2024 Programmatic Status Report on Climate Change

In accordance with §2–1305 of the Environment Article

December 31, 2024

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Table of Contents

Executive Summary

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). This report summarizes the programs that MDE leads to make progress on greenhouse gas (GHG) reduction 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 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. Although Maryland's coastal areas are particularly vulnerable, all areas of the state are at risk for infrastructure damage. 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 Maryland's economy by restricting or disrupting 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 seeks to protect and restore the environment for the health and well-being of Marylanders[1]. Many studies show that EJ communities bear a disproportionate share of the negative environmental consequences resulting from industrial activities, land use planning and zoning, municipal and commercial operations, and other pollution.

MDE has enhanced compliance monitoring, capacity building, and pollution reduction enforcement in communities with EJ concerns, like Cheverly, Curtis Bay, and Turner Station, and has developed enhanced communications and outreach for permitting action. MDE has made efforts to increase its presence within Maryland EJ communities. MDE seeks to attend community events, and has provided infographics, magnets, and games for kids to play. Additionally, in 2024, the Maryland Department of the Environment appointed its First Assistant Secretary for Environmental Justice to oversee efforts to address environmental disparities and reduce pollution in overburdened communities.

MDE has created two new tools to map EJ areas: MDE's EJ Screening and Mapping Tool (EJScreen) and the Climate Vulnerability Score (CVS). Since EJ Screen's initial release in 2022, the tool has been updated this year to incorporate new sensitive population data from the Maryland Department of Health (Asthma, Myocardial Infarction, and Low Birth Weight), as well as an updated methodology to better capture the geographical distribution of pollution burden exposure and its associated environmental effects. Some datasets were also updated to reflect upstream changes from the American Census Bureau and/or the EPA.[2] The CVS uses data from EJScreen and climate hazard data to identify climate vulnerable communities. The CVS utilizes three metrics: (a) Adaptive Capacity, (b) Sensitivity, and (c) Aggregated Climate Exposure, in order to calculate a census tract's CVS. Adaptive Capacity includes Tree Canopy Cover and Underserved Community metrics from EJScreen whereas the Sensitivity component includes EJScreen's Overburdened Community data. The Aggregate Climate Exposure component includes urban heat island, drought, storm surge, and flooding. CVSs are calculated by combining (a) Adaptive Capacity and (b) Sensitivity, and then multiplying them against (c) Aggregated Climate Exposure. This tool is publicly available for organizations and agencies to use at will to inform where and how to focus resources.

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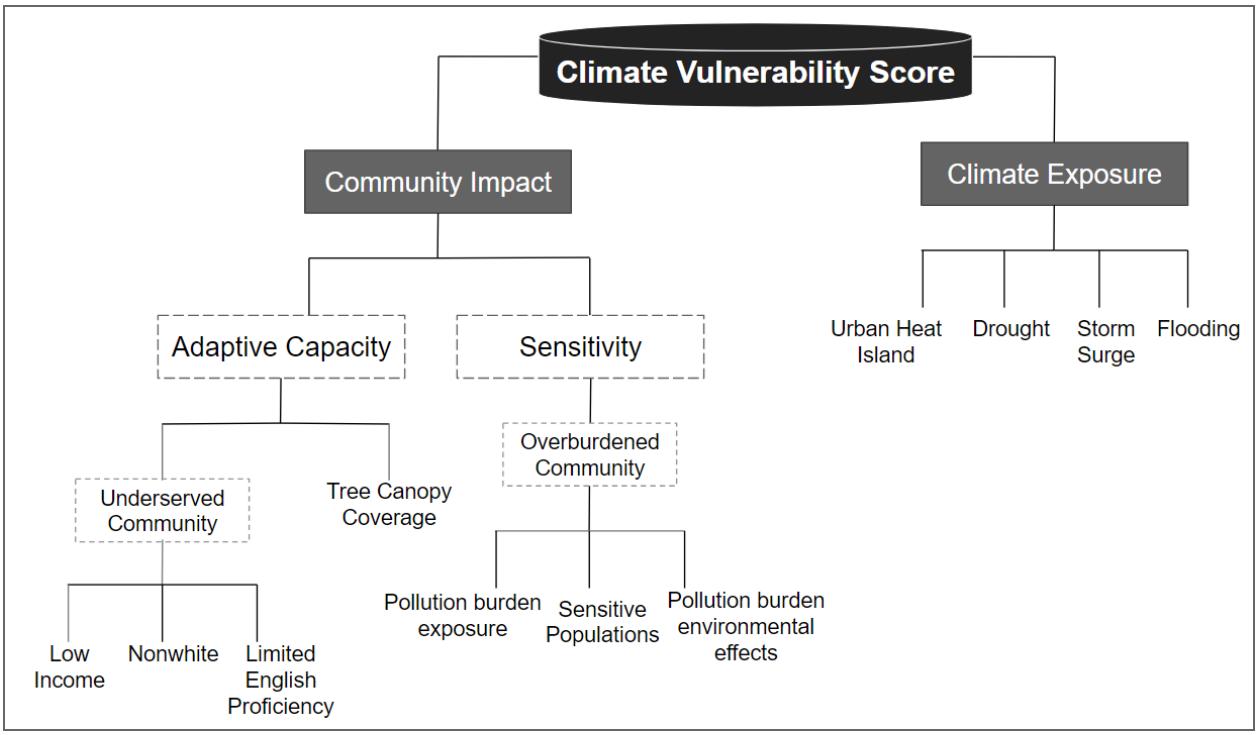
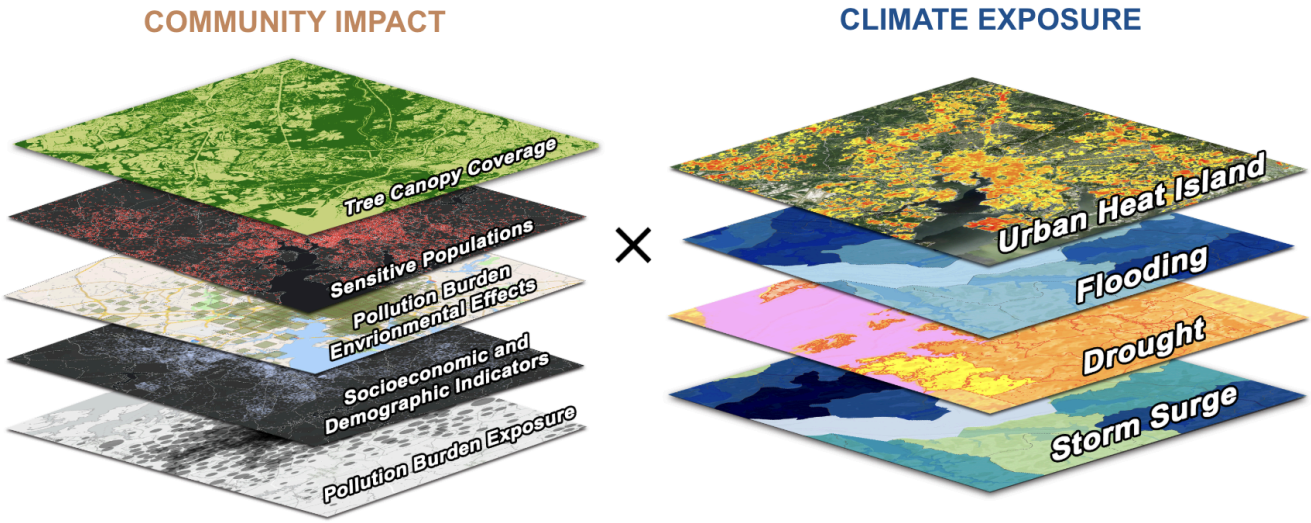
[1] Environmental Justice at MDE, https://mde.maryland.gov/EnvironmentaUustice/Pages/Landing%20Page.aspx

[2] In addition to updating EJScreen's user interface, the tool has been circulated for internal agency review to improve its accessibility. Due to disruptions in availability of federal datasets and tools, MDE is monitoring ongoing needs and opportunities for maintaining and leveraging EJScreen.


Climate Vulnerability Score
Community Impact
Climate Exposure
Adaptive Capacity
Sensitivity
Urban Heat Island
Drought
Storm Surge
Flooding
Underserved Community
Tree Canopy Coverage
Overburdened Community
Low Income
Nonwhite
Limited English Proficiency
Pollution burden exposure
Sensitive Populations
Pollution burden environmental effects


COMMUNITY IMPACT
CLIMATE EXPOSURE
Tree Canopy Coverage
Sensitive Populations
Pollution Burden Envrionmental Effects
Socioeconomic and Demographic Indicators
Pollution Burden Exposure
Urban Heat Island
Flooding
Drought
Storm Surge

Air and Radiation Administration (ARA) Programs and Initiatives

Climate Change Program

In 2022, the Climate Solutions Now Act (CSNA) became law, requiring MDE to develop a Plan that would allow the state to reach 60% greenhouse gas (GHG) emissions reduction, compared to 2006 levels, by 2031 and net-zero by 2045. The Climate Change Program released the Climate Pollution Reduction Plan in December 2023, and is responsible for various implementation efforts related to the CSNA and tracking greenhouse gas planning efforts. The Climate Change Program manages a wide range of activities for MDE that includes supporting the Maryland Climate Change Commission (MCCC), providing community engagement opportunities, and leading decarbonization measures.

The Maryland Commission on Climate Change (MCCC)

The MCCC is a multi-stakeholder and independent body that informs the state's climate change initiatives. MCCC was codified in law in 2015 and is composed of state government agencies, the legislature, local government, businesses, environmental non-profit 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. The MCCC also offers policy recommendations in its yearly report to the General Assembly[3]. The MCCC serves as a forum for public dialogue on critical issues associated with climate change policy. Meetings are open to the public, providing all stakeholders with an opportunity to participate. MCCC has eight active working groups:

1) The Adaptation and Resilience Working Group;
2) The Education, Communication, Outreach Working Group;
3) The Energy Industry Revitalization Working Group;
4) The Energy Resilience and Efficiency Working Group;
5) The Just Transition Employment and Retraining Working Group;
6) The Mitigation Working Group;
7) The Scientific and Technical Working Group; and
8) The Solar Photovoltaic Systems Recovery, Reuse, and Recycling Working Group.

Of the eight active working groups, four were established in 2024: the Energy Industry Revitalization Working Group; the Energy Resilience and Efficiency Working Group; the Just Transition Employment and Retraining Working Group; and the Solar Photovoltaic Systems Recovery, Reuse, and Recycling Working Group. These working groups are stakeholders who represent public and private interests relevant to the charges of the working group, and are supplemented by a formal study required by the CSNA.

