

THE CLASS OF 1964 POLICY RESEARCH SHOP  
**VERMONT FLOOD RESILIENCE**

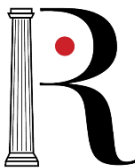


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ECONOMIC DEVELOPMENT, HOUSING, & GENERAL AFFAIRS

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## EXECUTIVE SUMMARY

As climate change transforms global weather patterns, extreme weather events, especially flooding, will increase in severity. Following the July 2023 flooding event, Vermont suffered catastrophic physical, monetary, and social losses. The state had previously implemented some flood resilience measures following Hurricane Irene in 2011, but Vermont state and local governments could not keep up with the inundation.

This report examines flood resilience and mitigation strategies, giving the Vermont Senate Committee on Economic Development, Housing, and General Affairs policy options based on five case study analyses and eighteen expert interviews with Vermont stakeholders. Case studies focus on several flood resilience strategies: urban infrastructure and development, flood control districts, riparian buffer restoration, property buyouts, and housing policies. Interviews were conducted with key Vermont stakeholders, including federal officials, state officials, nonprofit leaders, and farmers.

The New Orleans Gentilly Resilience District provided insight into traditional and innovative infrastructure strategies that reduce flood risk within an urban environment. It also emphasized the importance of community feedback and resilience building to integrate infrastructure projects into neighborhoods. The King County Flood Control District functions as a regional governing body that manages flood infrastructure projects, property buyouts, grant provision, and a flood warning system for King County, Washington, demonstrating how a singular body for flood recovery can improve response times and reduce future flood risk. The Pennsylvania Riparian Buffer Initiative exemplifies a state-led collaborative program, leveraging federal and state resources to achieve “nature-based solutions” through an innovative funding mechanism. The Initiative also provided a window into the challenges of tracking riparian buffer creation, particularly the tracking of buffer plantings and the yearly variability of state budget allocation. The Blue Acres Buyout program in New Jersey is a state-run property flood buyout program, purchasing already destroyed-or damaged homes and properties at risk of severe flood damage. To do so, Blue Acres reduces procedural hurdles, has dedicated buyout teams with institutionalized knowledge, and utilizes consistent non-federal funding. An examination of current flood-related housing policies in Vermont yielded insight into issues with flood disclosure regulations and river corridor zoning.

Expert interviews yielded four common themes of flood resilience and mitigation policy for further consideration: grant provision, capacity issues, the need for higher-level organization, and forms of community support. Experts identified several challenges with the grant provision mechanism, including a lack of knowledge of available grants, long wait times for distribution, and difficulty in the application process. They also highlighted the capacity issues that arise from a lack of town resources, overburdened and undertrained municipal employees, and gaps in project management personnel. The need for higher level organization at either the regional, state, or watershed level to standardize and streamline flood response was emphasized by many experts. According to experts, building programs to increase community support for mental health provision, grant application assistance, and technology access would likely bolster community resilience.

Based on the findings from these research components, this report identifies strategies that incorporate short-term, intermediate-term, and long-term solutions to balance financial and resource constraints.

# 1 INTRODUCTION

River valley flooding has impacted humanity for centuries.<sup>1</sup> In 2022, 57.5 million people were affected by flooding events worldwide.<sup>2</sup> As climate change alters the global landscape, its effects on flooding and precipitation patterns will affect more of the world population.<sup>3</sup> Projections indicate that as global temperatures rise, the frequency and severity of extreme precipitation events will increase.<sup>4</sup> As a result, models predict that more areas will flood, exposing an additional 20-24 percent of the global population to flooding, with even more areas impacted in the future.<sup>5</sup>

Natural disasters, especially flooding, resulted in \$2.97 trillion in global economic losses from 2000 to 2019, and it is expected that worsening flood events will lead to increases in cost.<sup>6</sup> In the United States, the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP) oversee flood rebuilding and restoration efforts, including funding.<sup>7</sup> Flooding has additional social costs that monetary inputs do not address. Differences in zoning laws, the distribution of racial/ethnic groups, and socioeconomic status lead to inequities in the effects of flooding on communities.<sup>8</sup> Areas of low socioeconomic status are more likely to be vulnerable to flooding and struggle with recovery in the aftermath of floods.<sup>9</sup>

As flooding damage worsens, flood management has become increasingly important for states and localities. When implementing flood management strategies, communities need to consider the solution's fit, which is determined by several factors: receptivity, ease of participation, design, and the interactions between factors.<sup>10</sup> However, federal, state, and local governments struggle to assume responsibility for implementation, so both top-down and bottom-up approaches are common.<sup>11</sup> There has been no consensus on the best approaches, which has exacerbated the diffusion of management responsibility. Some researchers suggest a balance between resistance (flood prevention) and resilience (minimizing impacts and improving recovery) while others believe in implementing one over the other.<sup>12</sup> As a result, there is debate about whether or not gray infrastructure usage (dams, levees, etc.) or green/blue infrastructure (green spaces, rain gardens, etc.) are the most effective.<sup>13</sup> Recently, emphasis has been placed on sustainable flood management, bringing nature-based solutions to the forefront of flood mitigation research.<sup>14</sup>

## 2 PROBLEM STATEMENT

Recent flooding events have caused severe damage throughout the state of Vermont, including Hurricane Irene in 2011 and the heavy rainfall of mid-July 2023. These events cost Vermonters hundreds of millions of dollars' worth of property damage and resulted in several deaths. In coming decades, flooding severity and frequency are expected to increase as the impacts of climate change become more pronounced, placing greater pressure on Vermonters who live and work in flood-prone areas. Some flood resilience policies have been enacted in Vermont, but their performance has been

at best mixed. To prevent continuing cycles of destruction, more work is needed to reduce future flood risk for Vermont residents and businesses.

A wide range of potential policies have been developed and implemented across the world, with various interpretations of flood management including resistance (the ability to prevent damaging events) and resilience (the ability to rapidly recover from damage that occurs). The unique physical environment of Vermont makes some policies more effective than others. Additionally, funding will need to be secured for the development of these projects, which may come from municipal, state, federal, or private nonprofit sources. Minimizing costs will be an important factor due to the statewide scale of flood risk mitigation. This report aims to provide a framework for legislators to choose the most appropriate policies to improve Vermont flood resilience and mitigate future damages.

## 3 BACKGROUND INFORMATION

This section explores current federal and Vermont flood management policies and programs, the historical significance of flooding in Vermont, and the funding structures in place for resilience programs.

### 3.1 Federal Laws and Programs

The Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP) define the federal policy landscape surrounding flood resilience policies and programs.

