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**COMMONWEALTH of VIRGINIA**  
DEPARTMENT OF CONSERVATION AND RECREATION

July 30, 2019

The Honorable Ralph S. Northam  
Governor of Virginia  
1111 E. Broad St.  
Richmond, Virginia 23219

Dear Governor Northam;

On behalf of the Department of Conservation and Recreation please accept the enclosed report as directed by Executive Order 24 (2018).

Section 2 C. of the Order directed the Department, in coordination with the Commonwealth's Chief Resilience Officer, to review Title 10, Chapter 6 (Flood Protection and Dam Safety) of the Code of Virginia and make recommendations that would strengthen Virginia's ability to protect life and property from flooding by natural and man-made causes. This report offers extensive recommendations that, if fully implemented, will make the Commonwealth safer and more resilient from the undeniable changes in climate that have already begun to affect our ability to protect our land, infrastructure, businesses and citizens.

In addition to our dedicated staff in the Division of Dam Safety and Floodplain management, I would like to thank Secretary Strickler and Deputy Secretary Saks for their assistance and guidance in the development of this report.

With kind regards, I am,

Sincerely,

Clyde E. Cristman  
Director

Cc: The Honorable Matthew Strickler  
The Honorable Joshua Saks  
Mr. Russell W. Baxter  
Ms. Wendy Howard-Cooper

**Response to Executive Order 24**  
**Department of Conservation and Recreation**

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## **INTRODUCTION**

Flooding has major consequences for the Commonwealth of Virginia. It impacts public safety, environmental quality, local economies, and can devalue or destroy the most significant financial asset for many individuals - their home or business. With more than 100,000 miles of streams and rivers, as well as 10,000 miles of estuarine and coastal shoreline, Virginia's flood risk is statewide, comes in many forms, and is increasing because of climate change and increased development in flood-prone areas.

2018 was the wettest year on record for 21 localities across Virginia, including Roanoke, Lynchburg, and Arlington which each received more than five feet of rain. Based on preliminary data, the statewide annual precipitation record of 86.06 inches was surpassed by nearly a foot, with a station in Nelson County receiving more than 97 inches.<sup>1</sup> We can expect more wet conditions in the coming years. The 2018 National Climate Assessment, published by the U.S. government, anticipates that "Both the frequency and severity of extreme precipitation events are projected to continue increasing in the [Southeast] region under both lower and higher scenarios. By the end of the century, projections indicate as much as double the number of heavy rainfall events (2-day precipitation events every 5 years) and up to a 21% increase in the amount of rain falling on the heaviest precipitation days (days with a 20-year return period)."<sup>2</sup>

According to the National Oceanic and Atmospheric Administration (NOAA), during 2016-2018 alone, six different billion-dollar hurricanes hit the United States, causing nearly \$330 billion in damage. During this same time period, National Flood Insurance Program (NFIP) flood insurance claims exceeded \$95 million in Virginia. Since the NFIP's creation in 1976, Virginians have filed more than 48,000 claims and received more than \$733 million in damage payments. Although flooding continues to become more frequent and more severe, only three percent of Virginians are covered by federally backed flood insurance.

Several federal programs are in place to address flood risk across the United States including the NFIP, the Community Rating System (CRS), and the Coastal Barrier Resource System (CBRS). These programs provide critical services and flood risk reduction measures, including access to flood insurance, disaster assistance, flood insurance premium discounts, and conservation of undeveloped coastal barriers. However, these programs alone cannot reduce all flood risk, and the Commonwealth must build upon the foundation these programs create to further protect life, public infrastructure and private property in Virginia.

To address this growing threat, on November 2, 2018, Governor Northam issued Executive Order 24: Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards. Section 2C of that order requires the Director of the Department of Conservation and Recreation (DCR), in coordination with the Chief Resilience Officer of the Commonwealth, to review DCR's

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<sup>1</sup> [https://www.richmond.com/weather/year-of-extremes-richmond-and-virginia-s-biggest-weather-stories/article\\_a2c08eb0-07ec-5f10-b582-b66904c53a08.html](https://www.richmond.com/weather/year-of-extremes-richmond-and-virginia-s-biggest-weather-stories/article_a2c08eb0-07ec-5f10-b582-b66904c53a08.html)

<sup>2</sup> Fourth National Climate Assessment, Southeast Region Section <https://nca2018.globalchange.gov/>

implementation of the Code of Virginia, Title 10, Chapter 6, Flood Protection and Dam Safety. Implementation of this Code section entails: assisting the Federal Emergency Management Agency (FEMA) with mapping the Commonwealth's flood risk, assisting communities in reducing their flood risk through participation in the NFIP and CRS, providing education and outreach related to flood risk and flood insurance, and regulating construction, operation and maintenance of dams, among other activities.

Through the work outlined above, DCR is the lead state agency in helping individual property owners assess and mitigate their flood risk and risks to the public related to dams. While Virginia's Coastal Resilience Master Plan will work from a regional or statewide level to deliver large scale, coastal flood protection measures, the recommendations in this report focus on reducing both riverine and coastal flood risk at a property or community level across the Commonwealth. This report also addresses the risks associated with poorly maintained dams and the costs to dam owners in the Commonwealth to properly operate and maintain their dams. These approaches, in many cases, will build off of existing local, state and federal programs and work in concert to protect people and property from flooding, sea level rise, and extreme weather.

This report, submitted per the requirements of Executive Order 24, provides an overview of Virginia's Dam Safety and Floodplain Management laws and regulations and makes recommendations for improving dam safety and floodplain management across the Commonwealth.

## **FLOODPLAIN MANAGEMENT**

### **Overview of Existing Laws, Regulations, and Requirements**

Title 10, Chapter 6 of the Code of Virginia grants powers and duties to DCR regarding the protection of life and property from the impacts of flooding. DCR is empowered to serve "as the coordinator of all flood protection programs and activities in the Commonwealth" with local, state, regional and federal agencies. DCR is also empowered to "[e]stablish guidelines which will meet minimum requirements of the National Flood Insurance Program."

The Code of Federal Regulations (44 CFR 60.11-13) defines how states may comply with the NFIP. There are two options for compliance. First, state agencies must follow local floodplain ordinances (so long as those ordinances meet NFIP minimums) or states must establish and enforce a state-level regulatory program to ensure state projects do not conflict with NFIP minimum standards. If any state-owned property is located in a community that is not participating in the NFIP, the state must have state level regulations for that property. Virginia has 290 communities that participate in the NFIP and 33 communities that do not. Of the communities that do not participate in the NFIP, only 16 have mapped special flood hazard areas, effectively masking their risk and leaving people and property vulnerable.

The Code of Federal Regulations (23 CFR 650) also "prescribes Federal Highway Administration (FHWA) policies and procedures for the location and hydraulic design of highway encroachments on flood plains, including direct Federal highway projects administered by the FHWA."

Regulations in this section of Code “apply to all encroachments and to all actions which affect base flood plains, except for repairs made with emergency funds (23 CFR part 668) during or immediately following a disaster.” Requirements are identified for public involvement, location hydraulic studies, alternatives, and design standards for encroachments, including that the “design of encroachments shall be consistent with standards established by the FEMA, State, and local governmental agencies for the administration of the National Flood Insurance Program”.

In 1997, Governor George Allen issued Executive Memorandum 2-97 (the Memorandum) which required that state owned development in participating NFIP communities must comply with the standards of the NFIP. According to the Memorandum, DCR, as the designated “state coordinator” of the NFIP, is responsible for ensuring that “all construction or land disturbing activities initiated by an agency of the Commonwealth, or by its contractor, in floodplains shall comply with the locally adopted floodplain management ordinance.” The Memorandum also requires state agencies “undertaking land disturbing or construction activity” in communities without floodplain ordinances, “shall comply with the standards of the Program” and that new state-owned buildings are prohibited in floodplains unless a variance is granted by the Department of General Services (DGS) which, per the Memorandum, must consult with DCR prior to issuance.

In addition to DGS reviews, DCR receives some projects for review from the Virginia Department of Transportation (VDOT) through their inter-agency coordination meeting, as well as other state agency projects through Joint-Permit Application reviews or the Environmental Impact Review (IER) process. When reviewing these projects, DCR provides comments that the state agency must reach out to the local floodplain administrator and comply with the local floodplain ordinance in accordance with the memorandum. DCR is not aware of the project status after comments are submitted, and DCR does not review all state agency projects through these review processes.

It is our assessment that the state is not in full compliance with 44 CFR 60.11-13 or 23 CFR 650. It is unclear if all new state-owned buildings are reviewed by DGS in accordance with the memorandum during the EIR process or if those buildings are complying with local floodplain ordinances. DCR has discussed complying with the Memorandum on several occasions with VDOT, and VDOT believes it is not required to be permitted on a local level per the Memorandum. During local program reviews conducted by DCR and FEMA, it has been reported that not all state projects have been permitted in compliance with local floodplain ordinances, as required by the Memorandum. Examples include bridges and boat ramps. Furthermore, due to staffing constraints, DCR has been unable to fully discharge its responsibilities outlined in Code and the Memorandum.