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[3] Maryland Commission on Climate Change, https://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Pages/index.aspx

Climate Pollution Reduction Grants (CPRG)

The U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program, authorized under the U.S. Inflation Reduction Act (IRA), will provide $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. Maryland will deliver statewide 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[4].

In July 2024, the EPA announced competition winners[5]. Maryland led or participated in four applications, two of which were awarded implementation grants: the Clean Corridor Coalition and the Atlantic Conservation Coalition. The Clean Corridor Coalition was a New Jersey-led multi-state coalition application that included Maryland, Connecticut, and Delaware. This project proposes electric vehicle charging infrastructure for commercial medium and heavy-duty zero-emission vehicles, traveling along the I-95 corridor and adjacent roadways from Connecticut to Maryland. The Atlantic Conservation Coalition was a North Carolina-led multi-state coalition including South Carolina, Virginia, and Maryland. This application proposes natural carbon sequestration through improved forest management, the protection and restoration of highly threatened, high-carbon coastal habitats, and forests with the greatest carbon sequestration potential and/or heat island abatement co-benefit.

Phase 1 - Planning Grant	Phase 2 - Implementation Grant
✅ Develop a Priority Climate Action Plan (March 2024)	✅ Submit competitive grant applications for implementation funds (April 2024)
◯ Develop a Comprehensive Climate Action Plan (December 2025) ***in progress***	✅ EPA announces competition winners (July 2024)
◯ Develop Status report (July 2027).	✅ EPA awards funds (October 2024)

[4] Maryland Climate Pollution Reduction Grants (CPRG), https://mde.maryland.gov/programs/air/ClimateChange/Pages/CPRG.aspx

[5] During February 2025, CPRG Planning and Implementation Grants funds were suspended from the US EPA. As of March 2025 publication date of this report, grant funds are open and available to grant recipients.

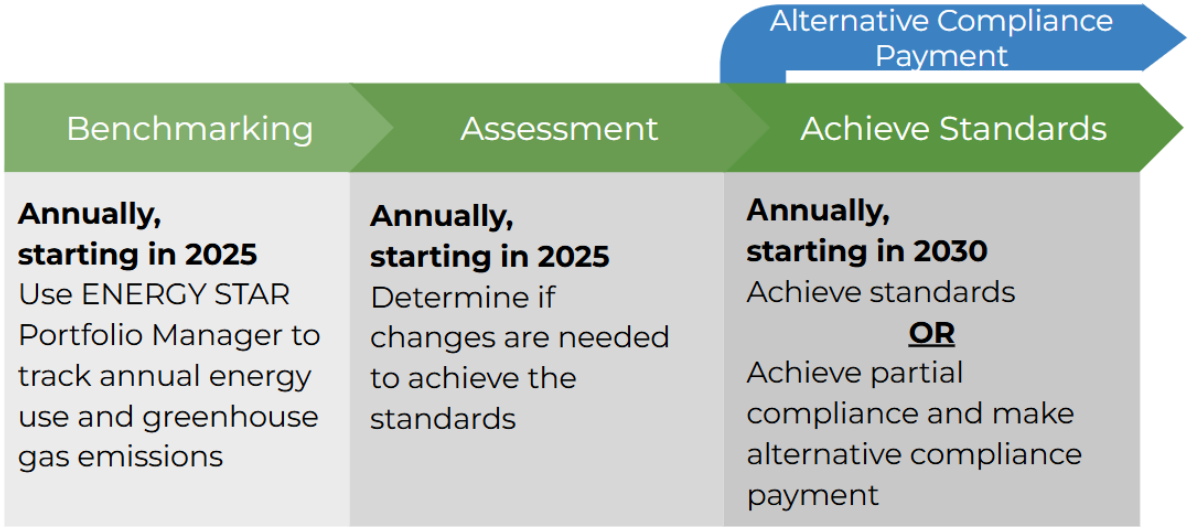
Building Energy Performance Standards (BEPS)

Commercial and residential buildings emit GHGs and other pollution into the atmosphere, contributing to climate change and air quality concerns in Maryland. Burning fossil fuels for heat and hot water are two of the most common sources of direct emissions from buildings. Recognizing the need for building decarbonization, the CSNA of 2022 required MDE to develop Building Energy Performance Standards (BEPS)[6]. 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 by June 1, 2025. Phased emissions standards begin in 2030. Building owners can choose to pay an alternative compliance fee for a building's excess emissions over the standards.

Efficient net-zero emissions buildings improve occupant comfort, resilience, and reliability, and provide savings on energy costs compared to old, inefficient buildings that run on fossil fuels. Investments in achieving these standards will pay dividends to occupants and building owners for decades to come. MDE and Maryland Energy Administration (MEA) are working together as part of BEPS implementation to help buildings realize the benefits of efficient electrification.

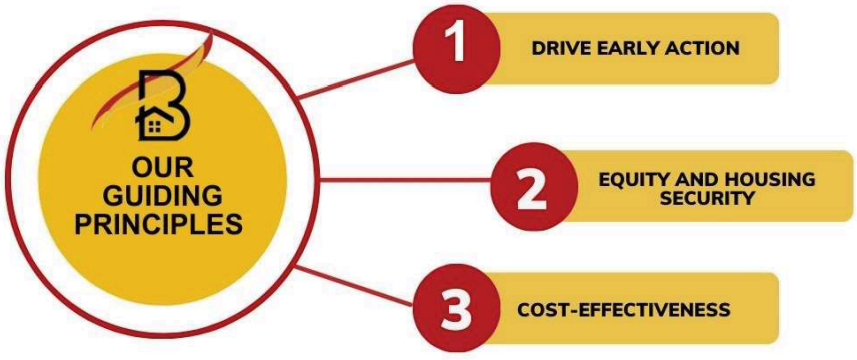


[6] Building Energy Performance Standards, https://mde.maryland.gov/programs/air/ClimateChange/Pages/BEPS.aspx

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 online 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 hired new BEPS staff while a new law was passed that required MDE to repropose BEPS regulations. On September 6, 2024, MDE released new proposed regulations that kept the requirement for benchmarking but removed energy usage intensity (EUI) requirements[7].

Building Energy Transition Implementation Task Force

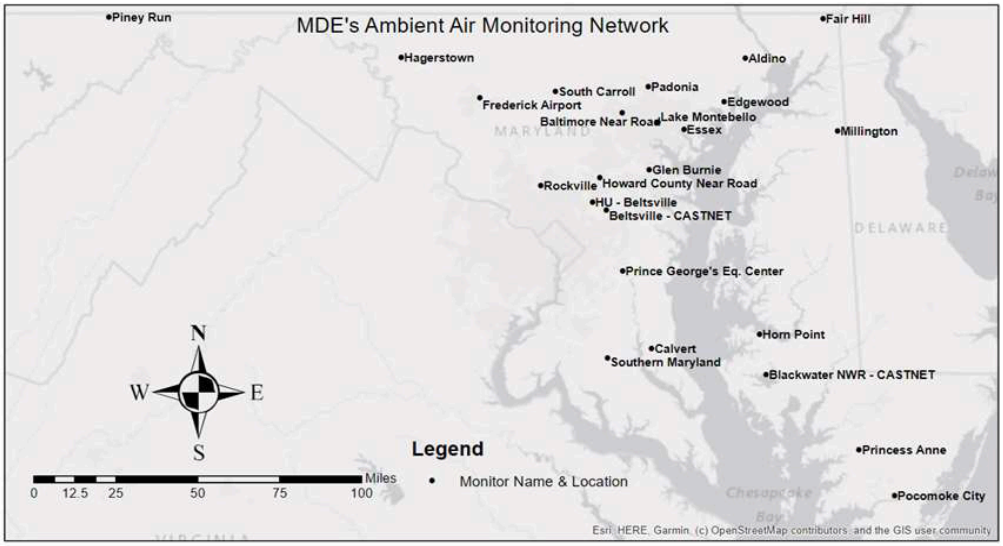
The CSNA created the Building Energy Transition Implementation Task Force ("Building Energy Task Force") with the objective of providing the Governor and General Assembly with recommendations on programs, policies, and incentives aimed at reducing GHGs from the building sector[8]. The Buildings Task Force membership, composed of representatives from a diverse set of sectors, identified three guiding principles as follows: drive early action, equity and housing security, and cost-effectiveness. The Building EnergyTask Force was co-chaired by MDE Secretary, Serena McIlwain, and 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. On January 24, 2024, the Buildings Task Force finalized their efforts through the publication of their Final Report[9].



[7] MDE acknowledges the many unique situations across covered buildings in Maryland and is working with the General Assembly to be granted authority to provide additional alternative compliance pathways, as well as with other state agencies to help building owners navigate funding for covered buildings to help defray the cost of upgrades.
[8] Building Energy Transition Implementation Task Force, https://mde.maryland.gov/programs/air/ClimateChange/Pages/BETITF.aspx
[9] The Building Energy Transition Implementation Task Force Final Report

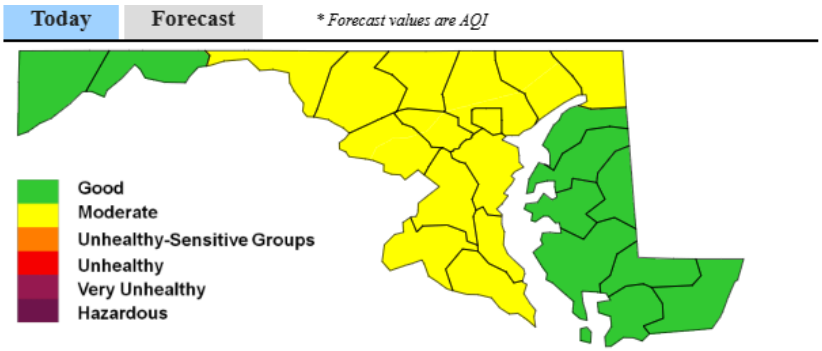
Air Monitoring Program

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 in 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.