#### 3.1.1 Federal Emergency Management Agency

The Federal Emergency Management Agency was established in 1979 by President Carter with the dual goals of emergency management and civil defense.<sup>15</sup> Modern procedures for disaster response and recovery were established by the Robert T. Stafford Disaster Relief and Emergency Assistance Act.<sup>16</sup> In the event of a natural disaster, particularly floods, FEMA's primary role is to evaluate the extent of the damage and allocate funding to businesses and homeowners in the form of loans to aid in recovery.<sup>17</sup> FEMA also helps state and local governments implement flood resilience and mitigation measures.<sup>18,19</sup> Risk is determined by the National Flood Insurance Program, a branch of FEMA.<sup>20</sup>

#### 3.1.2 National Flood Insurance Program

The passage of the National Flood Insurance Act of 1968 created the National Flood Insurance Program to fill the gap in private insurance for flood damage and increase federal disaster assistance.<sup>21</sup> In 1979, the NFIP was incorporated into FEMA.<sup>22</sup> The NFIP takes a three-pronged approach to management: flood insurance, floodplain development regulations, and floodplain maps.<sup>23</sup>

The NFIP creates Flood Insurance Rate Maps to determine the level of risk within communities.<sup>24</sup> These maps visualize Special Flood Hazard Areas (SFHAs), which are areas in which there is a one percent chance of flooding occurring annually.<sup>25</sup> However, many of these maps are based on inaccurate data that does not factor in climate change's effects on flood patterns, resulting in

communities that have little FEMA support as they try to prevent flooding or recover from it.<sup>26</sup> There are current efforts to create new, more accurate maps.<sup>27</sup>

The NFIP has both voluntary and mandatory components. Communities can voluntarily opt into the NFIP, making insurance available for everyone in the community.<sup>28</sup> Since 1973, the NFIP has mandated that those living in SFHAs own flood insurance.<sup>29</sup> Flood insurance is only mandatory if the individual living on that property has a loan or mortgage on the structure, but is available for renters within these communities.<sup>30</sup> In 2014, the NFIP reverted to previous rate levels, repealing rate increases (instated to be risk reflective instead of artificially lowered) while instituting annual surcharges.<sup>31,32</sup> In recent years, there has been some backlash surrounding the high cost of insurance premiums.<sup>33</sup>

Communities that join the NFIP must adopt minimum development regulations for locations within SFHAs.<sup>34</sup> Standards aim to reduce flooding damage to new structures and improve existing structures within the floodplain.<sup>35</sup> These regulations are detailed in Title 44 of the Code of Federal Regulations.<sup>36</sup> Regulations do not address a wide variety of flooding impacts, including public safety, social costs, water quality, etc.<sup>37</sup> As a result, the NFIP emphasizes the importance of adopting higher standards to improve community resilience.<sup>38</sup> To incentivize these higher standards, the NFIP Community Rating System discounts the cost of insurance for those who embrace these higher standards.<sup>39</sup>

## 3.2 Vermont Policy Landscape

Alongside federal responses, certain state agencies and departments—primarily, the Vermont Agency of Natural Resources (ANR) and the Department of Environmental Conservation (DEC)—collaborate to implement programs from state law regarding flood resilience policies and programs.

### 3.2.1 Agency of Natural Resources

The Vermont Agency of Natural Resources plays a central role in overseeing flood resilience efforts. Their publicly accessible website (<https://anr.vermont.gov/>) details flood recovery resources, especially pertinent in the wake of the devastating July 2023 floods.<sup>40</sup> These resources include flood resource contacts—emergency contacts and non-emergency contacts to report landslides, erosion threatening homeowners' property, flood damage, and managing flood debris—as well as routes to apply for flood recovery funding through FEMA.<sup>41</sup> In crises, the ANR coordinates with the Department of Public Safety's Division of Emergency Management and Homeland Security on flood disaster response and recovery activities.<sup>42</sup>

The River Management Program is responsible for managing Vermont's rivers and supporting community-based floodplain management initiatives. The program works to develop and implement regulations and guidelines related to river corridor protection and floodplain development. The Land Use and Development Law (i.e. Act 250) for example, passed in spring 1970, created nine district commissions to oversee eco-sustainable development by issuing permits that attach conditions to land-use permits.<sup>43</sup> Criteria include that applicants' development plans allow for unrestricted flow of

waterways, (when along shorelines) stabilize riverbanks from erosion as necessary with vegetation cover, and don't impede on existing river corridors or wetlands.<sup>44</sup>

### 3.2.2 Department of Environmental Conservation

A subdivision of the ANR, the DEC more directly focuses on state flood resilience and risk management efforts. The DEC's Watershed Management Division is responsible for protecting, maintaining, enhancing, and restoring Vermont's river and stream ecosystem services.<sup>45</sup> Vermont's approach to flood resilience places a significant emphasis on the protection of river corridors and floodplains, as through the department's Vermont Rivers Programs.<sup>46</sup> River corridors, in particular, are designated areas that encompass the river channel and adjacent floodplains. Corridor planning safeguards river ecosystems and reduces flood risks, emphasizing the importance of natural buffers and sustainable land use practices.<sup>47</sup> The state has developed guidelines and regulations for river corridor protection to minimize development in these areas, thereby reducing the risk of flood damage to properties and infrastructure.<sup>48</sup> These regulations are informed by floodplain mapping like that of the NFIP's Flood Insurance Rate Mapping to identify hazard areas.<sup>49</sup>

The DEC encourages communities to adopt zoning and land use regulations that restrict development in these high-risk floodplain areas (per guidance of Act 250).<sup>50</sup> The state provides support and technical assistance to municipalities in developing and implementing these regulations, helping them balance economic development with flood risk reduction.<sup>51</sup> These efforts align with those of FEMA's National Flood Insurance Program, enhancing communities' eligibility for NFIP benefits and support the state's overall resilience objectives.<sup>52</sup> Ultimately, though, the DEC faces many limitations in implementing flood resilience efforts in great part due to resource constraints—limited funding and staff, as well as heavy dependence on volunteers in communities to implement extensive projects and programs.<sup>53</sup>

## 3.3 History of Flooding in Vermont

Large floods have been documented in Vermont as early as the 18<sup>th</sup> century.<sup>54</sup> Major floods in 1927 prompted the first major flood risk mitigation efforts, specifically the construction of three flood-control dams in the Winooski valley funded through the New Deal's Civilian Conservation Corps.<sup>55</sup> Other major flooding events occurred in 1938 and 1973, both of which caused several fatalities and cost hundreds of millions in today's dollars.<sup>56</sup>

Prior to the 2023 floods, the worst flooding in Vermont during the 21st century occurred in 2011 when Hurricane Irene (by then downgraded to tropical storm status) impacted the state. The storm flooded 20,000 acres of farmland, washed away 500 miles of roadway, destroyed or damaged 3,500 homes, and killed three. Total damage was estimated at \$700 million.<sup>57</sup> After Irene, the Vermont Agency of Commerce and Municipal Development published a 728-page report called the Vermont Economic Resiliency Initiative (VERI), which detailed flood resiliency plans for five towns hit



especially hard by the flooding. The goal of VERI was to create a template which other towns could emulate, improving flood resilience across the state. Elements of the report's recommendations included the elimination of hard berms along rivers to restore natural floodplains, the construction of large culverts to channel floodwaters away from centers, and the installation of "trash racks" to catch debris that would otherwise clog culverts during flooding.<sup>58</sup>

The flooding during July 10-11, 2023, brought new challenges to Vermont. Four to eight inches of rain fell across much of the Green Mountains, with the greatest portion of the damage occurring in central communities, such as Montpelier and Barre, though other areas, such as Rutland, also experienced significant damage.<sup>59</sup> Two people were killed, and damage estimates to public infrastructure are still being tallied but have already exceeded \$100 million.<sup>60</sup> Private damage will bring this total significantly higher.