There is no place in Code, regulation, or executive guidance that clearly defines the standards for agency compliance with the NFIP in non-participating communities. The Uniform Statewide Building Code (USBC), the regulations that must be complied with when constructing a new building, outlines the regulations for construction and rehabilitation of buildings, structures, and equipment across the Commonwealth, with which state agencies must comply. The current edition of the USBC (2015 Version, effective September 4, 2018) addresses some provisions for construction in flood zones, but it does not currently meet NFIP minimums. At this time, we are unable to ascertain whether the state has developed land in floodplains in the 16 communities that

have mapped floodplains but do not participate in the NFIP. It is possible that no state-owned development has taken place in these areas, but we would require further investigation to make any definitive determination.

## **Recommendations**

In our judgement, an update to the Commonwealth's approach to managing activities in floodplains – including sustained investments to improve services – is overdue in order to reflect current authorities, requirements, and conditions. This update will result in a safer, more resilient Virginia with a lower potential for flood related deaths, reduced damage to infrastructure and buildings, lower insurance costs, more efficient and targeted use of current and future resources, and achievement of administrative efficiencies. We offer the following recommendations to help achieve those goals by:

### **A. Building Stronger State Government Capabilities**

A strong foundation of proper authorities, communication, consultation, and review will ensure state agencies are supporting each other and acting in full compliance with the NFIP and other relevant local, state, and federal requirements. With such a foundation, state property will be better protected, reducing taxpayer exposure to the costs of recovering from flooding.

#### **1. Establish a process to increase communication and coordination on flood-related activities between state and federal agencies, as well as state and federally-recognized Indian tribes in the Commonwealth**

§10.1-602 of the Code of Virginia establishes DCR as the coordinator of all flood protection programs and activities in the Commonwealth, including the coordination of federal flood protection programs administered by the United States Army Corps of Engineers (USACE), the United States Department of Agriculture, FEMA, the United States Geological Survey (USGS), the Tennessee Valley Authority (TVA), other federal agencies and local governments.

In order to properly discharge these responsibilities, DCR must be aware of activities being proposed or conducted by other agencies to ensure information being shared among state, federal and local agencies and the public is accurate and that efforts are not duplicated.

- 1.1. Create a formal process for all state agencies to submit information on all flood-related activities or projects they propose to conduct to DCR for review, evaluation, and feedback.
  - a. Information provided to DCR should include, but not be limited to, development projects in a floodplain, flood-related educational or outreach materials, communications with localities about flooding, flood-related projects

being funded by any agency of the Commonwealth, including independent agencies and institutions of higher learning.

- 1.2. Create a formal process that federal agencies may use to share flood-related information with DCR.
- 1.3. Continue the Virginia Silver Jackets team (an interagency team of federal and state agencies primarily funded by the USACE that was established in Virginia in 2010 to address flood risk) and work to add more state and federal partners. Utilize this group and associated funding opportunities to coordinate and implement flood-related activities. DCR is the lead state agency on the team, and the current Silver Jackets co-chair is a DCR employee.
- 1.4. Require the state and federal recognized tribes to commence discussions about flood risk.

**2. Create a state level program for NFIP compliance for all state agencies, to be administered by DCR**

NFIP compliance can be best assured with clear standards and a proper review, approval, and enforcement process for state agencies. The current authority, Executive Memorandum 2-97, is more than two decades old, is deficient in scope and requires an update to ensure current NFIP compliance. A program with one set of requirements applicable to all state agencies will reduce the administrative burden on both state agencies and localities, and assist in maintaining compliance with the NFIP as state agencies will not have to adjust activities based on multiple local ordinances

- 2.1. Request that the Governor issue an Executive Order that replaces Executive Memorandum 2-97 to create a new policy and conditions that are compliant with the NFIP, and direct DCR to develop such a program until requirements are established in Virginia.
- 2.2. Amend §10.1-603 of the Code of Virginia to include state-level floodplain management requirements that conform to NFIP minimums including a review, approval, and enforcement process for relevant activities covered by all state agencies, to be administered by DCR. Such state regulations should not be confined to NFIP minimums if other factors dictate additional protections, such as future flood conditions and sea level rise. Additional resources will be required to accommodate the administrative review, approval, and enforcement and additional staff resources would be necessary to properly implement such a program in a timely manner.

**B. Engage, Assist, and Strengthen Virginia Communities**

In order to fully realize the benefits of the NFIP and for the safety and protection of life and property, local floodplain ordinances must be in compliance with NFIP minimums. This will require some revisions to local ordinances and other local land use regulations and plans. Leadership from the state is necessary to ensure localities fully protect life and property in conformance with NFIP standards. Therefore, the Commonwealth should establish minimum floodplain management requirements for local ordinances and by a specified date, require all localities to participate in the NFIP.

- 1. Create minimum floodplain management requirements identified in Code, with oversight administered by DCR, which mandates NFIP participation for all localities and local compliance with the established requirements. Such regulations should not be confined to NFIP minimums if other factors dictate additional protections, such as future flood conditions and sea level rise**

§10.1-602 of the Code of Virginia empowers DCR to establish guidelines that comply with the minimum NFIP standards “to assure that all citizens living in flood-prone areas may have the opportunity to indemnify themselves from flood losses through the purchase of flood insurance” through the NFIP and to “[m]ake, in cooperation with localities, periodic inspections to determine the effectiveness of local flood plain management programs, including an evaluation of the enforcement of and compliance with local flood plain management ordinances, rules and regulations.”

Thirty-three (see [Appendix C](#)) of Virginia’s 323 communities do not participate in the NFIP. Of those that do not participate, 16 have been mapped by FEMA with special flood hazard areas and 17 have been mapped as having no special flood hazard areas. Regardless of such status, the benefits of participation as noted above can accrue to localities even where no special flood hazard areas exist, and NFIP flood insurance is only available to citizens residing in participating communities.

Participation in the NFIP allows communities to be eligible for NFIP flood insurance, disaster assistance, certain federal grants and loans, and federally backed mortgages in special flood hazard areas. It can also increase awareness to flood risk among residents of those communities.

A program with uniform standards for all localities will reduce the administrative burden on local governments and DCR, assist in maintaining compliance with the NFIP, provide CRS credits, and address flood risk more consistently across Virginia. This would also allow the Commonwealth more control over the floodplain program by decreasing dependency on FEMA for determining and enforcing compliance. The Commonwealth has this authority as §10.1-658.A. of the Code of Virginia states that “Flood waters disregard jurisdictional boundaries, and the public interest requires the management of flood-prone areas in a manner which prevents injuries to persons, damage to property and pollution of state waters.”

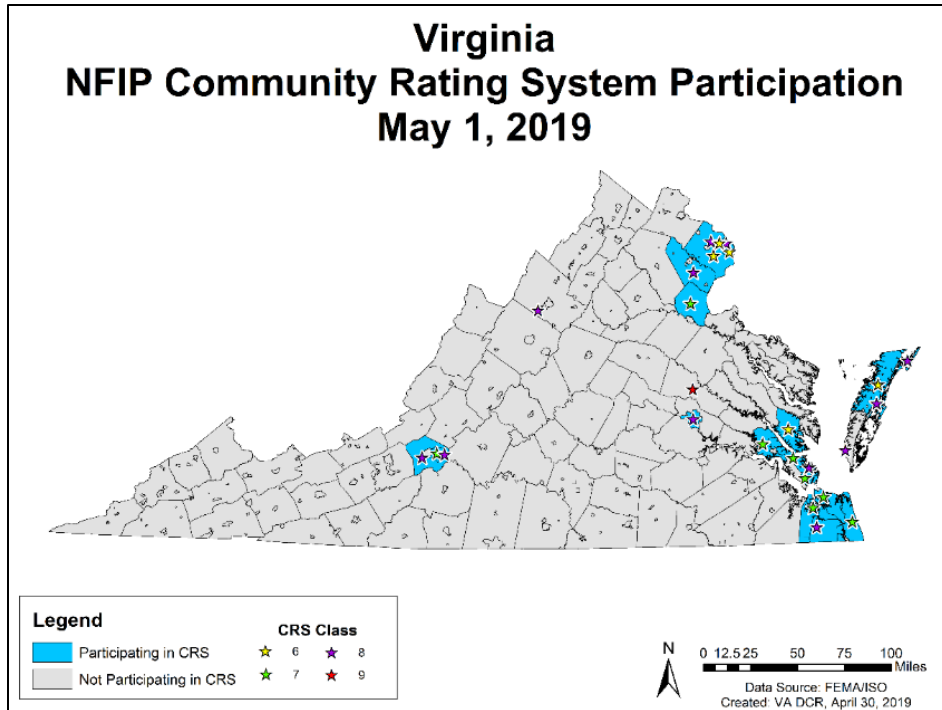


- 1.1. Propose legislation establishing authority in Code for DCR to develop such a program. Additional resources will be required to accommodate the administrative review, approval, and enforcement of this program.
- 1.2. Amend §15.2-9 of the Code of Virginia to clarify the powers of local governments to adopt floodplain regulations outside of their zoning ordinances.
- 1.3. Amend §15.2-2223 of the Code of Virginia to require that flood risk is addressed in Comprehensive Plans so that local development and planning goals are established to limit or reduce flood risk within the community similar to the requirements for Hampton Roads localities to address recurrent flooding in §15.2-2223.3.
- 1.4. Amend the Library of Virginia retention policies to add a special category that requires floodplain documents be maintained in perpetuity, in compliance with NFIP minimums.
  - a. The NFIP requires that records related to development in all special flood hazard areas be maintained as a prerequisite for participation in the NFIP (44 CFR 59.22(a) (9)). These records must be available for review if DCR or FEMA requests these documents, such as part of a community assistance visit to review the local program's compliance with the NFIP. These records (i.e. permit files, elevation certificates, flood proofing certificates, variances, etc.) currently fall under several different categories, with different retention periods, identified in the Library of Virginia Records Retention of Disposition Schedule.