Air Quality Forecast Discussion

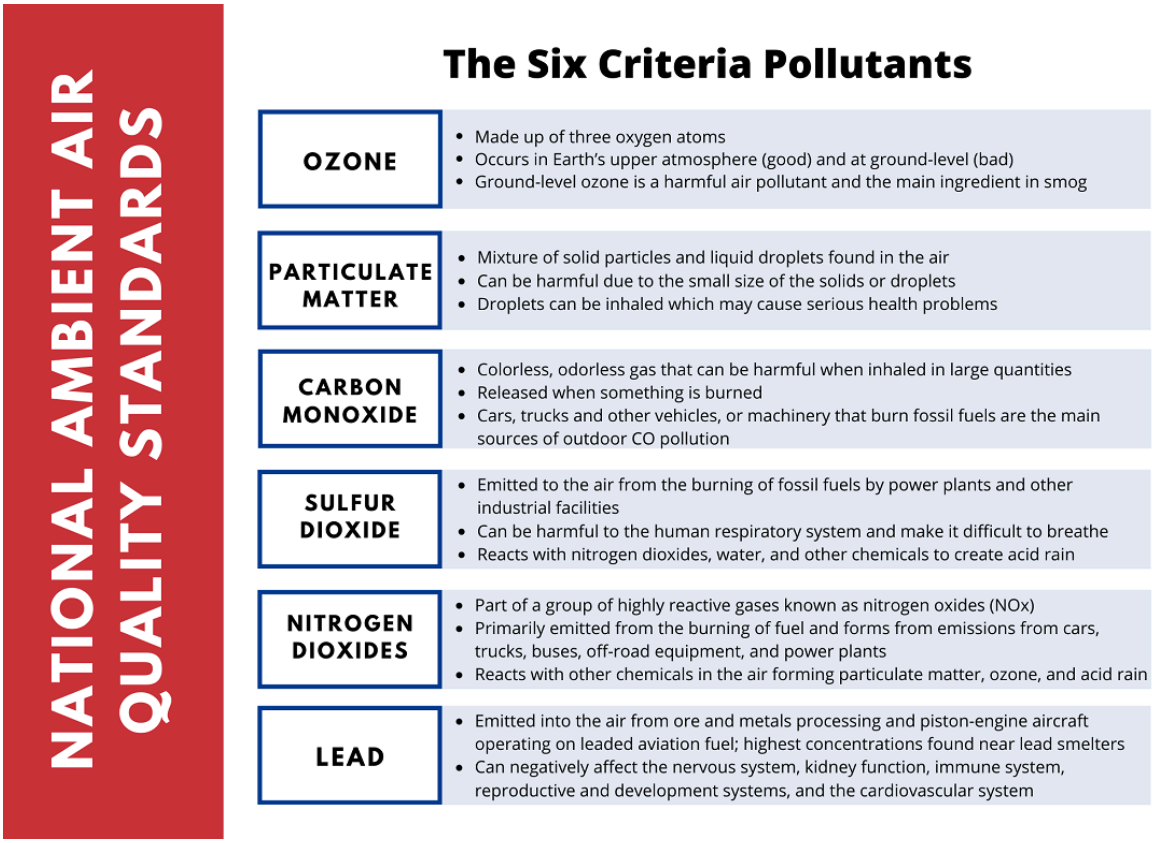
A strong ridge of high pressure will linger over the Eastern US Wednesday, helping to keep dew points elevated and temperatures unseasonably warm. This accompanied by overnight and early morning surface inversions will help to push much of the state into the low Moderate range for fine particulate pollution. Highest concentrations will be along the urban corridor during the early morning hours when mixing heights are at their lowest. By Thursday, a strong low pressure system will impact the region. Winds will turn breezy as much cleaner air filters into the state. Expect a drop in fine particulates back into the Good AQI range statewide, persisting into Friday. For the latest air quality information, please visit our website here. -MDE

Example of an Air Quality Forecast, put out daily by the Air Monitoring Program. This is the forecast for November 20, 2024.

One of the 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 (PM2.s & PM10), 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	Averaging Time	Level	Attainment Status
Carbon Monoxide (CO)	8-hour	9 ppm	Attainment
	1-hour	35 ppm	Attainment
Lead (Pb)	Rolling 3-mo. Average	0.15 µg/m^3	Attainment
Nitrogen Dioxide (NO_2)	1-hour	100 ppb	Attainment
	Annual	53 ppb	Attainment
Ozone (O_3)	8-hour	0.075 ppm	Attainment
Particulate Matter ($PM_{2.5}$)	Annual	12 µg/m^3	Attainment
	24-hour	35 µg/m^3	Attainment
Particulate Matter (PM_{10})	24-hour	150 µg/m^3	Attainment
Sulfur Dioxide (SO_2)	1-hour	75 ppb	Attainment
	3-hour	0.5 ppm	Attainment

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 MDE'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 PM2.s 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. One example of these partnerships includes the partnership between the Town of Cheverly, the University of Maryland School of Public Health's Center for Community Engagement, Environmental Justice and Health (CEEJH), and MDE. This partnership utilizes funding provided by the EPA American Rescue Plan (ARP) Grant, which helps fund increased localized air monitoring for the community.

Air Quality Planning and Regulations Program

Regional Greenhouse Gas Initiative (RGGI)

RGGI comprises eastern states in the Northeast and mid-Atlantic regions[10]. The participating states have established a regional cap on CO2 emissions, which sets a limit on the emissions from regulated power plants within the RGGI states. Over time, the regional cap declines, so that CO2 emissions decrease in a planned and predictable way. Since 2005, the RGGI10 states have reduced annual power sector emissions 50%, which is almost 50% faster than the nation as a whole, and have so far raised over $7 billion to invest into local communities. These states adopted market-based carbon dioxide (CO_2) programs designed to reduce emissions of CO_2 from fossil fuel-fired electricity generators with a nameplate capacity of 25 megawatts or greater. In 2024, RGGI states Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.[11]

Participating RGGI states each requires electricity generators to have acquired, through regional auction or secondary market transactions, one CO_2 allowance for every ton of CO_2 emitted over a three-year

[10] RGGI, Inc. https://www.rggi.org/rggi-inc/contact
[11] RGGI in Maryland, https://mde.maryland.gov/programs/%20Air/ClimateChange/RGGI/Pages/index.aspx

compliance period. The RGGI program establishes a regional cap on CO_2 emissions from eligible sources, which is then reduced in subsequent years leading to a reduction in CO_2 emissions.

Auction proceeds go to the Strategic Energy Investment Fund (SEIF), which is administered by the MEA and funds several programs across other state agencies and other organizations, including direct energy bill assistance, energy efficiency programs that reduce electricity demand, electric vehicle (EV) charging stations, and renewable energy projects that reduce CO_2 emissions. Under state law, more than half of all funds collected by Maryland are invested in direct energy bill assistance for low-income individuals and this program is managed by the Maryland Department of Human Services.

Auctions

Maryland has successfully participated in all 65 regional auctions of CO_2 allowances with RGGI. As of October 2024, Maryland has generated $1.38 billion in cumulative proceeds.

Comprehensive Program Review

RGGI participating states are committed to periodic reviews of their CO_2 budget trading programs to consider successes, impacts, and design elements. The First Program Review was completed in February 2013[12], and the Second Program Review was completed in December 2017[13], resulting in the 2017 Model Rule[14]. The Third Program Review[15] was officially released on September 23, 2024, and provides exploratory policy scenarios. As the participating states continue the discussion of Program Review, Maryland will continue to support stringent policies sufficient to meet the goals of the CSNA, including reaching net zero by 2045.

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 the authority to control electric generating sources within their jurisdiction. The initial cap was based on the average of 2000-2002 CO_2 emissions and the initial cap was set at 188,076,976 short tons of CO_2. 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 CO_2. During the Second Program Review, the states selected a regional cap of 75,147,784 tons of CO_2 in 2021, which will decline by 2.275 million tons of CO_2 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

[12] 2012 Program Review Materials, https://www.rggi.org/program-overview-and-design/design-archive/2012-materials
[13] 2016 Program Review, https://www.rggi.org/program-overview-and-design/design-archive/2016-materials
[14] Model Rule and MOU Versions, https://www.rggi.org/program-overview-and-design/design-archive/mou-model-rule
[15] RGGI Program Review Updates, https://www.rggi.org/sites/default/files/Uploads/Program-Review/2024/Third_Program_Review_Update_9-23-2024.pdf

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 2024. RJ4's, the RGGI Vintage 2024 Futures, peaked at over $27 this year after a steady rise, nearly doubling last year's high. Secondary prices only saw decreases after the release of news on the Third Program Review. Auction 63 of Q1 2024 triggered the Cost Containment Reserve (CCR) with a clearing price of $16. 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. This immediately followed a CCR trigger in Q4 2023. The Emissions Containment Reserve, the CCR's counterpart for when prices fall too low, did not trigger this year.

Maryland currently recognizes three project categories eligible for the award of CO_2 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.

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 Aims for Geographic Expansion

Maryland holds a leadership role on the RGGI, Inc. Board of Directors[16] 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 has since attempted to exit the program. 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

[16] Maryland's Secretary of the Environment was Vice Chair of RGGI in 2023.

our climate. As opposed to CO_2, 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[17] 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 CO_2 by 2050. Improving the energy efficiency of room air conditioning equipment alone can provide further mitigation of up to 100 billion tons of CO_2 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, the EPA has recently promulgated two sets of regulations[18] 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

[17] Hydrofluorocarbon (HFC) Initiative Factsheet, ccacoalition.org/en/resources/hfc-initiative-factsheet
[18] Protecting Our Climate by Reducing Use of HFCs, https://www.epa.gov/climate-hfcs-reduction

Program Overview

In 2018, the 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 state operations, which occurs 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 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.

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, the 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[19].

[19] Actions and Notices about Oil and Natural Gas Air Pollution Standards, https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-operations/actions-and-notices-about-oil-and-0#nsps

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 significant GHG with a global warming potential more than 25 times that of CO_2. Landfills are the second largest industrial source of methane emissions in the United States and are the single largest source of 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 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[20], there are several MSW landfills in Maryland with the capability of producing landfill gas. 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[21].

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.

[20] MDE Greenhouse Gas Inventory, https://mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx
[21] Permitted Solid Waste Facilities, https://mde.maryland.gov/programs/land/solidwaste/pages/permittedfacilities.aspx

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[22]. 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.

Hydrofluorocarbons (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 reviews substitutes within a comparative risk framework in the following industrial sectors:

- Adhesives, Coatings, and Inks

[22] Waste Diversion in Maryland, https://mde.maryland.gov/programs/Land/RecyclingandOperationsprogram/Pages/index.aspx

- 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 U.S. 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.

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 were observed in 2021, and MDE has been corresponding with businesses on a case-by-case basis.

Federal Progress

Since 2020, the EPA has been 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, and 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, the EPA requires labeling, reporting, and recordkeeping requirements for companies that import, manufacture, sell, or offer for sale products using HFCs.