Some of VERI's projects had already been implemented at the time of the 2023 summer flooding, with mixed success: Brandon's flood water culvert saved the town from significant damage while Barre's trash racks performed as intended but failed to stop flooding due to overwhelming amounts of water. While these town-level projects have demonstrated promise, they do not alter the fact that Vermont's river-valley centered development inherently places its towns and cities at heightened risk of flooding disaster. Their slow and piecemeal implementation also demonstrates a need for simplified FEMA funding applications for small communities, which may not have adequate resources to locally match federal funds or even conduct cost-benefit analyses necessary to receive funding.<sup>61</sup>

### 3.4 Pre-existing Federal and State Funding Sources

Federal funds provide most of the monetary support for major disaster recovery in the form of loans and grants.<sup>62</sup> Federal funding differs in type from individual homeowners and business assistance to funding for state initiatives. For individuals who lack flood insurance or whose insurance does not cover all the expenses, the Individuals and Households Program (IHP) provides financial and direct services to meet basic needs, such as temporary housing funding or hazard mitigation assistance.<sup>63</sup> The Small Business Administration (SBA) provides many disaster assistance loans, (physical damage loans, mitigation assistance, economic injury disaster loans, and military reservist loans) protecting losses not covered by private insurance or FEMA.<sup>64</sup> The United States Department of Agriculture offers a series of programs and loans (livestock assistance, farm loans, farmland damages, and crop loss) that help farmers and ranchers physically and financially recover from flooding damage.<sup>65</sup> For states in need of funding to recover from flood damage, FEMA and the Department of Housing and Urban Development (HUD) are the primary funders. HUD's Community Development Block Grant (CDBG) program funds recovery efforts following Presidential Disaster Declarations.<sup>66</sup> FEMA has two primary funding mechanisms: the Disaster Relief Fund (DRF) and the Hazard Mitigation Grant Program (HMGP) both of which aid states in recovery following presidentially declared disasters.<sup>67,68</sup> Except for the HMGP, most federal funding focuses on rebuilding/loss recuperation, and not flood

resilience. While there are several smaller grants that focus on flood resilience measures, they are not well known or well-funded.

State government provides some funding for flooding recovery; however, it does not reach the same level of monetary assistance as the federal government.<sup>69</sup> Vermont has several state programs and partnerships with private statewide organizations to provide individuals and businesses with assistance.<sup>70</sup> After a disaster occurs, the Emergency Relief and Assistance Fund provides state funds to supplement insufficient federal funds.<sup>71</sup> The Flood Resilient Communities Fund, funded by the American Rescue Plan Act, allows the state to make up differences between FEMA buyout payments and property value and complete buyouts that fall outside of FEMA.<sup>72</sup> The purpose of the program is to improve landscape and community resilience while reducing the state's future risk to public safety and water quality threats posed by floods.<sup>73</sup> Under the program, the State of Vermont will pay people for their destroyed homes at the “day before the storm” value, or will even pay them to leave their houses with no damage at all.<sup>74</sup> FEMA buyout can only occur in inundation zones, limiting the extent of the program.<sup>75</sup> Further, the Vermont Agency of Transportation has designated funds set aside for town highway repairs following natural disasters.<sup>76</sup> The state also has several other funding opportunities that fluctuate year to year depending on the budget. While the state can appropriate funding to these recovery projects, local governments in Vermont are often small and have relatively little funding, so it can be difficult for them to finance many of these larger projects.<sup>77</sup>

## 4 CASE STUDIES

### 4.1 Methodology

To better understand potential policy options and their applicability, we researched several examples of flood resilience policy within the United States: New Orleans, Louisiana, King County, Washington, Pennsylvania, New Jersey, and Vermont. Our research of these “case studies” emphasized the geographical context, implementation approaches, funding structures, and comparison to existing programs and policies in Vermont. Case study research primarily investigated existing data through detailed analysis of scientific papers, government reports, and popular media. To fill additional gaps in our knowledge, we conducted expert interviews with individuals associated with some of the cases listed above.

Our investigation will be centered on four main questions:

- A) *Placement*: In what area is it located? What is the geography/political landscape? Is this similar to Vermont?
- B) *Method*: What is the flood risk reduction method, and what are its major principles?
- C) *Funding*: How is the method paid for? How much does it cost?
- D) *Feasibility*: Is this method feasible to implement in Vermont, either technically or politically?

## 4.2 Urban/Suburban Flood Resilience Measures: New Orleans

### 4.2.1 Background

New Orleans' population is roughly 384,000, increasing approximately 11.7 percent from 2010 to 2020, following patterns of post-Katrina growth.<sup>78,79</sup> The demographic breakdown of New Orleans makes it particularly vulnerable to the effects of flooding with 23.8 percent of the population living below the poverty line.<sup>80</sup> This risk is further compounded since New Orleans' location makes it geographically predisposed to flooding. It is mostly flat land with elevation situated at or around sea level.<sup>81</sup> Levees built along the nearby Mississippi River and Lake Pontchartrain create a rim around the city, causing water to flow into New Orleans with little to no place for it to escape.<sup>82</sup> Because of its position along the Gulf of Mexico, New Orleans experiences frequent intense hurricanes. In 2005, Hurricane Katrina extensively damaged New Orleans, costing roughly \$100 billion.<sup>83</sup> In 2012, Hurricane Isaac battered the city once again with high storm surge and flooding.<sup>84</sup> Following Isaac, New Orleans began implementing new solutions, seeking to improve flood resilience.