## **2. Encourage participation in NFIP's Community Rating System (CRS)**

NFIP participating communities can reduce policyholders' premiums by participating in the CRS program. The program awards points to communities that implement flood protection policies beyond minimum NFIP participation requirements. In Virginia, 26 communities participate in the CRS program, as shown in Figure 1 below (see [Appendix D](#) for additional information).

Although this is just nine percent of the 290 NFIP communities in Virginia, 80 percent of all flood insurance policies in Virginia are written in CRS communities. This amounts to a total statewide savings of more than \$6.8 million for about 86,000 policyholders. Nationally, CRS communities represent about 5 percent of all NFIP communities and about 69 percent of all flood insurance policies written according to FEMA. Encouraging greater CRS participation amongst Virginia's localities will lower flood insurance rates, better communicate risk and sometimes reduce risk



*Figure 1: Virginia CRS Participation and Class effective May 1, 2019*

- 2.1. Provide assistance localities to help with joining CRS, as well as maintaining and improving their program. Establish a CRS Assistance Team on the state level to provide this assistance. Additional staff resources and associated funding would be necessary to effectively implement this program and as CRS participation increases, additional resources may be needed.
- 2.2. Create a CRS tool kit to aid communities in joining the CRS program, including, but not limited to, an outline of eligible activities localities are already required to implement and opportunities to receive more CRS credits by taking actions to reduce flooding and better communicate risk.
- 2.3. Pursue developing a regional CRS model for localities to implement to lessen the burden on local governments that wish to participate in CRS.
- 2.4. Encourage local implementation of CRS eligible activities to reduce flood risk even if CRS participation is not desired by the locality.
  - a. Although CRS participation can benefit all Virginia communities, we do not believe it should be mandatory for localities to join the CRS program at this time because acceptance into the program is entirely dependent on FEMA and its contractor's approval. Programmatic changes and additional resources on the state and federal level would be needed to implement a mandatory program.
3. **Establish a comprehensive post-disaster damage assessment process**

- 3.1. As part of the responsibilities of the Emergency Operations Center (EOC) develop a state-level damage assessment procedure involving DCR, FEMA, the Virginia Department of Emergency Management (VDEM), and the Virginia Department of Housing and Community Development (DHCD) to establish a comprehensive damage assessment process that complies with NFIP, Hazard Mitigation Assistance, and building code requirements.
- 3.2. Upgrade Crisis Track, damage assessment software purchased by VDEM for localities, to incorporate floodplain information and substantial damage forms to make this process more efficient.
- 3.3. Develop guidance and training related to implementing this comprehensive damage assessment process on the local level for both local and state agency staff.

**B. Improve Risk Identification and Risk Communication**

A key to ensuring proper planning, awareness, and response is the development and maintenance of state-of-the-art flood risk maps and associated mapping tools for all of Virginia. The Virginia Flood Risk Information System (VFRIS) should be upgraded, based on the example set by North Carolina that contains digitally accessible flood hazard data, models, maps, risk assessments, and reports. It also provides geospatial base map data, imagery, LiDAR data, along with hydraulic and hydrologic models that are available for download and use.

**1. Create a statewide floodplain mapping program to produce more detailed and accurate floodplain maps for the entire state, available through VFRIS**

- 1.1. Secure new mapping models to update the A flood Zones throughout the state that do not currently have elevation data or floodways delineated. (Descriptions of all flood zones referenced in this report are available in Appendix B.)
- 1.2. Secure new mapping models to update the AE Zones throughout the state to accurately reflect the flood risk in those areas and delineate floodways where they do not exist.
- 1.3. Model flood risks beyond the one percent annual chance flood that is mapped by FEMA, including but not limited to future conditions, stormwater runoff, sea level rise, and different storm frequencies throughout the state.
  - a. Additional resources will be required to create, implement, and maintain a mapping program. Additional staff resources would be not be necessary, but additional contract support would be needed.
  - b. By providing the state, localities, and property owners with information needed to better manage flood risk and reduce flood damages, it would also allow the

state more control over the floodplain program by decreasing dependency on FEMA for such mapping.

**2. Create a clearinghouse of flood-related information and inundation mapping in Virginia**

More and better data regarding flood risk, repetitive loss, and other information will enhance Virginia's ability to plan for and protect against flooding.

- 2.1. Integrate a variety of datasets into VFRIS to provide a comprehensive analysis of risk. Include data such as parcel information, property and structure values, structure construction data, flood zones and associated data, stream gauges, ground elevations, evacuation routes, first floor elevations, historic flood damages, and other attributes.
- 2.2. In accordance with §10.1-602 of the Code of Virginia, include all flood protection projects implemented by federal agencies and the estimated value of property damaged by major floods.
- 2.3. Obtain or create first floor elevations for all structures across the Commonwealth to incorporate into this data.
  - a. Make elevation data publicly available to help Virginians better understand flood risk, flood insurance rates, and potential damages faced by property owners and localities. To address the potential significant cost of such an effort, limit analysis only for structures that exceed a certain size.
  - b. Create a public database for elevation certificates in the state. Certificates could be obtained from localities or property owners.
- 2.4. Identify and compile maps and other relevant information regarding historic flood damage for the Commonwealth.
- 2.5. Identify all rain gauges, stream gauges, forecast points, dam monitoring devices, and other available sensors in the Commonwealth, identify areas without coverage, and add or update equipment where needed to improve Virginia's Integrated Flood Observing and Warning Systems (IFLOWS) a statewide network to track flood risk in real-time.
  - a. Use this statewide gauge network to develop flood warning and response systems for state agencies and local governments to be better prepared for flooding disasters, including potential dam failures. Ensure warning and response systems are implemented in accordance with CRS requirements to maximize local benefits.

- b. Use this data, with mobile LiDAR and the floodplain mapping program, to assist with real time disaster efforts, such as identifying road closures, shelters that may be inundated, etc.
  - c. Partnerships with federal, state, and local agencies will be vital to implement an effective statewide network.
  - d. Ensure DCR's role in developing and administering the IFLOWS network as maintained by VDEM.
- 2.6. Use this clearinghouse to prioritize mitigation opportunities, support grant applications, and target outreach efforts.
- 2.7. Ensure updated CBRS maps developed by the U.S. Fish and Wildlife Service (FWS) are incorporated into Virginia's mapping program and that future changes reflect the Commonwealth's interest in protection and resilience.
- a. The CBRS maps are currently a layer in VFRIS, but these maps are no longer included on FEMA Flood Insurance Rate Maps (FIRM). CBRS maps in Virginia were updated in 2014 and changes are currently being proposed.
  - b. DCR should identify areas for FWS to include in the CBRS as System Units or Otherwise Protected Areas.

### **3. Acquire mobile LiDAR along roadways across the Commonwealth**

This data would allow for flood models to be developed that more accurately determine how flooding will impact roadways and travel routes throughout the Commonwealth, including how flood waters will inundate roadways and the depth of that water.

- 3.1. Use data to develop flood models based on different storm frequencies for roadways and travel routes throughout the Commonwealth and make available on VFRIS.
- 3.2. Use these new flood models to create and/or update state and local evacuation routes and plans based on inundation of roadways.
- 3.3. Use these new flood models to steer maintenance and future development plans of roadways.
- 3.4. Use these new flood models to update local community development plans, statewide development plans, hazard mitigation plans, etc.

### **C. Encourage Broader Adoption of Flood Insurance**

Flood insurance provides building and contents coverage for property owners and renters to recover from flood damage and is intended to restore property to its pre-damage state. Flood damages are not typically covered by homeowner's insurance, and federal disaster assistance is only available when a Presidentially Declared Disaster occurs. The cost of flood damages can be catastrophic, so it is imperative that Virginians have flood insurance coverage to protect their property and be able to recover faster after a flood event.

According to FEMA, only three percent of Virginians have flood insurance for residential properties, slightly less than the national average, and 31 percent of Virginians located in the special flood hazard area have flood insurance for residential properties. Old Dominion University, as part of their 2018 Life in Hampton Roads Survey, found that 60 percent of homeowners that said they purchased flood insurance thought flooding was covered by their homeowner's insurance; however, most homeowner's insurance policies do not cover flooding. Outreach and education related to flood insurance coverage is necessary.

Additional staff resources will be required to provide regular and consistent messaging and to effectively manage dedicated flood insurance and flood risk outreach through DCR.