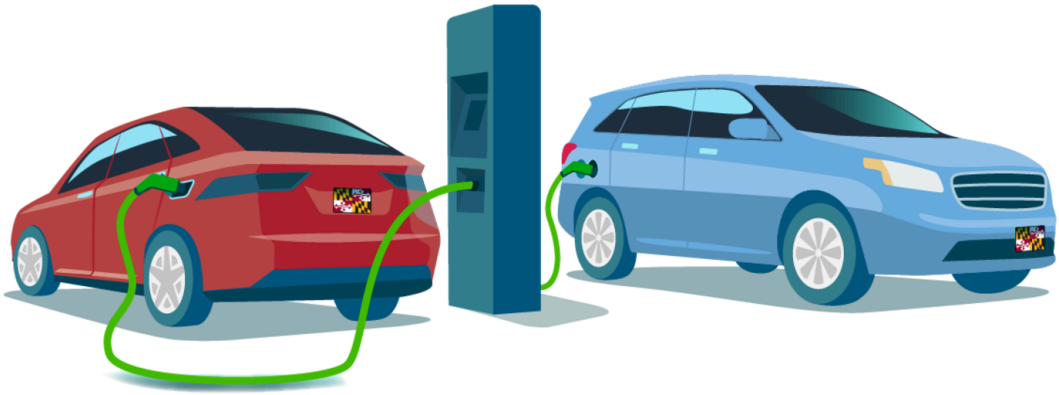
The EPA's AIM Act HFC Technologies Transition rule covers more end use categories than Maryland's HFC regulations and lowers the GWP allowable limit significantly from Maryland's HFC regulations. Maryland's regulations help to reduce HFCs with compliance deadlines between 2021 - 2024. The EPA's new rules 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.

Mobile Sources Control Program

Multi-State Zero Emission Vehicle (ZEV) Task Force

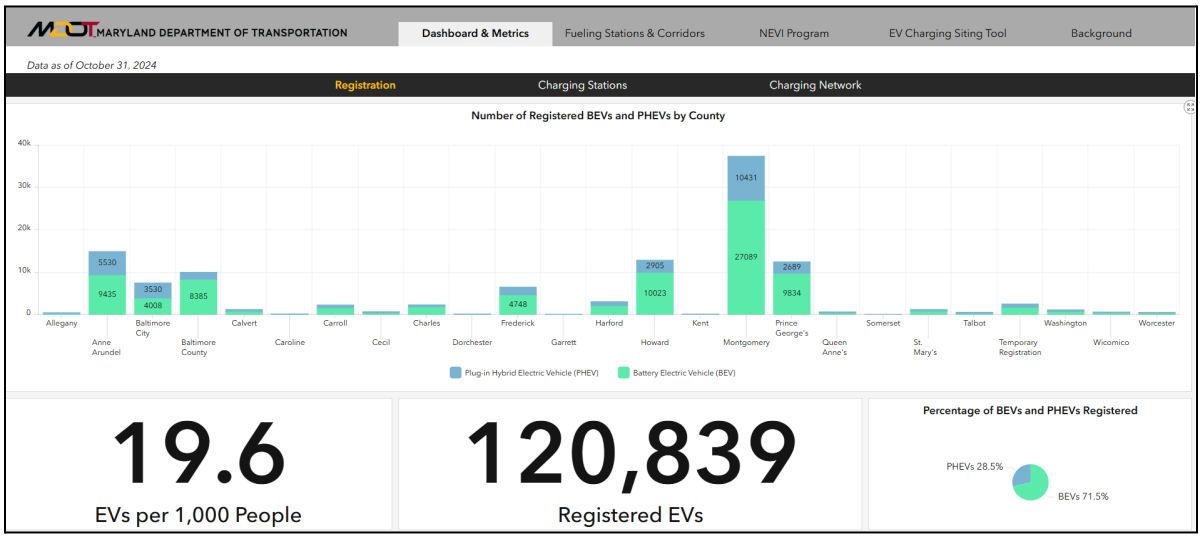
On June 20, 2018, nine Northeast and West Coast states reaffirmed their strong commitment to a clean, low-carbon transportation sector with the release of a new Multi-State Zero Emission Vehicle (ZEV) Action Plan (Action Plan) for 2018-2021 to support the successful implementation of the states' ZEV programs. Maryland was a leader in this effort. This Action Plan, built on the successes and lessons learned from the 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[23] in late July 2022. The action plan is built 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.



The Maryland Department of Transportation maintains a live, publicly available dashboard for registration of electric vehicles, charging stations, and charging networks. This graphic displays the number of registered electric vehicles, including hybrid vehicles, by county.

A New Market Phase

The ZEV market is entering a new phase of development. In the few years since the release of the updated ZEV Action Plan[24], 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 plans to significantly expand EV offerings across market segments.

Key Action Plan Recommendations

The updated Action Plan represented a redoubling of state efforts to accelerate electrification of the

[23] Multi-state Medium- and Heavy-Duty Task Force Zero-Emission Vehicle Action Plan, nescaum.org/documents/multi-state-medium-and-heavy-duty-zev-action-plan.pdf/
[24] Multi-state ZEV Action Plan, https://www.nescaum.org/documents/2018-zev-action-plan.pdf

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 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.

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[25]. 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 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. The state remains active in promoting EVs and promoting their emission-reducing benefits.

[25] Medium-Duty and Heavy-Duty Zero-Emission Vehicle Grant Program, Maryland Energy Administration, https://energy.maryland.gov/transportation/Pages/MediumandHeavyDutyGrant.aspx

Table 1: FY24 Medium-Heavy Duty Grant Program Incentives for Zero Emission On-Road Vehicles (Diesel to Electric and Diesel to Hydrogen)

Zero Emission Type	Vehicle Type	ZEV Costs	Diesel Costs	Incremental Cost (ZEV minus diesel vehicle costs)	% of Incremental Cost Eligible for Grant Request	Maximum Up to Grant Award (per new vehicle)
Battery Electric (BEV)	Single Unit Short-Haul Truck	$150,000	$70,000	$80,000	Up to 75%	**$60,000**
	Single Unit Long-Haul Truck	$185,000	$75,000	$110,000	Up to 75%	**$82,500**
	School Bus	$300,000	$100,000	$200,000	Up to 75%	**$150,000**
	Refuse Truck	$500,000	$300,000	$200,000	Up to 75%	**$150,000**
	Combination Short-Haul Truck	$480,000	$130,000	$350,000	Up to 75%	**$262,500**
	Transit Bus	$900,000	$500,000	$400,000	Up to 75%	**$300,000**
	Combination Long-Haul Truck	$850,000	$150,000	$700,000	Up to 75%	**$525,000**
Hydrogen (FCEV)	Combination Short-Haul Truck	$360,000	$130,000	$230,000	Up to 75%	**$172,500**
	Combination	$400,000	$150,000	$250,000	Up to 75%	**$187,500**
	Long-Haul Truck					
	Transit Bus	$1,125,000	$500,000	$625,000	Up to 75%	**$468,750**

Volkswagen Mitigation Plan

On September 18, 2015, the EPA and CARB issued a Notice of Violation of the CM 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 oxides (NOx). 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 NOx due to the installation of "defeat devices" on 2 liter diesel engines. The use of "defeat devices" has increased vehicle emissions of NOx, 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[26] that outlines the eligible projects Maryland will use to reduce excess NO emissions.

Benefit

Strategies for reducing NOx emissions could also result in reductions of GHG emissions, including CO_2 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 CO_2. As projects receiving funds from the VW Trust are implemented, MDE will track avoided or reduced CO_2 emissions resulting from these projects. The evaluation criteria for proposed projects also includes identifying benefits to EJ and underserved communities.

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.

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 included an increase in funding for local government projects and the addition of a pilot program of electric school buses. The plan was finalized and approved. 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 distributed funds to projects that install Level 2 EV stations and Level 3 EV DC Fast charging stations throughout Maryland.

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

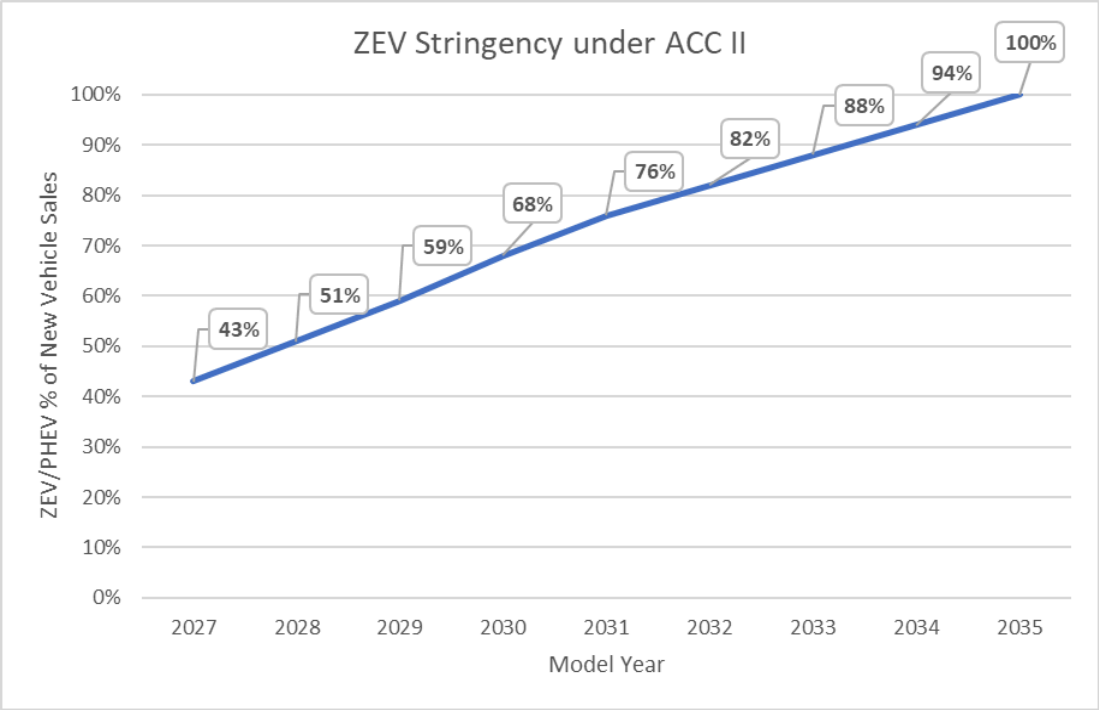
[26] Maryland Volkswagen Mitigation Plan, https://mde.maryland.gov/programs/air/mobilesources/pages/marylandvolkswagenmitigationplan.aspx

benefits, including reductions in GHG emissions.