### 4.2.2 Methods

New Orleans approached resilience building from two perspectives: strengthening gray infrastructure and creating green and blue infrastructure.<sup>85</sup> A multifaceted approach allowed New Orleans to fill gaps in resilience planning and lessen risks for vulnerable communities, utilizing all available mitigation practices.<sup>86</sup> Resilience-building efforts were not citywide and instead focused on the Gentilly neighborhood, one of the hardest hit by Hurricane Katrina.<sup>87</sup> The Gentilly Resilience District acts as a case study for future neighborhood resilience projects in New Orleans and throughout the country.<sup>88</sup> Based on input from community engagement meetings, public feedback opportunities, and lessons learned through previously piloted programs, the Gentilly Resilience District creates a comprehensive framework of resilience and mitigation, understanding the challenges flooding poses to the people directly affected within the district.<sup>89</sup> The final plan includes nine infrastructure projects and three additional programs.<sup>90</sup> Projects and programs will be completed and implemented in partnership with the New Orleans Redevelopment Authority (NORA) and the Sewerage & Water Board of New Orleans (SWBNO).<sup>91</sup> Many projects began construction in 2023, so the outcome of each initiative is still unknown.<sup>92</sup>



Figure 1: Map of Gentilly Resilience District  
Source: City of New Orleans: "Gentilly Resilience District Fact Sheet"

#### 1. Blue and green corridors

Six major boulevards and neutral ground will be transformed into blue and green corridors.<sup>93</sup> Blue corridors are a network of canals in wide neutral ground.<sup>94</sup> Green corridors are constructed in smaller

neutral grounds, consisting of trees, other plants, and pervious sidewalks (sidewalks made of material that allows for increased water infiltration compared to regular concrete).<sup>95,96</sup> Boulevards at the most risk of flooding and that had the highest concentration of vulnerable socioeconomic populations were selected for resilience improvements.<sup>97</sup> Corridors will also serve as connections between the other projects in the resilience plan, creating a network of resilience throughout the District.<sup>98</sup> Upon completion, blue and green corridors will greatly reduce the city's flood risk, provide new civic space (corridors will serve as neighborhood parks), improve general neighborhood infrastructure, and enhance social cohesion.<sup>99</sup>

## 2. Dillard Wetlands/Campus

Restoring the Dillard Wetland area, a 27-acre woodland parcel, will increase the area's water storage capacity through increased absorption and infiltration capacity.<sup>100</sup> The project will restore the original forested wetland ecosystem by removing the invasive species and replanting with native species, including oak, willow, and other hardwoods.<sup>101</sup> Following completion Dillard Wetland will be opened to the public as a nature preserve and educational center, increasing public health and creating an outdoor classroom.<sup>102</sup> There will also be green and drainage infrastructure installed around the Dillard University Campus, further increasing neighborhood stormwater storage capacity.<sup>103</sup>

## 3. Mirabeau Water Garden

Twenty-five acres off Mirabeau Ave will be transformed into the Mirabeau Water Garden, turning open flat space into flood management and recreational space.<sup>104</sup> There are four primary goals: divert and store up to 10 million gallons of water in a detention pond, infiltrate water, plant native wetlands to clean polluted water, and educate the public about sustainable water management and local ecology.<sup>105</sup> Construction will occur in two phases: the first is stormwater management infrastructure and the second is the educational and recreational elements.<sup>106</sup>

## 4. St. Anthony Green Streets

Building upon the blue and green corridor construction, the St. Anthony Green Streets project, in the St. Anthony neighborhood, will redesign and retrofit six residential streets and two parks to increase flood resilience.<sup>107</sup> The redesign was split into three phases, creating the opportunity for work to occur simultaneously across the neighborhood.<sup>108</sup> To reduce flood risk, new plans include planting trees alongside roads, increasing the amount of green space, and building bioswales ("linear, vegetated ditches which allow for the collection, conveyance, filtration, and infiltration of stormwater").<sup>109,110</sup> Because of the community-specific nature of the project repeated community outreach meetings were held to gain feedback and adjust plans to address residents' concerns.<sup>111</sup>

## 5. London Avenue Canal - Public Art and Placemaking

A separate project of the St. Anthony Green Streets project is the London Avenue Canal Public Art and Placemaking project. Building community resilience is about more than new infrastructure that reduces flood risk; it also involves fostering a healthy and cohesive community.<sup>112</sup> The London Avenue Canal Public Art and Placemaking project builds on this idea by providing a space for young and local artists to display their work along the London Canal and other Gentilly water features.<sup>113</sup> The goal is to transform the public perception of water, emerging from repeated flooding and destruction of the city particularly following Katrina, from threat to asset.<sup>114</sup>

## 6. Pontilly Neighborhood Stormwater Network

The Pontilly Neighborhood Stormwater Network focuses on the Pontchartrain Park and Gentilly Woods neighborhoods, constructing green infrastructure to reduce flood risk and beautify green spaces.<sup>115</sup> Drainage improvements in the Dwyer Canal, which separates the two neighborhoods, will enhance its stormwater capture capacity. Building green infrastructure – green alleyways, stormwater lots and parks, and bioswales—in vacant lots, streets, and alleyways will expand the stormwater network beyond the Canal, reducing flood risk for both neighborhoods.<sup>116</sup> Following the implementation of green infrastructure, recreation space will be built, improving social cohesion and connectivity between two historically segregated neighborhoods.<sup>117</sup>

#### 7. Milne Campus

Milne Campus is home to many community spaces and under-utilized space.<sup>118</sup> Community spaces will be upgraded to green infrastructure —high-performance play fields with subsurface storage, bioswales, pervious cover, more tree cover, and constructed wetlands—will combine to store an estimated 3.7 million gallons of stormwater.<sup>119</sup> Improvements to the Campus buildings will create new opportunities for youth programming, water education, and economic development.<sup>120</sup>

#### 8. St. Bernard Campus

The St. Bernard Campus project integrates green infrastructure within its recreation improvement plan at McDonogh 35 High School and Willie Hall Playground through three initiatives.<sup>121</sup> First, constructing new athletic fields and a recreation building with underground detention basins capable of holding 5 million gallons of stormwater.<sup>122</sup> The second integrates rain gardens into the St. Bernard drainage system in conjunction with road repairs that improve drainage infrastructure.<sup>123</sup> The third opens access to Bayou St. John as a recreation space.<sup>124</sup>

#### 9. Oak Park

The Oak Park project transformed five vacant lots on Perlita Street into a stormwater management area by building bioswales that collect stormwater into an underground tank.<sup>125</sup> The tank then slowly releases stormwater through a weir, reducing the flooding risk for 209 nearby homes.<sup>126</sup>

#### 10. Community Adaptation Program

The Community Adaptation Program (CAP) is facilitated by NORA, helping private property owners improve flood resilience on their property.<sup>127</sup> To qualify for CAP assistance, homeowners must earn under 80 percent of the area median income and must maintain their resilience improvements for a five-year minimum.<sup>128</sup> If a homeowner qualifies, they are eligible for a \$10,000 to \$25,000 grant for improvements.<sup>129</sup> CAP interventions include impermeable surface demolition, installation of permeable pavements, tree planting, installing planter boxes, rain gardens, rain barrels, or French drains, reaching approximately 200 properties.<sup>130</sup>

#### 11. Reliable Energy and Smart Systems

The Reliable Energy and Smart Systems initiative focuses districtwide on improving energy infrastructure, making it more resilient in times of disaster.<sup>131</sup> To provide backup electricity to critical facilities, microgrids are being constructed.<sup>132</sup> Energy redundancy measures are being implemented at critical water infrastructure sites to ensure a water supply for residents during disasters.<sup>133</sup> A groundwater monitoring system is also being installed and operated to see water saturation levels throughout the District.<sup>134</sup>