- 1. Identify and implement strategies to increase flood insurance coverage in Virginia and support FEMA's goal to increase flood insurance coverage by 50 percent by 2022.**
  - 1.1. In concert with the insurance industry, FEMA, the State Corporation Commission (SCC), and others, promote flood insurance and encourage all Virginians in the mapped floodplain to purchase flood insurance.
- 2. An evaluation of the adherence to the requirement in §38.2-2125 of the Code of Virginia should be undertaken by the Commissioner of Insurance with a report to the Commonwealth's Chief Resilience Officer.**
  - 2.1. §38.2-2125 of the Code of Virginia requires that "any insurer that issues or delivers in this Commonwealth a new or renewal contract or policy of fire insurance, or a new or renewal contract or policy of fire insurance in combination with other insurance coverages, which policy or contract excludes coverage for damage due to flood, surface water, waves, tidal water, or any other overflow of a body of water, shall provide written notice that (i) explicitly states that flood coverage is excluded; (ii) states that information regarding flood insurance is available from the insurer, insurance agent or the National Flood Insurance Program; and (iii) advises the policyholder that contents coverage may be available with the flood policy for an additional premium."
- 3. Establish a long-term, multi-agency effort to increase outreach through media campaigns, social media, local and regional utility mailings, and other means to increase public awareness regarding the importance of acquiring flood insurance.**

- 3.1. Declare flood awareness and dam safety awareness days, weeks, and/or months.
- 3.2. Develop targeted outreach materials, training, and activities to coordinate with awareness weeks, hurricane season, etc.

**4. Evaluate and implement options to increase access to private flood insurance**

- 4.1. This may include incentives for insurance agents, removing any legal barriers to writing non-NFIP policies, and making it less attractive for insurers to only write low risk policies.
- 4.2. Work with the SCC to identify companies (both admitted and non-admitted<sup>3</sup>) that sell private flood insurance and make the list publicly available.

**5. Evaluate the cost of flood insurance and identify policies to increase affordability of NFIP and private flood coverage.**

- 5.1. Any policies should address the ability of low-income households to bear any additional costs and should consider a “means test” to determine priorities for premium subsidies or other support.

**D. Improve Education and Training Programs**

There is a need for improved and increased education and training related to flood risk and floodplain management across Virginia. This applies to local and state agency employees that are implementing and enforcing floodplain management regulations, as well as private sector professionals whose work directly relates to floodplain management. Better informed and trained floodplain managers and other officials from state and local agencies will advance Virginia’s capabilities to address flood risk and prevention. Furthermore, all Virginians should be aware of their flood risk and flood insurance options to better prepare themselves and reduce their flood risk.

Additional staff resources will be required to implement a comprehensive training program.

**1. Develop a training curriculum for floodplain management regulations, floodplain mapping, NFIP compliance, and other flood related topics for state and local agencies.**

- 1.1. Require all localities to have a designated floodplain administrator, and require at least six hours of floodplain management training each year.

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<sup>3</sup> Admitted insurers are licensed by the state to sell insurance and are covered by the Virginia Property and Casualty Insurance Guaranty Association. Non-admitted insurers are not licensed, but they can still sell insurance in the state, and they are not covered by the Guaranty Fund. Additional information can be obtained from the SCC or here <https://www.gfms.org/faq/state/virginia>

- 1.2. Make training available to other local officials, including but not limited to building officials, planners, zoning administrators, emergency managers, engineers, etc.
  - 1.3. Partner with all appropriate state agencies to coordinate and implement this training.
  - 1.4. Require representatives of state agencies that maintain and build facilities to attend at least one training per year.
- 2. Develop a training curriculum for the private sector, including but not limited to real estate agents, insurance agents, mortgage companies, design professionals, and professional engineers.**
    - 2.1. Where appropriate, incorporate this training into continuing education requirements for professional certifications and licenses administered in Virginia. This may involve partnerships with the Department of Professional and Occupation Regulation and professional associations.
    - 2.2. Evaluate existing continuing education requirements for insurance agents and determine if changes are necessary to ensure agents that sell flood insurance have been adequately trained to do so.
- 3. Incorporate information on flood insurance coverage into homebuyer training provided by the Virginia Housing Development Authority.**
    - 3.1. Where feasible, encourage other organizations that provide homebuyer education, such as Housing Opportunities Made Equal of Virginia, Inc. (HOME), to incorporate information on flood insurance coverage.
- 4. Identify and promote existing programs and research topics at community colleges and state universities. Encourage incorporating flood-related coursework when feasible.**
    - 4.1. Encourage community colleges and state universities to partner with localities through course projects or independent studies to undertake flood-related projects that provide students with invaluable work experience and a needed service to the locality.
- 5. Identify opportunities to incorporate flood-related information and programs into Virginia Public Schools through science and environment Standards of Learning.**
    - 5.1. Partner with Virginia Public Schools to spread flood awareness through activities such as education days, demonstrating a flood model, providing student-friendly flood materials, etc.
- E. Review Existing and Potential Funding Sources for Pre-disaster Hazard Mitigation**



In §10.1-658.B. of the Code of Virginia, the General Assembly declared that “the expenditure of public funds and any obligations incurred in the development of flood control and other civil works projects, the benefits of which may accrue to any county, municipality or region in the Commonwealth, are necessary expenses of local and state government.” The Commonwealth should identify existing funding sources and opportunities that may provide financial assistance to localities or property owners to make flood risk reduction more affordable.

Several federally funded grant programs that provide flood-related assistance are administered in Virginia. NFIP participation is required if these funds will be used in a special flood hazard area (SFHA), and if development occurs, compliance with the local floodplain ordinance is required. As the coordinator for all flood protection programs and activities in the Commonwealth, DCR’s Floodplain Management program should have a formal role in the administration of these grants.

1. **Determine the ability of the existing Dam Safety and Flood Prevention and Protection Assistance Fund to address this issue.**
2. **Review all existing funding sources administered by state agencies to determine the eligibility for funding flood risk reduction projects.**
3. **Determine DCR’s role in administering a portion of FEMA’s Pre-Disaster Mitigation (PDM) funds related to flooding that are currently under the purview of VDEM.**

The Disaster Recovery Reform Act of 2018 amended Section 203 of the Robert T. Stafford Disaster Relieve and Emergency Act to authorize the National Public Infrastructure Pre-Disaster Mitigation fund. This new program is named Building Resilient Infrastructure and Communities (BRIC). FEMA is currently working to develop and implement the BRIC program, so it is unclear at this time how the PDM program will transform. It is anticipated that BRIC will be implemented in the fall of 2020.

4. **Determine DCR’s role in administering FEMA’s Flood Mitigation Assistance (FMA) funds that are currently under the purview of VDEM.**

The FMA program funds mitigation projects and planning efforts to reduce or eliminate long-term flood risk to NFIP insurance structures. This grant program is designed specifically for flood-related projects. Although FMA grants are often administered through state emergency management departments, some states administer these grants

through their NFIP Coordinating office. For example, Arkansas,<sup>4</sup> Nebraska,<sup>5</sup> Texas,<sup>6</sup> and South Carolina<sup>7</sup> manage their FMA programs through their NFIP coordinating offices.

5. **Expand DCR’s role in administering a portion of post-disaster funds related to flooding, such as Hazard Mitigation Grant Programs funds currently under the purview of VDEM or Community Development Block Grant Disaster Recovery funds currently under the purview of DHCD.**
6. **Determine DCR’s role in administering Coastal Zone Management (CZM) funds related to flooding and CRS that are currently under the purview of the Department of Environmental Quality.**
7. **Develop a fund to cover (all or partial) the costs of surveying or engineering work for low income residents to obtain elevation certificates, determine base flood elevations, or similar work necessary to properly document flood risk for flood insurance policies or allocate necessary funds for state employees to provide this service.**
  - 7.1. Determine the feasibility of other options for Virginians to reduce their flood insurance costs, such as vouchers or subsidies for this work.
8. **Conduct an evaluation of using taxes (sales, property, etc.) to fund flood risk reduction projects in individual communities or on the state level, with a report to the Commonwealth’s Chief Resilience Officer.**
9. **Support existing or future federal initiatives that provide funding for pre-disaster mitigation.**
  - 9.1. Encourage Congress to increase the total amount available for Increased Cost of Compliance (ICC) funds, make these funds available in addition to maximum policy limits, and consider making these funds available after a non-flood damage or without a substantial damage determination.

**F. Encourage Flood Risk Reduction Efforts that Protect and Conserve the Natural Functions of Floodplains**

The Governor’s *ConserveVirginia* initiative seeks to identify the highest quality of lands for protection through the Commonwealth’s land conservation actions. Land conservation can be a key tool to protect the integrity of natural infrastructure and features like wetlands,

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<sup>4</sup> <https://www.anrc.arkansas.gov/divisions/water-resources-management/floodplain-management/floodplain-management-programs/>

<sup>5</sup> <https://dnr.nebraska.gov/floodplain/flood-mitigation>

<sup>6</sup> <http://www.twdb.texas.gov/flood/grant/FMA.asp>

<sup>7</sup> <http://www.dnr.sc.gov/water/flood/mitgrants.html>

natural floodplains, dunes and others can reduce flooding and provide additional ecosystem benefits.

