require the application of hydrologic and hydraulic models that can predict where flooding might occur under a variety of rainfall events in the future.

Drought Vulnerability Resilience

WSA's Water Supply Program has invested in research and planning to build drought resilience:

- In 2021 Program staff completed a groundwater yield study[61] in fractured rock areas of Maryland, which are vulnerable to drought. This set of initial studies provides a technical foundation for water appropriation permits that account for drought conditions.
- In 2022 Program staff oversaw completion of a technical study of the viability of indirect potable water reuse treatment system for the City of Westminster in 2022. This technology could provide resilience to droughts in places where it is technically and financially viable.
- In 2023 Program staff completed a draft technical report entitled, "The Effects of Climate Change on Maryland's Water Supplies", which assessed water supply reliability on a regional basis.

Living Shoreline Protection

For several years MDE has directed EPA funding toward conducting a series of technical tidal shoreline analyses and the development of updated shoreline maps. The product is a Maryland Shoreline Stabilization Map. This tool will enable MDE permitters to more rapidly and effectively determine when living shoreline methods must be used as directed by Maryland's 2008 Living Shoreline Protection Act. Living shorelines are generally considered to provide more ecological benefits and climate resiliency. In 2023, the Maryland Shoreline Stabilization Mapper was completed Statewide for tidal waters. MDE is actively promoting use of the tool[62].

Water & Wastewater Utility Climate Vulnerability Assessments

In 2022, WSA helped MDP host several of EPA's Climate Resilience Evaluation and Awareness Tool (CREAT) webinars. These events led to technical assistance opportunities for three coastal communities sponsored by the US EPA's Creating Resilient Water Utilities program in 2023 (Crisfield, Cambridge, and Chesapeake Beach). During 2023, several western Maryland communities were recruited to receive technical assistance using EPA's CREAT in 2024 (Middletown, Boonsboro and Emmitsburg).

Funding

Chesapeake Bay Restoration & Climate Resilience Funding

In spring 2022, WSA coordinated with other state agencies to identify projects with climate resilience co-benefits to effectively use $2.8 million of the *Most Effective Basin* funds provided by CBP. These funds, from the federal Infrastructure Investment and Jobs Act, gave priority to underserved communities. In 2023, investment of a similar amount of funds was targeted to restoration and resilience-building projects by DNR.

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[61] mde.maryland.gov/programs/water/water_supply/Documents/ReliableDroughtYieldsPWS_wellsInFractured.pdf
[62] https://cmap22.vims.edu/MSSMTool/

Technical Assistance for Underserved Communities to Secure Climate Resilience Infrastructure

In 2022, WSA led an effort to direct about $400,000 toward helping underserved communities compete for future infrastructure grant funding. This will allow these communities to build climate resilience to flooding and other risks, while also helping to restore water quality. In 2023, WSA developed a grant proposal to fund Water Infrastructure Climate Resilience Assessment (WICRA) technical assistance. The WICRA initiative, if funded, will hire people to connect with underserved communities and offer technical assistance in assessing their water and wastewater infrastructure for climate vulnerabilities. Cost-effective remedies will be developed and assistance will be provided to secure funds and management capacity to implement the remedies.

Flood Management Infrastructure

Legislation has been adopted to restore funding to the Comprehensive Flood Grant Management Program over recent years[63]. Between FY20-24 the Maryland General Assembly authorized over $49 million in capital funding for flood mitigation, which can have local stream and Bay restoration co-benefits.

[63] mde.maryland.gov/programs/Water/StormwaterManagementProgram/Pages/floodmgmt.aspx