Clean Cars

The Maryland Clean Cars Act required the MDE to adopt regulations to apply California's Low-Emission Vehicle (LEV) standards to vehicles purchased in Maryland. On September 18, 2023, the Maryland Advanced Clean Cars (ACC II) regulations (COMAR 26.11.34.02) were finalized, incorporating California's latest Clean Car Program. The ACC II program sets new and more stringent emissions standards for light-duty vehicles. These standards apply to automobile manufacturers that produce new motor vehicles for sale in Maryland, and will become effective beginning with the 2027 model year, with stringency increasing through the 2035 model year. All vehicle types that have a gross vehicle weight rating of less than 14,000 pounds are affected. 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% 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.



By adopting ACC II in 2023, Maryland's regulation will apply starting in model year 2027.

Advanced Clean Trucks Regulations

By December 2023, the Maryland Advanced 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 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 and reinforces Maryland's ongoing commitment to reducing climate pollutants. 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 (NOx) 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 adopts 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. As required by the Clean Trucks Act of 2023, MDE 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

Overview

MDE, MDOT, MEA and the MDOT Maryland Port Administration (MPA) continue their cooperative partnership 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 workgroup, made up of representatives from the participating agencies, has met regularly to effectively leverage resources and pool their knowledge to implement the agreement's goals.

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 secure funding for emissions reduction projects, with the total U.S. EPA grants awarded now reaching $20 million since 2008. The funds helped upgrade or purchase cleaner equipment and vehicles servicing the Port of Baltimore.

Projects

- National recognition of Maryland's air quality improvements occurred during a media event where the U.S. EPA congratulated Maryland on its Diesel Emissions Reduction Act (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.
- U.S. 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 about community concerns.
- Private Port tenants joined meetings to exchange information and ideas. CSX briefed the workgroup on their climate efforts, which included 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 workgroup 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 grant-funded Port-related projects that have supported emissions reductions. 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 MOOT MPA, has worked diligently to identify and implement a variety of environmental programs, with a focus on climate initiatives for MOOT MPA; 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 Carbon Dioxide Equivalent (CO_2e) level. The Port initiatives will help reduce both CO_2 and black carbon emissions

Land and Materials Administration (LMA) Programs and Initiatives

Oil Control Program

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. In its regulations (see COMAR 26.10.0l.04E), OCP requires new aboveground storage tank facilities and other oil handling facilities to 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).

In the future, 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

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.

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. LRP recently 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].

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

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

[27] Brownfields Redevelopment Initiative, https://mde.maryland.gov/programs/LAND/MarylandBrownfieldVCP/Pages/bf_info.aspx

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. 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 to conduct outreach and provide 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.

[28] Renewable Energy Siting and Development, https://mde.maryland.gov/programs/land/MarylandBrownfieldVCP/Pages/Renewable-Energy-Siting-and-Development.aspx

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

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);
- Implementing 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;
- 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 their entire lifecycles. 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 the 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

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

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 sequester carbon and enrich 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 2024, MDE has been an active participant in the Maryland Food System Resiliency Council.

In 2024, MDE held its fourth Maryland Food Recovery Summit, 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 the 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.

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 online.

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

[30] Maryland Solid Waste Management and Diversion Report, https://mde.maryland.gov/programs/land/RMP/Documents/MSWMaDR%20%2722.pdf

disposal will require not just enhanced collection of recyclables, but may create markets for those recyclable materials once collected.

To this end, MDE launched a new recycling markets development initiative[31]. During the 2021 legislative session, HB 164, Recycling Market Development, 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 and recycled products in the state. As part of this effort, MDE consults 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.

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 review 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

[31] MDE Recycling Webpage with more information on HB 164, https://mde.maryland.gov/programs/land/RecyclingandOperationsprogram/Pages/Recycling-Market-Development.aspx

work with regional businesses and institutions to drive supply and marketing. MDE will generate online tools that promote publicly available data to continue 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 on expanded polystyrene food service products. 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.[32]

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 previously described.

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

Further Food Waste Reduction and Recycling

The U.S. EPA and the U.S. Department of Agriculture have a joint food loss and waste goal of 50% by 2030. The 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 the 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 diversion. RMP will

[32] Expanded Polystyrene (EPS) Food Service Products Ban, https://mde.maryland.gov/programs/land/RecyclingandOperationsprogram/Pages/Expanded-Polystyrene-Food-Service-Products-Ban.aspx

review the 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 in-state agricultural land as well as export. 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.

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.

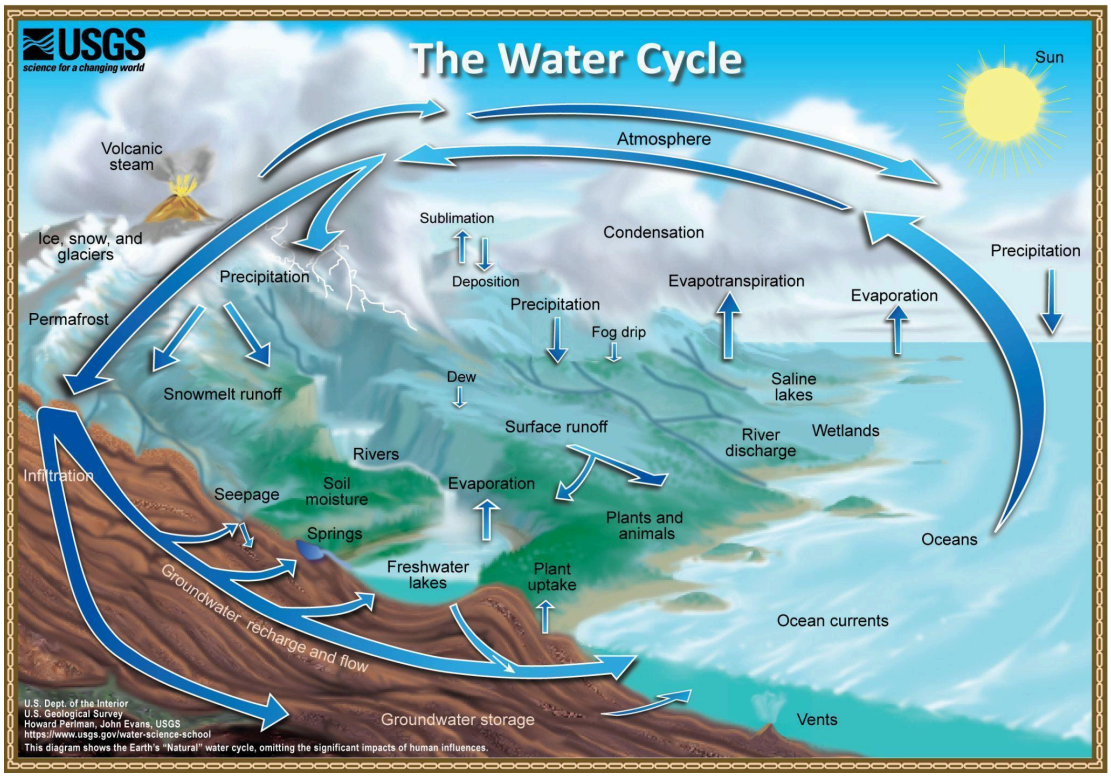
Future Activities

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.

Water and Science Administration (WSA) Programs and Initiatives

It could be said that climate change is water change, because the warming of the Earth causes changes throughout the water cycle. Many of these changes, often expressed as extreme weather events and sea level rise, are detrimental to our communities. Many historically underserved communities are at greater risk due to location and a lack of capacity to cope with these changes.



The Water and Science Administration (WSA) is responsible for managing Maryland's water resources. WSA has approximately 400 engineers, scientists, and natural resource professionals who implement and enforce state and federal water quality and safe drinking water laws as well as state laws governing water appropriations, wetlands protection, and water and sewer planning. WSA sets science-based standards; issues legally enforceable permits and approvals; monitors water bodies, public drinking water supplies, and wastewater systems; performs inspection and compliance activities; and responds to water pollution incidents and emergencies. WSA is committed to taking action to avoid or mitigate impacts of climate change through enhancements to its routine regulatory functions. To this end, WSA is updating its programs and giving special attention to at-risk communities that are underserved or overburdened. The remainder of WSA's section of this report is organized in two subsections:

- A Summary of WSA's Climate Adaptation Plan, which represents its commitment to strategic priorities and a transparent accountability framework (Climate Dashboard). This plan is responsive to the climate adaptation aspects of the CSNA and Governor Moore's Executive Order 01.01.2024.19.

- An Inventory of Accomplishments & Initiatives, many of which are not included in WSA's Climate Adaptation Plan. For brevity, this inventory covers the period of approximately 2022 through mid-2024. Prior accomplishments can be found in previous annual reports.

WSA's Climate Adaptation Plan

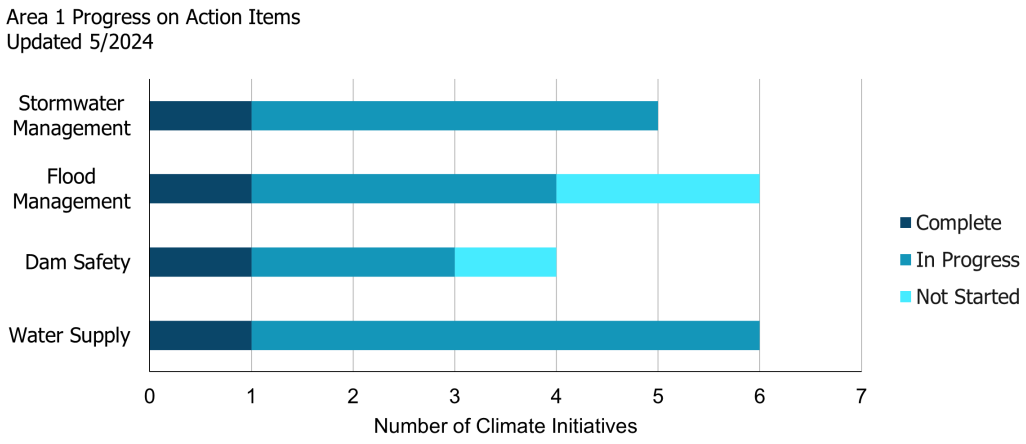
In 2019, MDE's WSA conducted a deliberate process of identifying four Priority Climate Change Action Areas. These four priority areas are:

1. Science and Planning
2. Climate Smart Permitting
3. Blue, Green, and Traditional Infrastructure
4. Emergency Preparedness and Response

In 2020, WSA leadership initiated a voluntary cross-program Climate Team to expedite action on these priority areas. In addition, the Climate Team developed a public facing accountability framework, which takes the form of WSA's Climate Adaptation Dashboard. The following is an overview of the Dashboard, which reflects the priority actions and their status as of May 2024.