- 1. Encourage the use of conservation easements for flood risk reduction and promote the Land Preservation Tax Credit’s eligibility for this activity.**
  - 1.1. Conservation Easements that protect floodplains are currently eligible for Land Preservation Tax Credits outlined in §58.1-512 of the Code of Virginia if conveyed for the conservation purpose of watershed Preservation, as identified in 4VAC5-20-20, the Virginia Land Conservation Foundation’s Conservation Value Review Criteria.
  - 1.2. Evaluate the Conservation Value Review Criteria for Watershed Preservation easements under the Land Preservation Tax Credit program and evaluate any allowable uses that may prevent these easements from qualifying as open space for CRS purposes. Open space is one of the highest scoring activities in CRS, with a maximum point value almost worth 3 class changes – 15 percent discount on insurance.
- 2. Allow localities to use Transfer of Development Rights as a way to protect floodplains via an amendment to §15.2-2316.2. Develop a model that localities may use for administering and implementing such a program.**
- 3. Prioritize mitigation projects that conserve floodplains, such as relocating structures outside of the floodplain, converting properties to open space, stream restoration, etc.**

## **DAM SAFETY**

### **Overview of Existing Dam Safety Regulations**

In accordance with the Dam Safety Act (§10.1-604 et seq. of the Code of Virginia), DCR administers the Commonwealth’s Dam Safety Program, which is overseen by the Virginia Soil and Water Conservation Board. The Dam Safety Program is governed by the Virginia Impounding Structure Regulations. The Program seeks to provide for the safe design, construction, operation, and maintenance of dams to protect public safety. “Regulated dams” or “impounding structures” in Virginia include those structures that are at least six feet in height and that impound a maximum capacity of at least 50 acre-feet, and those that are at least 25 feet in height and that impound a maximum capacity of at least 15 acre-feet.

Executive Order 24 directs DCR to “assess the effectiveness of current dam safety regulations in accounting for changing precipitation patterns and conditions.”

In 2014, the Virginia General Assembly authorized DCR to develop a new Virginia Probable Maximum Precipitation Study (VA PMP Study) to update hydrological information in use by the

Dam Safety Program. DCR Dam Safety contracted with Applied Weather Associates (AWA) in Colorado to complete the analysis. From July 2014 to December 2015, AWA developed the Virginia PMP Study and it was approved for use by the Virginia Soil and Water Conservation Board in December 2015. In March 2016, PMP information from the VA PMP Study for 6 hr., 12 hr., and 24 hr. storm events was required to be used for all Dam related calculations in Virginia (hydrological/flow related calculations). Virginia now has over 24,000 grid points filled with 100 years of real world storm data developed solely for use with the physiographic regions of Virginia.

Prior to May 2018, a licensed Professional Engineer had the choice to use a variety of accepted hydrologic temporal distribution curves to estimate hydrological flows with no guidance on which curve should be utilized in Virginia. A majority of these curves were developed more than 40 years ago with limited data and were never intended to be utilized with values such as the Probable Maximum Precipitation.

These engineering calculations are the basis of Dam Failure Analysis studies required by regulation in the Commonwealth. These analyses offer predictions of the downstream consequences if a dam were to fail. These analyses also include maps which aid emergency personnel in warnings and evacuations of downstream residents, schools, or businesses.

In May 2018, the Virginia Soil and Water Conservation Board adopted new temporal distribution curves that are specific to Virginia based on the study conducted by AWA. The use of these new curves based on Virginia specific rainfall data provide a greater degree of accuracy in assessing downstream impact. No changes are currently required to the Dam Safety regulations to ensure the most accurate precipitation data is being used; however, periodic updates will be necessary to account for changing precipitation patterns.

With the potential for more frequent and heavier precipitation events, the Dam Safety Program must be more robust to protect the lives and property of Virginians. Unfortunately, by a number of measures, the Commonwealth's Dam Safety program falls short. Virginia is ranked 15<sup>th</sup> among states for the number of regulated dams, but ranked 34<sup>th</sup> in the number of personnel dedicated to the Dam Safety Program. The national average for regulated dams is 294 per full-time equivalent, DCR's average is 409 dams for each FTE.

There are more than 3,000 dams in the Commonwealth, many constructed 50 years ago or longer. More, than 2,000 of these dams are regulated by DCR, with the majority being privately owned by individuals, families, and home owners associations or other common interest communities. This privately owned category of dam owners represent approximately 52 percent (1046) of regulated dams in the Commonwealth. Of these 1046 dams, 17 percent (178) are classified as High or Significant Hazard meaning they pose the greatest risk to public safety and the lives and property of the citizens of the Commonwealth. Another 66 percent have an unknown hazard classification and may include a number of High or Significant Hazard Dams. During the period from January 1, 2018 until January 31, 2019, there were 18 reported dam incidents and failures. Not all incidents and failures were to privately owned dams, but 45 percent of those failures related to High or Significant Hazard Dams.

While DCR is able to fund certain engineering, planning, and other activities through the Dam Safety, Flood Prevention and Protection Assistance Fund (Fund) (§10.1-603.16 et seq.), there is no funded source of grants or loans for owners for repair, upgrades, alteration, and construction activities who may be unable to afford to keep their dams in compliance with state law and regulation. A fund specifically dedicated to assisting dam owners would increase the safety of Virginia's dams. According to a 2019 Association of State Dam Safety Officials (ASDSO) report, of the \$65.89 billion needed to rehabilitate non-federal dams in the United States, about one-third – \$20.42 billion – is needed to repair high-hazard structures, both publicly and privately owned. This is up from the \$18.71 billion estimate in 2016.

No comprehensive cost analysis has occurred related to Virginia Dams since 2011. In DCR's 2011 report entitled *Costs, Funding and Prioritization of Virginia Dams to Meet Minimum Public Safety Standards* submitted to the Governor and the Chairmen of the Senate Finance Committee and The House Appropriations Committee the following data was provided.

#### *High Hazard Dams*

In 2011, the total number of high hazard dams was 221 and of those, 104 dams either met minimum public safety standards or money was already allocated for their repair. Virginia had 117 high hazard dams in need of repairs to meet minimum public safety standards. Of those, 21 were owned by the state, 37 by the Soil and Water Conservation Districts (SWCD), 23 by the local government, 33 were privately owned, and three were utility owned. The total estimated cost for each owner group was:

- State Owned (21) \$21,399,619
- SWCD (37) \$62,590,242
- Local Government (23) \$36,713,402
- Privately Owned (33) \$41,789,763
- Utility (3) \$5,174,208

#### *Significant Hazard Dams*

In 2011 the total number of significant hazard dams was 398, and of those, 75 met minimum public safety standards or money was already allocated for their repair. Of the 399 significant hazard dams, 323 were in need of repairs. Of those, ten were owned by the state, 14 by the SWCDs, 28 by the local government, 267 were privately owned, and four were utility owned. The total estimated cost for each owner group was:

- State Owned (10) \$17,374,976
- SWCD (11) \$14,920,953

- Local Government (28) \$58,435,535
- Privately Owned (266) \$323,612,385
- Utility (4) \$9,602,094

## **Recommendations**

The number of dams in disrepair across the Commonwealth continues to rise as does the cost of maintaining and upgrading these dams. Even in 2011, an estimated \$41 million price tag just to bring privately owned high hazard dams into compliance with regulations would require a significant investment from private dam owners.

Therefore, the following recommendations are offered:

### **A. Building Stronger State Government Capabilities**

A strong regulatory program requires more than solid regulations. A strong program must incorporate adequate human, technological, and financial resources to ensure full compliance with Virginia Impounding Structure Regulations. A strong program supports state, local, and private dam owners with the following priority goals:

- Reduce risks to life and property associated with dams
  - Increase awareness of the benefits and risks related to dams
  - Advance the state of practice of dam risk management
- 1. Establish a permanent budget and provide additional staff resources to manage the online Dam Safety Inventory System (DSIS) and fund continuing system upgrades.**
    - 1.1. DSIS was implemented in the summer of 2017. DSIS provides a web-based platform to aggregate regulatory information related to all dams in the Commonwealth and has been an invaluable asset in the EOC. At a cost of more than \$600,000 in federal, general and special funds, Phase I II and III have been completed and provide access to dam owners, engineers, emergency managers, and the general public to review, update and submit data, and submit online payment of fees.
      - a. Phase IV development in DSIS will create an emergency dashboard. The dashboard will provide dam specific data related to weather warnings and watches, including predicted rainfall and potentially staging based on the existing emergency action plan and provide critical safety information. The system will also be evaluated for the integration of a statewide gauge network to develop flood warning and response systems for state agencies and local governments to be better prepared

for flooding disasters. The warning and response systems would be implemented to meet CRS requirements to maximize local benefits.

- 1.2. The emergency dashboard and reporting functionality will allow users to quickly export and download essential files and documents for guidance and sharing as well as view real time data from internal and external data sources.
- 1.3. DCR will continue to work to identify and integrate connections between DSIS, ConserveVirginia and the ongoing development and updates to VFRIS where datasets may meet multiple user needs.

**2. Provide additional resources for dam safety regional engineers with a goal of each regional engineer being responsible for 200 dams or less.**

- 2.1. Currently there are five regional dam safety engineering positions responsible for the regulation of more than 2,000 dams. Additional staffing will create more manageable workloads and increase program compliance.