#### 12. Workforce Development

Following natural disasters, unemployment is a significant problem in NOLA. The Workforce Development initiative aims to combat unemployment by training individuals to construct water and green infrastructure projects.<sup>135</sup> It will also equip these unemployed individuals with the skills needed to work in this field beyond the scope of the project they are assigned.<sup>136</sup>

### 4.2.3 Funding

New Orleans received various funding sources to complete the Gentilly Resilience District projects. The two largest funding sources were the National Disaster Resilience Competition (The Department of Housing and Urban Development) and the Hazard Mitigation Grant Program (FEMA).<sup>137</sup>

Following Hurricane Isaac (2012), New Orleans received a Presidential Disaster Declaration, making it eligible for the 2014 National Disaster Resilience Competition.<sup>138</sup> The Competition provided \$1 billion to states, counties, and parishes that experienced a presidential disaster in 2011, 2012, or 2013.<sup>139</sup> New Orleans received \$141.2 million from the National Disaster Resilience Competition.<sup>140</sup>

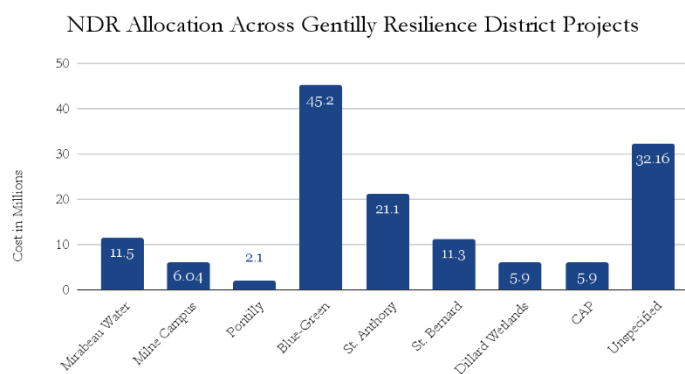


Figure 2: Allocation of National Disaster Resilience Funds by Project in Millions of Dollars

Source: City of New Orleans Stormwater Management

New Orleans was granted additional funding from FEMA’s Hazard Mitigation Grant Program (HMGP) following Hurricane Isaac. Like CDBG funds, HMGP funds are only available after presidential declared disasters.<sup>141</sup> Isaac’s Presidential Disaster Declaration was critical to accessing HMGP funding. HMGP funds help state and local governments “develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities.”<sup>142</sup> New Orleans received \$113.7 million in HMGP funding, but most of the projects fell outside of the Gentilly Resilience District<sup>143</sup> and \$31.7 million was allocated to projects in the District, and most of that money supplemented NDR funding.<sup>144</sup>

### 4.2.4 Vermont Feasibility

#### Monetary

The Vermont July flooding event received a Presidential Disaster Declaration, so it is potentially eligible to receive both CDBG and HMGP funding.<sup>145</sup> While it is likely Vermont will receive HMGP funding, it is unlikely funds will be coming to the state from CDBG. CDBG funding requires an act of Congress to set aside money in the Department of Housing and Urban Development’s budget for specific disasters.<sup>146</sup> Most CDBG funds come from CDBG—Disaster Recovery, not National Disaster Resilience.<sup>147</sup> The National Disaster Resilience Competition was a one-time allocation of funds that has not been replicated since.<sup>148</sup> Recent appropriations (2021) have included provisions for Mitigation Set-Aside Funds, which have allocated specific funds for mitigation efforts.<sup>149</sup> There does not seem to

be such a provision in the fiscal year 2024 budget. In future years, CDBG money may become available for Vermont, but in the current congressional climate, it seems that is unlikely for 2024.<sup>150</sup> Limited funding will constrain the number of projects Vermont can undertake, and a program of scale like the Gentilly Resilience District would not be possible.

### Methodology

There are several issues with applying the strategies used in the Gentilly Resilience District in Vermont. First, New Orleans and Vermont have vastly different geographies. New Orleans is flat and coastal whereas Vermont is mountainous and river adjacent, making methods of stormwater collection, such as collection tanks in low-lying areas much harder to implement.<sup>151</sup> Vermont is also less densely populated than New Orleans with its largest city having a population of 44,000 instead of the NOLA's 376,000, so pervious pavement and broad green infrastructure projects would be much more costly as the population is far less dense.<sup>152</sup> However, some of the principles of the Gentilly Resilience District are easily transferable to Vermont downtowns, which have more dense populations. Decreasing impervious surfaces and increasing green spaces would reduce the flood risk for Vermont downtowns. Furthermore, some of the broader scale programs like CAP, the Reliable Energy and Smart Systems Initiative, and the Workforce Development Initiative could be facilitated at the state level to improve private properties, critical infrastructure, and economic resilience.

## 4.3 Flood Control Districts: King County, Washington

### 4.3.1 Background

King County, Washington is known for Seattle, but the broader geography of the county includes thousands of square miles of mountainous terrain and several rivers, including the Green River, the Cedar River, the Snoqualmie River, and others.<sup>153</sup> King County covers 2,131 square miles and has a population of roughly 2.3 million.<sup>154,155</sup> In 2007, following the recommendations of the 2006 Hazard Mitigation Plan, King County created the King County Flood Control District, which funds and oversees planning, maintenance, and repairs to the flood control system for flood risk reduction.<sup>156</sup>

### 4.3.2 Methods

The Metropolitan King County Council comprises the Board of Supervisors who run the King County Flood Control District (KCFCD).<sup>157</sup> The Executive Committee, a subset of four members on the Board of Supervisors, is responsible for developing policy recommendations, approving contracts for goods and services up to \$100,000, and overseeing administrative policies and day-to-day business operations.<sup>158</sup> The KCFCD has four primary responsibilities: grant provision, buyout and home elevation, overseeing watershed projects, and maintaining the flood warning system.<sup>159</sup>

KCFCD runs three grant funds and programs: the Subregional Opportunity Fund, Flood Reduction Grants, and Cooperative Watershed Grants.<sup>160</sup> The Subregional Opportunity Fund allocates funds to each of the 40 jurisdictions in the KCFCD to design or implement flood and stormwater control

projects.<sup>161</sup> Flood Reduction Grants focus on medium and small flood reduction efforts in four ways: original flood reduction, urban streams, coastal erosion/coastal flooding, and culvert replacement/fish passage.<sup>162</sup> Cooperative Watershed Grants work with the four Water Resource Inventory Areas (WRIA) to achieve objectives specific to the Area.<sup>163</sup>

The home elevation program raises the finished floor of homes above the 100-year flood elevation to reduce the risk of future flooding.<sup>164</sup> The District buyout program purchases flood-prone properties and acquires the land for District use, often as open space for an extended flood plain.<sup>165</sup> By spending \$66 million from 2008 to 2023, the KCFCD elevated 66 homes and acquired 215 properties on 600 acres.<sup>166</sup>