Priority Area 1: Science and Planning

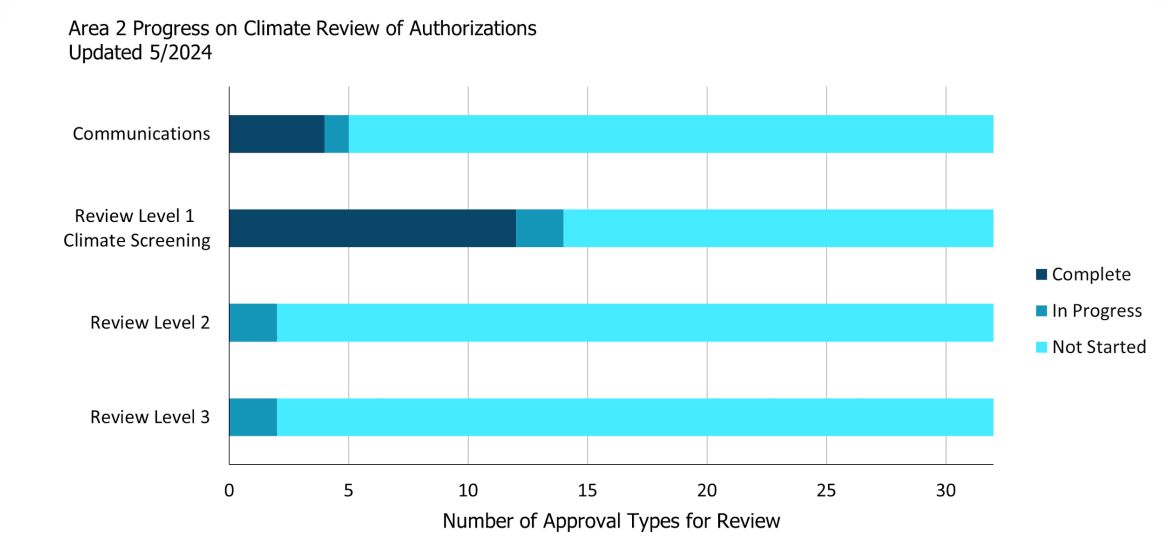
Harness science and planning to integrate climate resilience into MDE's water resource management responsibilities such as ensuring the safety of drinking water, maintaining dam safety, managing stormwater, controlling erosion and sediment, and overseeing flood management.



For More Details: Priority Area 1: Science and Planning

Priority Area 2: Climate Smart Water Permits

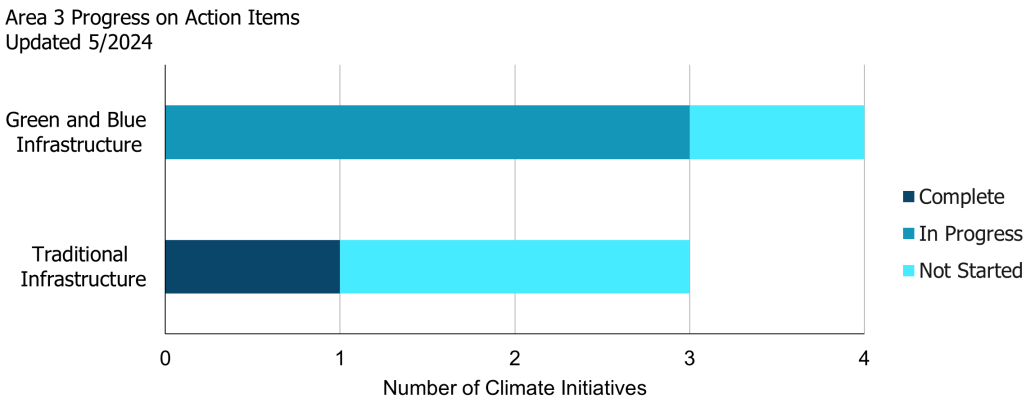
Review MDE's water regulatory approval instruments -- including permits, authorizations, and licenses -- to ensure they promote resilience to climate change impacts. The graph outlines three levels of review, each representing an increasing level of scrutiny. Higher-level reviews require more time to complete. A more detailed description of these review levels is provided in the document linked below the graph.



For More Details: Priority Area 2: Climate Smart Permits Review

Priority Area 3: Green, Blue, and Traditional Infrastructure

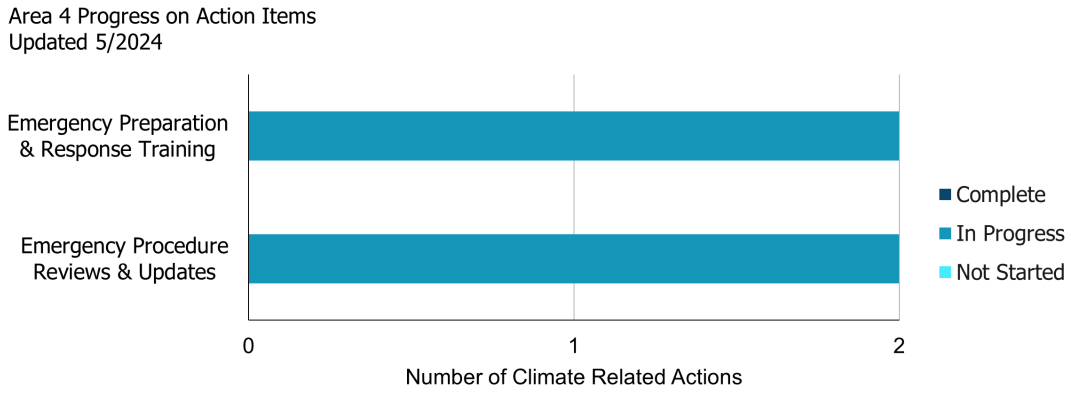
Accelerate the scale and pace of implementing green, blue, and traditional infrastructure. This will build resilience to climate change stresses, mitigate pollution, and enhance natural habitat.



For More Details: Priority Area 3: Green, Blue, and Traditional Infrastructure

Priority Area 4: Emergency Preparedness

Bolster emergency preparedness and response activities to better avoid, respond to, and reduce impacts of extreme events -- such as floods and heat waves -- that are becoming more frequent and severe due to climate change.



For More Details: Priority Area 4: Emergency Preparedness

WSA's Key Initiatives and Accomplishments

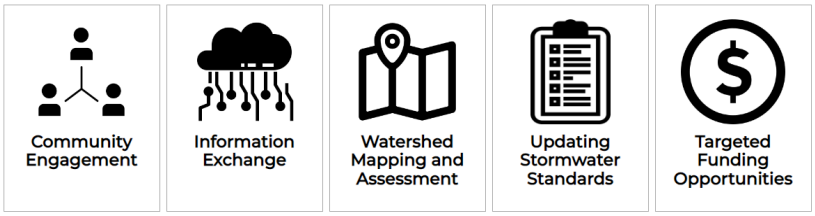
The following are highlights of accomplishments and new initiatives of the MDE Water and Science Administration (WSA). For brevity, this inventory covers the period of approximately 2022 through mid-2024. Prior accomplishments can be found in previous annual reports.

Stormwater & Flood Management

Although traditional stormwater and floodplain management are separate and distinct programs, their relationship has been acknowledged in State law for decades (Env. Art. 5-803). That's because land development can exacerbate downstream riverine flooding as well as localized pluvial flooding (flooding due to overwhelmed drainage systems). The increased intensity of some rain storms associated with climate change has prompted renewed efforts to integrate stormwater and flood management.

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[33]). The amendments call for State stormwater regulations to better account for flooding and climate change. In response, WSA submitted an action plan to the General Assembly in November 2021 entitled, "Advancing Stormwater Resiliency in Maryland (A-StoRM): Maryland's Stormwater Management Climate Change Action Plan". Since then the A-StoRM initiative has convened several stakeholder groups, including the Regulation Technical Advisory Group (RTAG), focused on updating the regulations, the Watershed TAG, focused on challenging technical and policy issues associated with regulating stormwater and flooding at a watershed scale, and the Stakeholder Consultation Group that reflects a broad spectrum of interested parties as called for in the 2021 statutory amendments.



Key A-StoRM Initiative Components

As of the Summer 2024, MDE's Stormwater, Dam Safety, and Flood Management Program, which leads the A-StoRM initiative, has released proposed Proposed Changes to State of Maryland Stormwater Management Regulations and the Maryland Stormwater Design Manual for public review. This is a precursor to amending Maryland's stormwater regulations and Design Manual to be published in the Maryland Register for formal public comment. In 2023, WSA proposed amendments[34] to Environment Article, §§4-201 And 4-203, Annotated Code Of Maryland Title 26 Department Of The Environment Subtitle 17 Water Management Chapter 02 Stormwater Management. Proposed amendments account for future changes in precipitation due to climate change.

A-StoRM Communications

The A-StoRM initiative involves major communications and outreach actions:

- The A-StoRM HUB Information center called AStoRM HUB[35] was launched in 2022.
- Three A-StoRM Regional Kickoff Meetings initiated the stakeholder engagement process in Spring of 2022.
- Three A-StoRM advisory groups, initiated in Summer 2022, are the Stakeholder Consultation (required in statute), the Regulation Technical Advisory Group (RTAG: Advises on technical aspects of amending the regulation), and the Watershed Technical Advisory Group (WTAG:

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[33] Senate Bill 227, mgaleg.maryland.gov/2021RS/Chapters_noln/CH_641_sb0227e.pdf
[34] Proposed Changes ot Environmental Article, §§4-201 AND 4-203, https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/AStoRM/Draft%20Update%20SWM%20MGMT%20Regs%20%26%20Design%20Manual%202024%20MDE.docx.pdf

[35]Advancing Stormwater Resiliency in Maryland, sb-227-maryland.hub.arcgis.com/

Advises on technical aspects of watershed scale stormwater and flood management). A list of stakeholder communications opportunities is maintained on the A-StoRM HUB.

- In December 2022, WSA's A-StoRM team circulated Proposed Stormwater Management Regulatory Requirements - December 12, 2022 for public comment.
- In July 2023, WSA's A-StoRM team circulated Proposed Stormwater Management Regulatory Requirements for public comment.
- In April 2024, WSA offered the Maryland Stormwater Regulatory Proposal for discussion with the Regulations Technical Advisory Group.