**B. Engage and Assist Dam Owners and Localities**

In 2016, Congress passed the National Dam Rehabilitation Program Act that establishes a grant program to assist local communities to rehabilitate, repair, or remove a high-hazard potential dam before it fails. Funding should be made available on the state level to leverage these and other dollars to perform the most work possible.

**1. Provide initial investment for dam repair or removal (decommissioning) of \$20M to be administered by DCR and the Virginia Resources Authority and additional funding at a minimum of \$5M-\$10M annually thereafter.**

- 1.1. Create a separate grant source to fund repairs for high and significant hazard dams with spillway deficiencies and/or poor or unsatisfactory conditional assessments that is related to the ability of the owner to pay.
  - a. This separate source could be used independently or as a source of match for federal or other state grant programs.

**2. Collaborate with localities and United States Army Corps of Engineers (USACE) to perform specified work on all potentially high or significant hazard dams in a locality with the goal of bringing them into compliance with Virginia Impounding Structure Regulations.**

- 2.1. In an effort to address the priorities of the Virginia Soil and Water Conservation Board and DCR to bring dams of regulatory size with unknown hazard class under certificate, ensure emergency action plans and inspection reports for all high hazard dams are recorded in DSIS, and further promote flooding awareness, the Board

approved the establishment of a Pilot Project with USACE-Norfolk District to perform initial assessments of all known dams of regulatory size within a selected locality or localities. After initial assessments, dams will be prioritized for inspections, dam break inundation zone mapping, emergency action plans, and, where the dam resides in a special flood hazard area, flood inundation zone mapping. All studies and mapping will be performed by the USACE.

USACE, through the Planning Assistance to States Program, is provided authority to assist the states, local governments, and other non-federal entities by performing studies such as dam safety/failure studies, flood damage reduction studies and floodplain management studies. These studies are cost shared on a 50 percent Federal and 50 percent non-Federal basis and may include 100 percent work in kind. The success and lessons learned through this pilot project can be replicated across the state.

Example: City of Lynchburg has 12 dams. Six have Regular Maintenance and Operation Certificates and six have no hazard determinations, but appear to be of regulatory size. DCR through the Fund, would coordinate with USACE to complete the required dam safety and flood protection studies. USACE would provide labor equivalent to 50 percent of costs, the locality in coordination with DCR, obtains permissions from all owners to complete the studies and commits up to 50 percent of costs up front; DCR reimburses the locality from the fund. This collaboration would result in zero final costs to the owner or locality and potentially provide additional CRS credit to communities. With adequate funding this model could be replicated across the Commonwealth where dams believed to be of regulatory size exist. At the current time there are more than 800 dams of unknown regulatory status in the Commonwealth.

**3. Amend §15.2-2243.1 of the Code of Virginia related to downstream development.**

Dam owners have no control over upstream or downstream development that may compromise storage capacity or the hazard classification of the dam.

- 3.1. Amend §15.2-2223 of the Code of Virginia to require that upstream and downstream development of a dam is addressed in Comprehensive Plans so that local development and planning goals are established to limit or reduce impact to existing dams.
- 3.2. Amend §15.2-2243.1 of the Code of Virginia to require the following:
  - a. Estimates of cost to upgrade the dam to be provided by the owner, at the cost of the developer.



- b. Remaining 50 percent of costs to be made available from the Dam Safety Flood Prevention and Protection Assistance Fund where funds have been specifically appropriated for this purpose or split 50/50 with the Fund and the locality.
- c. Development must be restricted below high hazard dams until dams are upgraded to meet Virginia Impounding Structure Regulations based on proposed and or approved development.
- d. Local governments must contact DCR if no inundation map is on file with the locality.

**4. Require approval by DCR before ownership of a dam and any attendant certificates or permits are transferred.**

DCR has encountered situations where developers purchase undeveloped or underdeveloped property with a dam on site. The developer obtains a Regular Operation and Maintenance Certificate or General Permit, Inspection Report and Emergency Action or Preparedness Plan based on current conditions. Significant development then occurs downstream of the dam. Prior to expiration of the Certificate or Permit, ownership and/or maintenance and repair responsibilities of the dam are transferred to the home owners. Because a Regular Operation and Maintenance Certificate or General Permit is being conveyed, home owners are often unaware of the needed upgrades and are left with the expense of upgrading the dam to the requirements due to a higher hazard classification.

- 4.1. 4VAC50-20-90. Transfer of Permits and 4VAC50-20-170. Transfer of Certificates of the Virginia Impounding Structure Regulations only relate to the transfer of regulatory documents, not transfer of ownership of the dam.
- 4.2. Changes to the Code of Virginia and Impounding Structure Regulations are needed to ensure developers upgrade impounding structures prior to any transfer of ownership, repair or maintenance responsibilities to the home owners in a developed neighborhood where development has occurred downstream of the dam.
- 4.3. DCR must certify the dam meets Impounding Structure Regulations prior to any legal transfer of ownership, repair, or maintenance responsibilities. The DCR certification must be provided to the transferee at the time of transfer. Transfers without DCR certification should be null and void and subject to penalty.

**5. Establish permanent budget and necessary personnel to fund a position to manage the online Dam Safety Inventory System and fund continuing system upgrades and capabilities.**

**C. Improve Education and Training Programs**

**1. There is a need for improved and increased education and training related to dam safety across Virginia.**

There is a need for improved and increased education and training related to dam safety across Virginia. This applies to local zoning and emergency management and public safety officials, state agencies responsible for emergency response, owners, engineers and the general population. Better informed and trained dam owners, officials from state and local agencies and those who live or recreate near dams will advance Virginia’s capabilities to address dam safety. Furthermore, all Virginians should be aware of their flood risk related to dams and prepare themselves to reduce that risk.

Additional staff resources will be required to implement a comprehensive training program.

- 1.1. Develop a comprehensive training curriculum for Virginia Impounding Structure Regulations for private, state, and local dam owners.
- 1.2. Develop a comprehensive training curriculum for local planning, zoning and emergency management, and public safety officials related to emergency action/preparedness plans and dam break inundation zone requirements.
- 1.3. Develop a comprehensive public education and outreach strategy to educate the general public about flood risk related to dams and safe behaviors while recreating around dams.
  - a. Declare flood awareness and dam safety awareness days, weeks, and/or months.
  - b. Develop targeted outreach materials, training, and activities to coordinate with awareness weeks, hurricane season, etc. This may include activities such as awareness days, community days, demonstrations of the flood model, providing dam safety materials, etc.
  - c. Collaborate with Floodplain Management to participate in school and community-based opportunities to incorporate dam-related information and programs into any training to spread dam safety awareness.

**CONCLUSION**

As the Governor stated in Executive Order 24, “[s]ea level rise, land subsidence, higher average temperatures, more frequent and intense weather events, severe drought, and increased development, have increased risk and will continue to increase and exacerbate risk from natural hazards across the Commonwealth of Virginia.” As directed by the Governor, the purpose of this report is to evaluate our current programs and offer recommendations regarding the need to improve them.

For Virginia to realize its goals of improving resilience and protecting life and property, ongoing improvements to the management of floodplains, dams, and related grey and green infrastructure are required. Virginia is long overdue in establishing updated policies and procedures, improving communication and awareness, and building an expert workforce to establish necessary programs, advise governmental agencies, and work cooperatively with citizens, businesses, and local, state, and federal agencies to advance these reforms.

This report demonstrates that much must be done and that we must begin now.

**APPENDIX A: FLOODPLAIN RECOMMENDATION ACTION TABLE**

Floodplain Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
<b>A. Building Stronger State Government Capabilities</b>						
<b>1: Increase communication and coordination</b>	X			X		X
1.1: Formal process for state agencies	X			X		
1.2: Formal process for federal agencies				X		X
1.3: Continue Virginia Silver Jackets Team				X		X
1.4: Establish relationships with state and federally recognized Indian tribes				X		X
<b>2: Create a state level program for NFIP compliance</b>	X	X		X	X	
2.1: Replace Exec. Memo. 2-97 with new Exec. Order	X					
2.2: Amend Va. Code to add state floodplain requirements		X		X	X	
<b>B. Engage, Assist, and Strengthen Local Communities</b>						
<b>1: Require NFIP participation and create minimum floodplain requirements for localities</b>	X	X	X	X	X	
1.1: Propose legislation establishing authority for DCR to develop such a program		X		X	X	
1.2: Amend Va. Code to clarify local powers to adopt floodplain regulations outside of zoning			X			
1.3: Amend Va. Code to require flood risk is addressed in Comprehensive Plans			X			
1.4: Amend Library of Virginia retention policies to comply with NFIP				X		
<b>2: Encourage participation in CRS</b>				X	X	
2.1: Provide assistance to localities to help join CRS				X	X	
2.2: Create a CRS tool-kit to aid communities in joining CRS				X		
2.3: Pursue developing a regional CRS model for localities				X		
2.4: Encourage local implementation of CRS activities even if not participating	X			X		