KCFCD works with many organizations, from local nonprofits to government agencies to tribes, to complete watershed infrastructure projects.<sup>167</sup> Projects are based on the 2006 Hazard Mitigation Plan and identify infrastructure needs based on the four river basins in King County: Cedar, Green, Snoqualmie/South Fork Skykomish, and White.<sup>168</sup>

The flood warning system is two-pronged: an online website platform and a mobile app.<sup>169</sup> The online platform allows people to sign up for email and phone flood alerts and access current flood conditions.<sup>170</sup> The mobile app enables people to monitor river conditions and directly sends out flood warning alerts.<sup>171</sup> Alerts are four phases: internal alert, minor flooding, moderate flooding, and severe flooding, but only phases two through four require public notification.<sup>172</sup> Both applications use river gauge data collected by the United States Geological Survey—river flow and height data—to provide real-time flood conditions for the seven major rivers in King County.<sup>173</sup> The website includes projections of flooding impacts at various potential river flows (closed roads, local flooding, etc.), whereas the mobile app does not.<sup>174</sup> The mobile app is also currently incompatible with the Android operating system. However, the mobile app updates conditions more frequently (every 10 minutes) and presents flood levels in one location, making it more user-friendly than the website portal.

### 4.3.3 Funding

A county-wide property levy tax funds the King County Flood Control District.<sup>175</sup> At first, the levy rate was about nine cents per \$1,000 assessed value.<sup>176</sup> The levy rate peaked in 2014 at about 13 cents per \$1,000 assessed value and now sits at the lowest amount of about six cents per \$1,000 assessed value.<sup>177</sup> In 2023, property levy taxes produced approximately \$59 million for the District.<sup>178</sup> High funding metrics allows the KCFCD to gain more state and federal matching funds.<sup>179</sup>

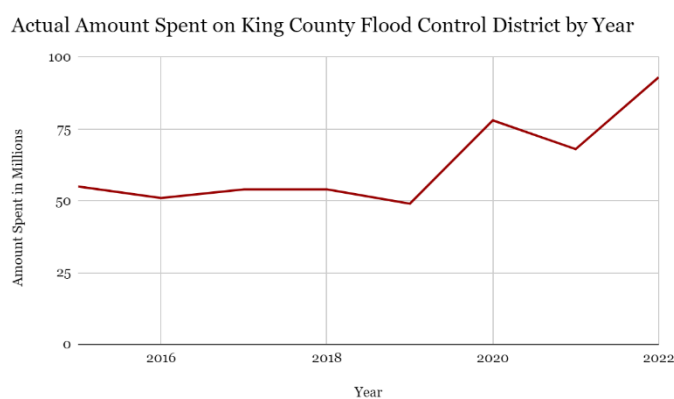


Figure 3: Actual Spending per Year for the King County Flood Control District in Millions of Dollars

Source: King County Flood Control District Annual Budget Appendix B 2018-2024



### 4.3.4 Vermont Feasibility

Vermont lacks county government, making a county-wide flood control district challenging to replicate as there would be little infrastructure to support it. The size difference between King County and the state of Vermont is also notable. King County's population is 2.2 million while Vermont's largest county is approximately 168,000 residents –about 13 times smaller, creating an additional scale challenge.<sup>180</sup> Some aspects of the KCFCD could translate to Vermont outside the county-based district structure.

Vermont could implement a flood warning system like King County's website and mobile app system. Vermont uses VT-Alert as its public emergency alert system, issuing alerts on everything from chemical spills to evacuations to road disruptions.<sup>181</sup> A new feature could be added for monitoring river flood conditions and sending out alerts for different phases of flooding. There is also no easily accessible real-time tracking for residents as they would have to go to the USGS website, manually input the correct locations to see river flow rates, and then interpret flooding consequences.

A regional watershed or state organization could be created to facilitate home elevations and buyouts. Presently, individual homeowners or municipalities are responsible for these projects instead of an aggregate body, making the process complex and costly.<sup>182</sup> Vermont is currently creating and updating Tactical Basins, whose primary objective is to investigate water quality in their specified drainage basin planning unit.<sup>183</sup> An additional mandate and funding could be given to Tactical Basins to provide them with the capacity to oversee flood resilience infrastructure projects and grant provision for these projects, similar to the KCFCD. Creating additional responsibilities for Tactical Basins or creating a new organizational body to oversee flood resilience infrastructure projects may be challenging due to funding constraints arising from a smaller tax base and no established way to generate the funds.

## 4.4 Riparian Restoration: Pennsylvania Buffer Initiative

### 4.4.1 Background

Riparian restoration is the re-establishment of natural river and stream banks to both improve water quality and reduce erosion and flood impacts.<sup>184</sup> The Commonwealth of Pennsylvania has established a state goal of planting 95,000 acres of riparian forest buffers by 2025 to improve water quality and restore aquatic life.<sup>185</sup> These buffers also serve to decrease flooding damage by reducing the rate of floodwater flow and erosion.<sup>186</sup> Much of this goal involves working with farmers to plant riparian buffers on private land abutting natural watercourses, which may include commercially harvestable crops to maintain working land value.<sup>187</sup> Funding is partly from federal grants as well as donations through a \$3 optional check-off box on new Pennsylvania drivers' license and vehicle registration online applications.<sup>188</sup>

Riparian forest buffers are planted with native tree species and typically take approximately 15 years to mature. To count for the state goal, buffers must be at least 35 feet wide, up to 300 feet.<sup>189</sup>

## 4.4.2 Methods

### Program Elements

The Riparian Buffer Restoration Program was first introduced in 2016 by the Pennsylvania Department of Conservation and Natural Resources (DCNR). It includes two primary functions: awarding grant money for buffer restoration and planting the buffers themselves. While the initiative's original purpose was to improve water quality and aid aquatic life in Pennsylvania's rivers and streams, riparian buffers are also an important flood reduction mechanism.

### Grant Management

Unlike buyouts, grants may be awarded to private landowners, municipalities, county governments, or nonprofit organizations. A variety of grants are available as part of the program, but one of the most important is the Community Conservation Partnerships Program grant program (CCPP). Under the CCPP, private landowners do not receive grants directly from the state; instead, they act as sub-grantees, applying for grants from their county, municipality, or a nonprofit organization that received the individual funds.<sup>190</sup> Initial grants to local governments and nonprofits tend to range from about \$100,000 to \$1,000,000.<sup>191</sup>

### Implementation

Landowners interested in planting a riparian buffer can contact the assigned DCNR regional watershed specialist, local government officials, or nonprofit organizers who will take them through the process.<sup>192,193</sup> Regardless of the initial source of contact, these specialists will directly contract professionals through state procurement mechanisms for the physical plantings.