For more information visit the Advancing Stormwater Resiliency in Maryland Website.

A-StoRM & Flood Management

- In April 2024, WSA offered its current thinking on the flood management components of Maryland's Stormwater Management regulations (Slides 35-43).
- Identification of Flood-prone Areas: In 2022, WSA began a collaborative effort with local governments to identify and characterize flood-prone areas. This effort continued in 2023 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.
- Watershed Flood Management Studies: In 2023, WSA applied for a FEMA grant to conduct watershed flood studies. In 2024, WSA was awarded $3 million to develop 1) a statewide watershed prioritization tool, 2) a framework for how to best model watersheds for establishing watershed studies and plans, and 3) use the information gained in parts 1) and 2) to model three watersheds, identify the flood impacts, and identify mitigation options from which cost-effective alternatives can be selected in coordination with local stakeholders. These studies will inform the development of guidelines for local governments to conduct similar studies.

Flood Management Infrastructure Funding

Legislation has been adopted to restore funding to the Comprehensive Flood Grant Management Program[36] over several recent years. 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. Although funding for studies and plans through the CFGMP continues to be a roadblock to performing the necessary work to implement capital improvement projects before the next disaster designation by the federal government. MDE has introduced legislation the last two years that would make CFGMP funds available for studies and plans as originally envisioned in 1976.

[36] Comprehensive Flood Management Grant Program, mde.maryland.gov/programs/Water/StormwaterManagementProgram/Pages/floodmgmt.aspx

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.[37] 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):

- 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

Industrial Stormwater General Permits - Climate Enhancements

WSA staff, in coordination with EPA Region III staff, have conducted screening level climate reviews of several sector-specific industrial stormwater general permits. This activity is part of WSA's Climate Adaptation Plan, *Climate Smart Permits* priority. These permits are listed below:

- Industrial Sources that Discharge Stormwater Only (20-SW)
- Surface Coal Mining and Related Facilities (19-CM)
- Mineral Mines, Quarries, Borrow Pits, and Concrete and Asphalt Plants (15-MM)
- Discharges from Marinas including Boat Yards and Yacht Basins (16-MA)

Examples of changes, depending on the permit, include things like requirements to identify specific factors related to climate change that must be considered when designing and implementing control measures on-site, identification of considerations for planned operational changes to reduce the likelihood of the flooding of new structures or pollutant sources at the industrial site, more explicit thermal discharge limits to cold water streams, and requirements for climate change vulnerability assessments of industrial sites.

Erosion and Sediment Control

Standards & Specifications Update Initiative

In 2023, the Maryland General Assembly adopted amendments to the state's erosion and sediment control (ES&C) statute (SB471). The amendments require the Department to review and update specifications for sediment control plans (ES&C Handbook) in a certain manner on or before December 1, 2025, and every 5 years thereafter accounting for updated precipitation data. In November 2023, the WSA published a report for the Maryland General Assembly entitled, Plans And Resources Needed For Reviewing And Updating Specifications For Sediment Control Plans. MDE recognizes that more intense rainfall events, due to climate

[37] Maryland Resiliency Partnership, md-resiliency-partnership-maryland.hub.arcgis.com/

change, warrant consideration of improved erosion and sediment control methods. Funding is being sought to update the standards and specifications.

Stormwater Industrial Permit Associated with Construction Activity - Climate Enhancements

As part of WSA's Climate Adaptation Plan, staff conducted a screening level review of Maryland's general permit for Discharges of Stormwater from Construction Activity (20-CP). This activity was done as part of WSA's Climate Adaptation Plan, *Climate Smart Permits* priority. It puts design engineers and others on notice that they are required to account for "The expected amount, frequency, intensity, and duration of precipitation" in designing E&SC controls. Licensed engineers have a professional duty to be knowledgeable about and account for climate change in meeting the intent of the E&SC general permit.

Compliance Training for New Erosion and Sediment Control General Permit

In 2023, WSA notified the regulated community that the general permit for the Discharges of Stormwater Associated With Construction Activity (20-CP) would be effective April 1, 2023. WSA provided training for the regulated community to roll-out the updated general permit. 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. Training included MDE WSA compliance inspection staff.

Dam Safety

Dam Information Mapping Tool

Water storage is a critical aspect of water resource management. However, the dams used for this purpose can pose a hazard if they are not maintained over time particularly as climate change places more stresses on our aged infrastructure.

In 2024, WSA's Dam Safety Program released a revamped Dam Information Mapping Tool that offers the location and basic information for more than 550 dams. Most importantly the tool includes mapped areas of potential dam failure inundation floods, which is itself a newly finalized analysis product. This mapping tool supports Maryland's climate change resilience building by providing essential information to dam owners, the dam safety community, emergency management professionals, land use and planners, and the citizens of Maryland.

Dam Removal Guidance

When removal is the best option for an aged dam, the removal process and aftermath pose risks to downstream property owners and the natural environment. As a consequence, dam removal is a complex process for the dam owners, engineering consultants, and others involved. Recent large federal infrastructure funding laws are driving more dam removal projects, which is good for climate resilience and the environment if done properly. To help expedite the proper removal of dams, MDE in collaboration with DNR, MDP, and others, finalized the Maryland Dam Removal Guidelines in April 2024.

Dam Safety Emergency Preparedness

Emergency preparedness for dams is essential to bolstering Maryland's climate change resilience. Past State legislation strengthened MDE's authority to require the repair or removal of unsafe dams, and required owners of higher hazard dams to develop, maintain, and regularly exercise emergency action plans (EAPs). In Spring 2022, MDE WSA staff participated in Federal Emergency Management Administration (FEMA) initiative that included a tabletop exercise centered on the town of Oakland, MD involving the scenario of an extreme rainfall event, which placed several dams at risk of failure simultaneously.

In 2023, WSA's Climate Team organized a workshop centered on its After-hours Emergency Response procedures. The workshop featured a what-if scenario focused on a dam at risk of failure. In 2024 WSA's Climate Team organized a webinar on the topic of dam safety in a time of climate change.

Financial Resources for Dam Safety

Many dams are owned privately by people or entities that lack sufficient financial resources to maintain them and ensure their safety. MDE does not have a dam repair fund that can be quickly accessed in an emergency or to prevent emergencies. This is a critical public safety need. In 2023, MDE presented the issues and options for funding dam repairs and removals, as well as ensuring sufficient staffing to inspect dams, in a report entitled, *Joint Chairman's Report on Dam Safety Program Funding Needed for Oversight of Privately Owned Dams*. MDE has proposed dam repair fund legislation several times, without success, over the past five years. The latest proposal was HB245 in 2024.

In 2023, WSA staff worked with several dam owners to solicit funding from FEMA's High Hazard Potential Dam grant. This grant, administered by the Maryland Department of Emergency Management (MDEM), is supported in part by the federal Infrastructure Investment and Jobs Act (IIJA). In 2024, WSA was awarded about $4.26 million for maintenance projects associated with six dams.

Water Supply and Drought Management

Water Appropriations Permit and Regulation Climate Reviews

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. A key recommendation is to ensure that permit holders collect sufficient data from water wells in regions of the State that rely on fractured rock groundwater aquifers for water sources. In 2024, WSA's Climate Team conducted a review of the Water Appropriations or Use regulations (COMAR 26.17.06) -- Level 2 climate review. The Team offered recommendations to WSA's Water Supply Program, which is undertaking a general review of the regulation.

Indirect Potable Reuse (IPR) for Drought Resilience

In 2023 the Maryland General Assembly adopted legislation authorizing WSA to develop an Indirect Potable Reuse Pilot Program. The purpose is to allow the safe regulated use of highly treated municipal wastewater as an indirect source for drinking water treatment facilities. The source is "indirect" in the sense that the treated wastewater will first be mixed with natural water before being used as a naturally buffered source of

raw water to be treated again for potable water use. Maryland has received one application for an IPR project to augment a water supply reservoir, and is currently reviewing that proposal. WSA will submit a report on the status of the Pilot Program to the Governor and General Assembly by December 31, 2024.

Climate Change and 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. In 2024, several regions of Maryland were placed on "watch" status due to low groundwater levels. MDE routinely communicates drought conditions via its drought information webpage. More broadly, MDE's Water Supply Program has created a website for climate change communications.

Wastewater Management

Climate Reviews of Permits: 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 a screening level climate review. This included accounting for peak flows as a trigger for requiring a treatment plant wastewater volume capacity management plan, including more explicit requirements for maintaining 24-hour holding capacity for plants that discharge near shellfish waters, and requiring more explicit responsibility for ensuring backup power even under extreme weather conditions. In 2022, MDE began incorporating this language into permits as they came up for renewal. Screening level climate reviews for several general permits for discharges have been conducted between 2021 and 2024. These include Seafood Processing discharges, Swimming Pool and Spa discharges, and Pesticides discharges.

Bermed Infiltration Ponds

In July 2021, MDE issued a 15-month suspension on the construction of Bermed Infiltration Ponds (BIPs) due in part to rising water tables associated with climate change. 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 are 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 [38]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.

[38] MDE Bermed Infiltration Pond Study, https://mde.maryland.gov/Documents/BIP%20REPORT.pdf

Water & Wastewater Utility Climate Vulnerability Assessments

In summer 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 Maryland 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).

Wetlands Protection and Waterway Construction

Climate Awareness through Wetlands Pre-Application Meetings & Routine Correspondence

The Wetlands and Waterways Protection Program is taking steps to phase in accountability for climate change. 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 acknowledgment 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. In 2022, the Program enhanced its Pre-Application Meeting[39] webpage to include a section on climate change impacts with links to resources for the evaluation of climate change risks.

Living Shoreline Protection

Living shorelines offer sustainable coastline stabilization by utilizing natural elements such as vegetation and oyster reefs. They not only protect against erosion and storm surges but also enhance biodiversity and resilience in the face of climate change. However, despite Maryland's 2008 Living Shoreline Protection Act requiring the use of living shoreline protection methods, many waterfront landowners seek waivers to install hardened shorelines.

To assist permit writers in making a technically and legally sound decision to deny waiver requests, MDE has directed EPA program development funding toward the development of updated shoreline maps. The product is a Maryland Shoreline Stabilization Mapper that assesses the suitability of using living shoreline stabilization methods.[40] This tool enables MDE permitters to more rapidly and effectively determine when living shoreline methods must be used. In 2023, the Maryland Shoreline Stabilization Mapper was completed Statewide for tidal waters. In 2024 WSA adopted a metric for measuring a goal of promoting more living shoreline stabilization versus hardened shorelines. 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 compared to hardened shorelines (bulkhead or revetment).