Floodplain Recommendation	Action Needed					
	Executive	Legislative State Authorities	Legislative Local Authorities	Operational	Budgetary	Federal
<b>3: Establish a comprehensive post-disaster damage assessment program</b>				X	X	
3.1: Establish a comprehensive damage assessment process that complies with NFIP, Hazard Mitigation Assistance, and building code requirements				X	X	
3.2: Upgrade Crisis Track to incorporate floodplain information and substantial damage forms				X		
3.3: Develop guidance and training related to implementing this comprehensive damage assessment process						
<b>C. Improve Risk Identification and Risk Communication</b>						
<b>1: Create a statewide floodplain mapping program</b>				X	X	X
1.1: Secure new mapping models to update A Zones				X	X	X
1.2: Secure new mapping models to update AE Zones and delineate floodways where not available				X	X	X
1.3: Model flood risks beyond the one percent annual change flood that is mapped by FEMA				X	X	X
<b>2: Create a clearinghouse of flood-related information and inundation mapping in VA</b>	X	X		X	X	X
2.1: Integrate a variety of datasets into VFRIS to provide a comprehensive analysis of risk				X		
2.2: Include all flood protection projects implemented by federal agencies				X		X
2.3: Obtain or create first floor elevations for all structures				X	X	
2.4: Identify and compile maps and other relevant information regarding historic flood damage				X		
2.5: Identify all rain gauges, stream gauges, forecast points, etc. to improve Virginia's statewide network to track flood risk in real-time	X	X		X	X	X
2.6: Use this clearinghouse to prioritize mitigation opportunities				X		
2.7: Ensure updated CBRS maps are incorporated into Virginia's mapping program and future changes reflect the Commonwealth's interest				X		X

Floodplain Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
<b>3: Acquire mobile LiDAR along roadways across the Commonwealth</b>	X			X	X	
3.1: Use data to develop flood models for roadways and travel routes				X	X	
3.2: Use new flood models to create/update evacuation routes	X	X		X	X	
3.3: Use new flood models to steer maintenance and future development plans for roadways	X	X		X		
3.4: Use new flood models to update local community development plans, statewide development plans, hazard mitigation plans, etc.	X	X		X		
<b>D. Encourage Broader Coverage of Flood Insurance</b>						
<b>1: Identify and implement strategies to increase flood insurance coverage</b>				X	X	X
1.1: Promote flood insurance and encourage all Virginians to purchase flood insurance.				X	X	X
<b>2: Evaluate the adherence to the requirements in Va. Code by the Commissioner of Insurance with a report to the Commonwealth's Chief Resiliency Officer</b>	X			X	X	
2.1: Va. Code requires that insurers statements related to flood coverage	X			X	X	
<b>3: Establish a long-term, multi-agency effort to increase outreach and public awareness related to flood insurance</b>	X			X	X	
3.1: Declare flood awareness days, weeks, and/or months	X				X	
3.2: Develop targeted outreach materials, training, and activities to coordinate awareness weeks, hurricane season, etc.				X	X	
<b>4: Evaluate and implement options to increase access to private flood insurance</b>	X	X	X	X	X	X
4.1: May include incentives for insurance agents, removing legal barriers, etc.		X	X	X		X
4.2: Work with the SCC to identify companies selling private flood insurance				X		

Floodplain Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
<b>5: Evaluate the cost of flood insurance and identify policies to increase affordability of NFIP and private flood coverage</b>	X	X		X	X	X
5.1: Any policies should address the ability of low income households to bear any additional costs and should consider a “means test” to determine priorities	X	X		X	X	X
<b>E. Improve Education and Training Programs</b>						
<b>1: Develop a training curriculum for floodplain management regulations, floodplain mapping, NFIP compliance, etc. for state and local agencies</b>	X	X	X	X	X	
1.1: Require all localities have a designated floodplain administrator and require 6 hours of training each year			X	X		
1.2: Make training available to other local officials				X		
1.3: Partner with all appropriate state agencies to coordinate and implement these trainings						
1.4: Require state agencies that maintain and build facilities to attend at least one training per year	X	X		X		
<b>2: Develop a training curriculum for the private sector</b>				X	X	
2.1: Where appropriate, incorporate this training into continuing education requirements for professional certificates and licenses administered				X		
2.2: Evaluate existing continuing education requirements for insurance agents				X		
<b>3: Incorporate information on flood insurance coverage into homebuyer training provided by the Virginia Housing Development Authority</b>				X		
3.1: Where feasible, encourage other organizations to incorporate flood insurance information into their trainings						
<b>4: Identify and promote existing programs and research topics at community colleges and state universities</b>				X		
4.1: Encourage community colleges and state universities to partner with localities				X		

Floodplain Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
<b>5: Identify opportunities to incorporate flood-related information and programs into Virginia Public Schools</b>	X			X		
5.1: Partner with Virginia Public Schools to spread flood awareness through activities as education days				X		
<b>F. Review Existing and Potential Funding Sources for Pre-disaster Hazard Mitigation</b>						
<b>1: Determine the ability of existing Dam Safety and Flood Prevention and Protection Assistance Fund address this issue</b>	X					
<b>2: Review all existing funding sources administered by state agencies to determine eligibility for funding flood risk reduction projects</b>	X					
<b>3: Determine DCR's role in administering a portion of FEMA's Pre-Disaster Mitigation funds related to flooding that are currently under the purview of VDEM</b>	X					
<b>4: Determine DCR's role in administering FEMA's Flood Mitigation Assistance funds that are currently under the purview of VDEM</b>	X					
<b>5: Determine DCR's role in administered a portion of post-disaster funds related to flooding, such as Hazard Mitigation Grant Programs or Community Development Block Grant Disaster Recovery funds</b>	X					
<b>6: Determine DCR's role in administering Coastal Zone Management funds currently under the purview of DEQ</b>	X					
<b>7: Develop a fund to cover the costs of surveying or engineering work for low income residents to obtain elevation certificates, determine BFEs, or similar work</b>	X	X	X	X	X	
7.1: Determine the feasibility of other options, such as vouchers or subsidies	X	X	X	X	X	
<b>8: An evaluation of feasibility of using taxes to fund flood risk reduction projects</b>	X					
<b>9: Support existing or future federal initiatives that provide funding for pre-disaster mitigation</b>	X					X



Floodplain Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
9.1: Encourage Congress to increase the total amount for Increased Cost of Compliance funds	X					X
<b>G. Encourage Flood Risk Reduction Efforts that Protect and Conserve the Natural Functions of Floodplains.</b>						
<b>1: Encourage the use of conservation easements for flood risk reduction and promote the Land Preservation Tax Credit's eligibility</b>	X			X		
1.1: Conservation Easements that protect floodplains are currently eligible for Land Preservation Tax Credits	X			X		
1.2: Evaluate the criteria for Watershed Protection easements	X			X		
<b>2: Allow localities to use Transfer of Development Rights to protect floodplains</b>	X		X			
<b>3: Prioritize mitigation projects that conserve floodplains</b>	X			X		X

## **APPENDIX B: FLOOD ZONE EXPLANATIONS**

The NFIP defines Special Flood Hazard Area as *the land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year. The area may be designated as Zone A on the FHBM. After detailed ratemaking has been completed in preparation for publication of the flood insurance rate map, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, or V1-30, VE, or V.* (44 CFR 59.1)

Below is a description of each flood zone, as defined in the April 2019 NFIP Flood Insurance Manual.

### **Special Flood Hazard Areas (High Risk Hazard Areas)**

#### **Zone A**

Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown on the map. Mandatory flood insurance purchase requirements and floodplain management standards apply.

#### **Zones A1–A30**

Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. The maps show the BFEs. Mandatory flood insurance purchase requirements and floodplain management standards apply.

*Note: Virginia does not have any A1-A30 Zones on currently effective FIRMs; they have been replaced with AE Zones.*

#### **Zone AE**

Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. The maps show the BFEs. Mandatory flood insurance purchase requirements and floodplain management standards apply. Some maps use AE in place of A1-A30.

#### **Zone AH**

Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. In this zone the maps show BFEs derived from detailed hydraulic analyses. Mandatory flood insurance purchase requirements and floodplain management standards apply.

#### **Zone AO**

Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Maps show the average flood depths derived from detailed hydraulic analyses in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.

### **Zone A99**

The A99 zone applies to areas with sufficient progress on the construction or repair of a protective system including features such as dikes, dams, and levees, to consider it complete for insurance rating purposes. The map does not have BFEs. Treat A99 Zones as non-SFHAs when determining Community Rating System (CRS) premium discounts. Mandatory flood insurance purchase requirements and floodplain management standards apply.

### **Zone AR**

The AR zone reflects the decertification of a previously accredited flood protection system that the community is in the process of restoring to provide base flood protection. Treat all AR Zones as non-SFHAs to determine CRS premium discounts. Mandatory flood insurance purchase requirements and floodplain management standards apply.

### **Zones AR/AE, AR/AH, AR/AO, AR/A1–A30, AR/A**

These are dual flood zones subject to flooding from other water sources that the restored flood protection system does not contain. Treat all AR Zones as non-SFHAs when determining CRS premium discounts and determining mandatory purchase requirements.

### **Zone V**

The V zones are areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm induced waves. The map does not have BFEs or flood depths because detailed hydraulic analyses were not performed. Mandatory flood insurance purchase requirements and floodplain management standards apply.

### **Zones V1–V30**

Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. The maps show BFEs derived from detailed hydraulic analyses. Mandatory flood insurance purchase requirements and floodplain management standards apply.