The state uses grant money to pay landowners a lease on land receiving buffer planting. Currently, the DCNR negotiates 25-year land contracts with private, non-state-owned landowners.<sup>194,195</sup> Landowners do not have to pay for the plantings, only long-term maintenance, including selective herbicide application or physical weed removal.<sup>196</sup> Eventually, mature trees will reduce required maintenance.

The program includes the option to install multifunctional forest buffers, such as syrup, fruit, or mushrooms, that can provide economic or personal benefits to partly outweigh the cost of reducing cropland.<sup>197</sup>

### Effects

The exact number of acres planted to date is unknown due to a previous lack of tracking and reporting mechanisms. Following project completion, grantees must self-report their amount of buffer land into a DCNR grants portal and to the Pennsylvania Department of Environmental Protection (DEP) through third-party software, resulting in some buffer land slipping through the cracks.

Based on the current planting trajectory, Pennsylvania is unlikely to reach its goal of 95,000 acres by 2025. DCNR staff have also attributed lower planting rates to a lack of sufficient outreach to landowners, partially due to funding constraints.<sup>198</sup> In 2022, DCNR planted approximately 2,000 acres of buffers, only about 2.1 percent of the total goal. However, 2,000 acres is a record yearly amount, vastly exceeding the roughly 200 acres planted per year at the program's conception.<sup>199</sup> This growth reflects DCNR staff's increased experience with the process over time.<sup>200</sup> It is difficult to gauge the effectiveness of the buffers as flood mitigation tools since it takes roughly 15 years for these effects to become apparent. Prior research does demonstrate that riparian buffers play an important role in reducing flood impacts.<sup>201</sup>

### 4.4.3 Funding

The Keystone Tree Fund is a restricted account established in 2019 by Pennsylvania House Bill 374 to support planting trees in Pennsylvania, 60 percent of which is allocated for “a riparian forest buffer grant program”.<sup>202</sup> The Fund primarily raises revenue through a “voluntary \$3 check-off box” on first time and renewal driver’s license and vehicle registration online applications.<sup>203</sup> It also accepts direct donations in the form of check and receives appropriations through the state budget. Currently, the check boxes raise approximately \$200,000 a year, enough for approximately 30 acres of buffers.<sup>204</sup> There is a fixed yearly state contribution of at least \$500,000, and some additional state funding, though it can fluctuate wildly from year to year based on budget priorities (\$50,000 to \$750,000).<sup>205</sup> Federal funds may also be used for example, the Fund received \$8 million from federal American Rescue Plan Act (ARPA) funds in the 2022-2023 budget period, approximately \$4.8 million of which went to riparian buffer restoration.<sup>206</sup>

### 4.4.4 Vermont Feasibility

#### Technical:

Vermont and Pennsylvania have somewhat similar geographies, including mountainous river valleys. Implementing forested riparian buffers in the way Pennsylvania has done should not pose significant technical differences. There may be differences in the species planted, but Vermont-specific species information is already available.<sup>207</sup>

#### Monetary:

Vermont has not set aside a specific, consolidated fund for riparian restoration; APRA funds may still be used for buffer projects as part of the Flood Resilient Communities Fund (FRCF, also known colloquially as the Vermont Resilient Communities Fund). FRCF has received \$15 million in ARPA funds and \$8 million in additional state funds; these are one-time allocations used for a variety of other purposes, including property buyouts.<sup>208</sup> Additionally, our research found no current grant system in

Vermont that covers 100% of riparian buffer installation cost. Facilitating such a system would require more funding from state or federal sources or a diversion of funds from elsewhere.

#### Methodological:

Financial assistance for riparian buffers in Vermont is offered through programs, such as the Grassed Waterway and Filter Strip program (GWFS), though this program only applies to farmland.<sup>209</sup> Required Agricultural Practices mandate riparian buffers on agricultural land although they are typically harvested for hay rather than trees.<sup>210</sup> Perennial hay grasses can bring a farmer extra income though they are not as effective at reducing flood impacts as trees.<sup>211</sup>

There are other grants for non-agricultural landowners to install riparian buffers on their property, but they exist as a patchwork of different, smaller grant sources rather than one larger program like Pennsylvania's. For example, Trees for Streams, run by Vermont's Natural Resources Conservation Districts, planted 34.25 acres in 2020 and 2021.<sup>212</sup>

Using available data, and considering size and population differences, the number of buffers planted by Vermont and Pennsylvania seem to be roughly comparable. In total, Vermont programs actively planted 470 acres of riparian buffers and "passively restored" 2,600 acres through land easements from 2016 to 2023.<sup>213</sup> Nevertheless, Pennsylvania's riparian buffer initiative may provide some inspiration for Vermont, most notably through the following:

- Additional supplementary funding sources, such as a dedicated state account, that can accept private donations, and/or a driver's license "check off box" program.
- Investigation into commercial use of forested buffers— sugar maple, nuts, other uses.
- A grant program in Vermont that covers 100% of riparian buffer installation cost.

## 4.5 Property Buyouts: Blue Acres

### 4.5.1 Background

New Jersey has a population of 9,290,000 and the highest population density of any state, 1,263 people per square mile.<sup>214</sup> Much of the state's population resides on a coastal plain at risk for flooding and sea level rise.<sup>215</sup> Recent storms highlighted New Jersey's vulnerability to flooding, most notably Hurricane Sandy, resulting in \$30 billion in damages, including 365,000 damaged or destroyed homes.<sup>216</sup> New Jersey's history and geography underscore its need to prepare for future events of a similar and larger magnitude.

In 1995, the New Jersey Department of Environmental Protection (NJDEP) introduced the Blue Acres buyout program. The program, greatly expanded since Hurricane Sandy, goes beyond the "reactive" buyouts generally supported through FEMA, that is, buyouts following the destruction or damage of property. Blue Acres also provides funding for voluntary state buyouts of properties

deemed likely to be at risk of such damage known as “proactive buyouts”.<sup>217</sup> Whether a neighborhood is eligible for a Blue Acres buyout is determined by DEP using a variety of criteria including:

- Communities with high risk and vulnerability to climate change (not only those meeting FEMA buyout criteria).  
High concentrations of severely damaged homes from recent storms, particularly when several homes resulted in an official declaration of substantial damage.
- Communities with homes that have submitted repeated flood insurance claims under the National Flood Insurance Program.
- Resilience interest and buyout support from the local government
- Cost-effectiveness of the buyout according to FEMA requirements under federal law.
- Opportunity for significant environmental impact and/or improvement to public health, safety, and welfare.

Since its inception in 1995, Blue Acres has completed over 1,000 buyouts, averaging approximately six to twelve months for a buyout to reach completion.<sup>218</sup> 700 buyouts were completed post Hurricane Sandy.<sup>219</sup> In comparison, post-Sandy Vermont buyouts averaged four to five years until completion.<sup>220</sup>

Buyouts can improve resilience to flooding in two ways:

- A) Returning flood-prone land to its natural state, enabling increased water absorption and reduced erosion during flooding events, and
- B) Altering housing patterns so that residents face less damage when flooding occurs.