In August 2023, WSA's Tidal Wetlands Division began hosting a Chesapeake & Climate Change Conservation Corps member for one year. The Corps member improved the tracking of progress toward

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[39] Pre-Application Introduction, https://mde.maryland.gov/programs/Water/WetlandsandWaterways/Pages/PreApplicationIntroduction.aspx

[40] Maryland Shoreline Stabilization Mapper, https://cmap22.vims.edu/MSSMTool/

increasing living shoreline adoption rates relative to the adoption of hardened shorelines. The Corps member also developed public outreach material to help promote the use of living shoreline protection techniques by coastal land owners. The Corps member continues to conduct a cost-benefit analysis of different shoreline erosion control methods. This work will include economic modeling to assess how living shorelines affect property values.

Wetlands and Waterways Ecological Restoration

In 2022, WSA's Wetlands and Waterways Protection Program was tasked by State legislation to conduct a study on the process for permitting ecological restoration projects, such as stream restoration, wetlands creation and restoration, and shoreline erosion control involving living shoreline techniques – HB 869[41]. During much of 2023, the study was conducted, involving a series of stakeholder group meetings. The process was part of a comprehensive analysis of the technical and procedural aspects of permitting ecological restoration projects. The Study generated recommendations for permitting and/or regulatory updates. Although the legislation is not explicit about climate change, WSA's report acknowledges its intent for projects to account for climate change considerations. The report summarizing the Study process and findings was completed and submitted to the Maryland General Assembly in August 2024.

Cold Water Protection

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

WSA's Watershed Protection, Restoration, and Planning Program continues developing water temperature models for streams that exceed their temperature water quality criteria. These models will be used to develop TMDLs in specific geographic areas of concern, 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.

MDE finished a draft TMDL for stream temperature in the cold water portions of Gwynns Falls watershed in 2020. Documentation was sent to EPA and comments were received during the interagency review. The Gwynns Falls TMDL will now go out for public review in the Fall of 2024.

In 2022, the Prettyboy Reservoir Watershed was selected as a second pilot watershed for the development of a TMDL. Program staff calibrated the Prettyboy Reservoir Watershed model for hydrology and stream temperature in 2023 and 2024, respectively. Staff will finalize the TMDL management scenarios and develop a draft temperature TMDL this year.

Cool and Cold Water Protection: Water Quality Standards & Permitting

In 2022, WSA adopted clarifications to Maryland's regulatory antidegradation procedures for Tier 1 waters that have cold water existing uses, redesignating some streams as Class III cold water and identifying others

[41] HB 869, mgaleg.maryland.gov/2022RS/Chapters_noln/CH_465_hb0869t.pdf

as having unique cold water existing uses (See Antidegradation Policy[42]). 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[43] 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 cold water streams, helps to enhance current and future protections for this important resource. In the fall of this year (2024), in consultation with DNR, the Department is proposing for public review of cold or cool water existing use determinations for 7 different waters of the State. Several of these existing use determinations will likely lead to use redesignations to Class III (Nontidal Cold Water) and Class IV (Recreational Trout Waters) designations during Maryland's 2025 Triennial Review of Water Quality Standards. An advanced notice of this public rule-making process soliciting public comment went out with the September 20th, 2024 edition of the Maryland Register.

WSA continues to evaluate 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.

Emergency Preparedness

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). WSA's Field Services Program responds to algal blooms with the potential to generate toxins and coordinates with the Water Supply Program when drinking water sources are involved. MDE WSA has invested in 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 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.

Emergency Preparedness Training

In 2023, WSA's Climate Team initiated the Climate Emergency Preparedness (CEP) Training initiative. This training is intended to build a culture of emergency preparedness and response among WSA staff. This awareness will enable staff to align with, contribute to, and draw upon this knowledge to make the State more resilient to climate emergencies.

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

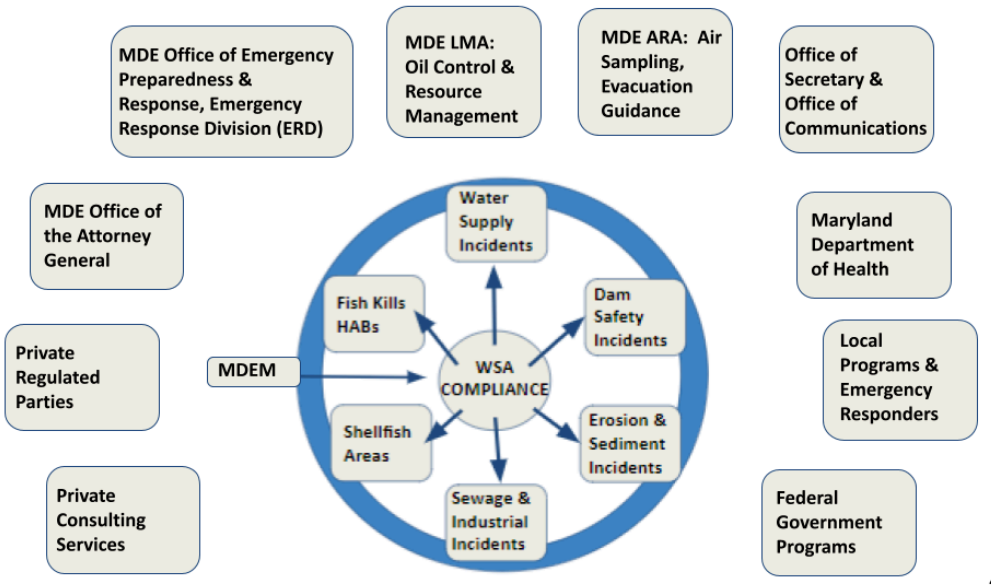
[43] Cold Water Existing Use Determinations: Policy and Procedures, mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Documents/Cold%20Water%20Existing%20Use%20Determinations%20Policy%20and%20Procedures.pdf

2023 Training sessions covered situations encountered by WSA's Water Supply Program, WSA's After Hours Emergency Response Procedures, Coordination with the Maryland Department of Emergency Management, Dam Safety, and Algal Blooms.

2024 Training sessions will cover Dam Safety, Shellfish Harvesting Area Emergency Response, and Responding to and Recovering From Catastrophic Emergencies.

After-Hours Emergency Response Procedures Update

In 2024, WSA completed the update of its After-Hours Emergency Response Procedures document. Also known as the Duty Office Manual, this document serves as both training and reference material for staff members of WSA's Compliance Program. Compliance Program Duty Officers serve as WSA's primary point of contact with the Maryland Department of Emergency Management (MDEM) Emergency Operations Center during off-hours. The Manual was updated in recognition of climate change being a threat multiplier. The image below depicts the hub and spoke conceptualized information flow from MDEM to WSA's Compliance Duty Officer to WSA Programs and beyond as needed.



WSA After-Hours Emergency Procedures hub and spoke information flow from MDEM to WSA's Compliance Duty Officer to WSA Programs and beyond as needed

Research, Planning, and Analyses

Maryland Climate Change Adaptation Strategic Planning

In 2023, WSA collaborated with DNR to translate Maryland's Climate Change Adaptation Framework[44] into Maryland's Next Generation Climate Adaptation Plan[45]. The Next Gen Plan includes near- and long-term action milestones. The Water element of the Next Gen Plan aligns with WSA's Four Climate Adaptation Priority Areas.

Chesapeake Bay Restoration Planning

Climate Addendum for Nutrient Reductions: In 2021, WSA conducted a technical analysis designed to offset predicted increases in nitrogen and phosphorus loading rates due to climate change. In 2022, staff produced an Addendum[46] to Maryland's Phase III WIP strategy for achieving nutrient pollution reduction targets by 2025, which account for climate change.

Beyond 2025, Maryland fully anticipates that additional nutrient reduction offsets will be required because of additional climate impacts on the Chesapeake Bay watershed and the Bay itself. The quantity of those reductions are not known at this time, and we anticipate those loads will be addressed in the next iteration of the Bay watershed implementation plan.

Water and Sewer Plan 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.

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

In 2022, the WRE Climate Change guidance was released via an MDP website.[47] 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

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[44]Maryland Climate Adaptation and REsilience Framework Recommendations, https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Documents/MD%20Climate%20Adaptation%20and%20Resilience%20Framework%20Recommendations.pdf

[45] Next Generation Adaptation Plan, https://mde.maryland.gov/programs/air/ClimateChange/MCCC/Documents/Next%20Generation%20Adaptation%20Plan.pdf

[46]Climate Change Addendum, mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Documents/Phase-III-WIP-Report/MD_Climate_Change_Addendum_2022.pdf

[47] Water Resources Element (WRE) Guidance Update, planning.maryland.gov/Pages/OurWork/envr-planning/water-resources-mg/2022/2022-guidance-update.aspx

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."

In 2024, recommendations and resource links were added to guide water resources planning decisions in relation to underserved or overburdened communities. The guidance gives particular attention to climate change considerations.

Climate Adaptation Communications

WSA Climate Adaptation Website and Dashboard

During 2022, WSA began developing a Climate Adaptation Dashboard[48] as a key feature of its Climate Adaptation and Resilience Website.[49] The Climate Dashboard, which went live in November 2023, highlights a set of top climate action priority areas and key climate adaptation activities for each. The Dashboard progress was updated in June 2024 and will be updated semi-annually in the future.

Vibrio Awareness

Vibrios are bacteria that occur naturally in estuarine and marine waters worldwide. Vibrio are in the same family of bacteria that cause cholera. Some species are known to cause serious infection when people are exposed through open wounds or punctures while swimming, wading, crabbing, or fishing. Though rare, such infections require immediate doctor's attention. The presence of vibrio is more prevalent in the summer and early fall when water temperatures are warm, which is becoming more common due to climate change. Consequently, WSA now promotes vibrio awareness during each swimming season.[50]

[48] MDE Climate Dashboard, https://mde.maryland.gov/programs/water/Pages/WSA-Climate-Dashboard.aspx
[49] Climate Change is Water Change, mde.maryland.gov/programs/Water/Pages/WSA_Climate_Change.aspx
[50] Vibrio, https://mde.maryland.gov/programs/water/MHB/Pages/Vibrio.aspx#:~:text=Since%20Vibrios%20can%20be%20naturally,to%20skin%20breakdown%20and%20ulcers.

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