*Note: Virginia does not have any V1-V30 Zones on currently effective FIRMs; they have been replaced with VE Zones.*

### **Zone VE**

Used in place of V1-V30 on some maps. Zone VE areas are subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. The maps show BFEs derived from detailed hydraulic analyses. Mandatory flood insurance purchase requirements and floodplain management standards apply.

## **Moderate or Minimal Hazard Areas**

### **Zones B, C, and X**

B, C, and X zones designate areas of moderate or minimal flooding hazard resulting from severe storm activity or local drainage problems. Zone X equals the designation for B and C zones on some maps.

*Note: Virginia does not have any B or C Zones on currently effective FIRMs; they have been replaced by X Zones. There are two different types of Zone X: shaded and unshaded. The shaded Zone X designates areas of moderate flood hazard subject to the 0.2% annual chance flood (also known as the 500 year flood). Unshaded X Zones designates areas of minimal flood hazard outside of the 0.2% annual chance flood.*

### **Zone D**

The D zone reflects an area where the flood hazard is undetermined and where there is sparse population. Agents may use Zone D for rating when a community incorporates portions of another community's area where no map has been prepared. Agents also use Zone D if the map shows an area as being unmapped.

**APPENDIX C: NON-PARTICIPATING NFIP COMMUNITIES IN VIRGINIA**

<b>Virginia Communities Not Participating in the National Flood Insurance Program as of June 2019</b>			
<b>Community ID</b>	<b>Community Name</b>	<b>SFHA</b>	<b>Comments</b>
510066	Galax, City of	Yes	Withdrawn from the NFIP
510092	Louisa County	Yes	Suspended from the NFIP
510208	Bowling Green, Town of	No	
510202	Brodnax, Town of	No	
510381	Capron, Town of	No	
510178	Cheriton, Town of	Yes	In process of joining NFIP
510045	Clintwood, Town of	Yes	
510300	Dendron, Town of	Yes	Suspended from the NFIP
510271	Floyd, Town of	No	
510268	Gordonsville, Town of	Yes	In process of joining NFIP
510331	Gretna, Town of	Yes	
510316	Hillsboro, Town of	Yes	
510277	Keller, Town of	Yes	
510171	Kenbridge, Town of	No	
510270	Keysville, Town of	No	
510165	La Crosse, Town of	Yes	
510378	Louisa, Town of	No	
510031	Madison, Town of	No	
510012	Melfa, Town of	Yes	
510377	Mineral, Town of	No	
510116	Montross, Town of	Yes	
510258	Newsoms, Town of	Yes	
510326	Nickelsville, Town of	No	
510285	Painter, Town of	Yes	
510299	Scottsburg, Town of	Yes	

<b>Virginia Communities Not Participating in the National Flood Insurance Program as of June 2019</b>			
<b>Community ID</b>	<b>Community Name</b>	<b>SFHA</b>	<b>Comments</b>
510008	South Hill, Town of	Yes	
510376	Surry, Town of	No	
510244	The Plains, Town of	Yes	
510051	Troutdale, Town of	Yes	
510278	Victoria, Town of	No	
510195	Virgilina, Town of	No	
510115	Warsaw, Town of	No	
510097	Waverly, Town of	Yes	

**APPENDIX D: CRS COMMUNITIES IN VIRGINIA**

<b>Community Rating System Communities in Virginia, with Policies and Savings, Effective May 1, 2019*</b>									
<b>Community ID</b>	<b>Community Name</b>	<b>Current Class</b>	<b>% Discount for SFHA</b>	<b>% Discount for non-SFHA</b>	<b>Total NFIP Policies</b>	<b>Total Premium</b>	<b>Average Premium</b>	<b>Savings per Community</b>	<b>Savings per policy</b>
510001	Accomack County	6	20	10	1,347	\$925,054	\$687	\$200,683	\$149
515519	Alexandria, City of	6	20	10	1,608	\$1,347,137	\$838	\$245,825	\$153
515520	Arlington County	8	10	5	1,022	\$389,978	\$382	\$17,706	\$17
510075	Ashland, Town of	9	5	5	52	\$44,400	\$854	\$1,978	\$38
510134	Bridgewater, Town of	8	10	5	54	\$81,170	\$1,503	\$8,233	\$152
510106	Cape Charles, Town of	8	10	5	195	\$86,530	\$444	\$839	\$4
510034	Chesapeake, City of	8	10	5	9,086	\$5,503,432	\$606	\$426,073	\$47
510002	Chincoteague, City of	8	10	5	1,781	\$1,347,910	\$757	\$141,147	\$79
515525	Fairfax County	6	20	10	6,881	\$3,530,844	\$513	\$476,192	\$69
510054	Falls Church, City of	6	20	10	173	\$191,754	\$1,108	\$38,274	\$221
510071	Gloucester County	6	20	10	1,539	\$1,266,259	\$823	\$271,936	\$177
515527	Hampton, City of	7	15	5	10,530	\$9,094,281	\$864	\$1,286,155	\$122
510201	James City County	7	15	5	1,023	\$629,404	\$615	\$63,193	\$62
510104	Norfolk, City of	7	15	5	12,383	\$9,118,547	\$736	\$1,207,988	\$98

**Community Rating System Communities in Virginia, with Policies and Savings, Effective May 1, 2019\***

<b>Community ID</b>	<b>Community Name</b>	<b>Current Class</b>	<b>% Discount for SFHA</b>	<b>% Discount for non-SFHA</b>	<b>Total NFIP Policies</b>	<b>Total Premium</b>	<b>Average Premium</b>	<b>Savings per Community</b>	<b>Savings per policy</b>	
510183	Poquoson, City of	8	10	5	3,200	\$2,822,590	\$882	\$291,523	\$91	
515529	Portsmouth, City of	7	15	5	4,097	\$3,025,097	\$738	\$392,766	\$96	
510119	Prince William County	8	10	5	1,357	\$856,369	\$631	\$48,551	\$36	
510129	Richmond, City of	8	10	5	616	\$685,813	\$1,113	\$55,660	\$90	
510130	Roanoke, City of	7	15	5	539	\$1,189,713	\$2,207	\$191,625	\$356	
510190	Roanoke County	8	10	5	422	\$451,971	\$1,071	\$40,723	\$97	
510154	Stafford County	7	15	5	710	\$432,579	\$609	\$38,338	\$54	
510053	Vienna, Town of	8	10	5	126	\$74,654	\$592	\$3,639	\$29	
510131	Vinton, Town of	8	10	5	33	\$62,649	\$1,898	\$6,465	\$196	
515531	Virginia Beach, City of	7	15	5	24,628	\$13,721,604	\$557	\$1,138,847	\$46	
510005	Wachapreague, Town of	8	10	5	79	\$48,808	\$618	\$3,706	\$47	
510182	York County	7	15	5	3,189	\$2,170,202	\$681	\$259,757	\$81	
					<b>Totals</b>	<b>86,670</b>	<b>\$59,098,749</b>	<b>\$22,327</b>	<b>\$6,857,822</b>	<b>\$2,607</b>

*\*Based on May 2019 data from FEMA and ISO.*



**APPENDIX E: NFIP POLICY INFORMATION**

<b>NFIP Policy Coverage and Losses in Virginia<sup>†</sup></b>					
<b>Total Policy Count</b>		<b>Total Coverage (in Thousands)</b>		<b>Total Losses*</b>	
<b>Total Dollars Paid*</b>					
107,788		\$28,766,558		48,935	
\$735,118,470					
<b>Repetitive Loss Properties in Virginia<sup>‡</sup></b>					
<b>Total Losses</b>	<b>Properties</b>	<b>Total Building Payments</b>	<b>Total Contents Payments</b>	<b>Total Payments</b>	<b>Average Payments</b>
18,960	6,720	\$349,928,854.79	\$61,629,471.61	\$411,558,326.40	\$140,055,930.07

Data Source: FEMA; current as of March 31, 2019.

<sup>†</sup>Losses and payments include NFIP claims from 1976 through March 31, 2019.

<sup>‡</sup>FEMA defines a Repetitive Loss Property as an NFIP-insured structure that has had at least 2 paid flood losses of more than \$1,000 each in any 10-year period since 1978.<sup>8</sup>

<sup>8</sup> <https://www.fema.gov/national-flood-insurance-program/definitions#R>

**APPENDIX F: DAM SAFETY RECOMMENDATION ACTION TABLE**

Dam Safety Recommendation	Action Needed					
	Executive	Legislative <i>State Authorities</i>	Legislative <i>Local Authorities</i>	Operational	Budgetary	Federal
<b>A. Building Stronger State Government Capabilities</b>						
1. Establish a permanent budget and additional staff resources for DSIS	X	X		X	X	
2. Provide additional resources for dam safety regional engineers	X	X		X	X	
<b>B. Engage and Assist Dam Owners and Local Communities</b>						
1. Establish baseline funding for dam repair or removal of \$20M	X	X		X	X	
2. Collaborate with localities and USACE to perform specified work on all potentially high or significant hazard dams	X	X		X	X	X
3. Amend Va. Code related to downstream development	X	X	X	X	X	
4. Require approval by DCR before ownership of a dam is transferred	X	X	X	X	X	
<b>C. Improve Education and Training Programs</b>						
1. Improve and increase education and training				X	X	