## 4.5.2 Methods

### Individual Homeowners

Only private, residential properties are eligible for the buyout program. Homeowners who would like to participate in a Blue Acres buyout can only do so if their home is in a neighborhood deemed eligible by NJDEP. Blue Acres is voluntary— even if a neighborhood is made eligible for Blue Acres buyouts, only those who consent to buyouts are made part of the process. Throughout the buyout process, homeowners will essentially only interact with state officials—buyouts are implemented by a team of real estate experts within DEP land management, the DEP’s Green Acres program, and the Office of Management and Budget.<sup>221</sup>

DEP hosts Blue Acres Open House events after they make a neighborhood eligible for the program. Residents may attend these events and discuss the buyout process with their case manager, including timelines, appraisal processes, and other general information. Appraisals, survey work, DOB review, and essentially every aspect is managed by the state (homeowners can hire an appraiser if they wish to appeal the state’s appraisal, though this adds several months to the buyout process).<sup>222</sup> Homeowners

also have access to tenant relocation assistance and the Blue Acres mortgage negotiation team, which has negotiated \$5.7 million in debt forgiveness for homeowners since Hurricane Sandy.<sup>223</sup>

### Local Governments

Blue Acres—and the state of New Jersey—covers all the administrative costs to implement buyouts through a mixture of state and federal funds described later in this section. The state also manages and implements nearly all of the program, relieving municipalities of the financial burden and capacity issues that might occur under a more decentralized system.

This comes with a tradeoff: all land purchased by Blue Acres remains state property. Local government plays a small role; they can provide substantial damage letters, property records, and other documents to state staff during the buyout process. They may serve as “custodial managers” of bought-out properties and provide insight for potential uses of properties.<sup>224</sup>

The lack of local government involvement in Blue Acres has been controversial. Local officials have opposed the lack of municipal say in the eligibility process. In Somerset County, the Mayor of Manville protested that DEP “blindsided the town” when it unilaterally canceled state and federal-funded applications for flood-related house repair and elevation in 2021, replacing them with buyout offers. A concern he and other Manville residents shared was a decrease in the town’s tax base as residents relocated.<sup>225</sup> The DEP conducts cost-benefit analyses for all potential buyout properties above \$275,000 in value and claims mayors have supported buyouts as the most cost-effective solution.<sup>226</sup> Nevertheless, the tax base concerns are still an important factor when considering the public perception of Blue Acres.

### 4.5.3 Funding

Funding for Blue Acres comes from a mix of federal and state sources. Much federal funding comes from FEMA’s Hazard Mitigation Grant Program (HMGP) and HUD’s Community Development Block Grants (CDBG). These sources are not fixed but are received piecemeal after the state applies for them following flooding events. In 2021, DEP applied for \$50 million in FEMA HMGP funding to implement 114 buyouts following damage from Hurricane Ida. As of January 30, FEMA has approved 14, for a cost of \$6 million – an average of \$428,000 per property.<sup>227</sup> In Manville, DEP officials estimated that demolishing 114 homes and relocating their residents would cost approximately \$47 million, an average of \$338,400 per property. In total, Blue Acres received \$94 million in federal funds from Hurricane Ida.<sup>228</sup> Before Hurricane Sandy, Blue Acres was entirely state funded through bond acts, but today New Jersey contributes a significantly smaller percentage of total funding. State funding comes from 6% of the revenue generated by the state’s Corporation Business Tax, which totaled \$10 million as of 2023.<sup>229,230</sup> State funds, while only a fraction of total funding, give Blue Acres more flexibility than purely federally-funded buyout programs, as it allows DEP to buy out properties that are at high risk of inundation but do not meet FEMA buyout criteria.

#### 4.5.4 Vermont Feasibility

##### Technical:

Much of the land in New Jersey impacted by Blue Acres is low-lying and coastal, unlike the higher-elevation, river valley corridors that are the most vulnerable to flooding in Vermont. However, the buyout process is not significantly affected by geographic differences.

##### Monetary:

The bulk of funding for Blue Acres comes from CDBG and HMGP grants, which Vermont is currently applying for following the summer 2023 floods.<sup>231</sup> CDBG appropriations require Congressional approval, potentially complicating the acquisition process. Regarding state funding, New Jersey's FY 2024 budget, \$54.5 billion, is significantly larger than Vermont's, \$8.5 billion (in fact, New Jersey currently has a large budget surplus of \$8.3 billion, almost equal to Vermont's entire budget).<sup>232,233</sup> While this makes large spending projects more difficult for Vermont, Vermont has approximately one-tenth the housing units as New Jersey and would have a smaller overall buyout need.<sup>234</sup>

##### Methodological:

The closest analog to Blue Acres in Vermont is the Flood Resilient Communities Fund (FRCF) established in 2021. FRCF, which, similarly to Blue Acres, uses both state money (an \$8 million one-time General Fund allocation) and \$15 million in federal money from the American Rescue Plan Act (ARPA) to both supplement FEMA buyout funds and conduct buyouts that do not meet FEMA criteria.<sup>235,236</sup> There are important differences between the two initiatives. Most importantly, FRCF acts primarily as a source of funds for buyouts rather than a state program that implements buyouts itself. Vermont does play a somewhat active role in FRCF buyouts, through a pilot program in which the state receives federal money and then sends it to towns, reducing the administrative burden on towns while including them as an active participant in the buyout process.<sup>237</sup> Additionally, there is no continuous state funding for FRCF, and all ARPA funds, the majority of FRCF funding, must be spent by 2026.<sup>238</sup> This may make long-term resilience measures under FRCF challenging to implement.

Certain elements of Blue Acres align with the comments and needs observed during our stakeholder interviews. Particularly relevant are the following:

- **Capacity:** Blue Acres incorporates full-time staff who are experts at the buyout process and whose sole responsibility is running the program. This allows for knowledge retention, long-term planning, and specialization that would be impossible for overburdened municipal officials or (as currently organized) RPC staff.

- **Fewer procedural hurdles:** The current process for buying out flood-destroyed, damaged, or at-risk properties in Vermont is exceptionally complicated, due to the constant trade-off of information and materials between towns, the state, and regional planning commissions.<sup>239</sup> Consolidating responsibility at a regional or state level as Blue Acres has done would reduce arbitrary steps and potentially decrease the time it takes for buyouts to be completed.
- **Dedicated non-federal funding:** A consistent source of funding, even if not enough to achieve all program priorities, would allow for more long-term resilience measures.

## 4.6 Housing Policies: Vermont

The Department of Environmental Conservation's Flood Hazard Area and River Corridor Rule oversees development activities that are exempt from municipal regulations within designated Flood Hazard Areas and River Corridors<sup>240</sup>. Such exempted development encompasses state-owned and operated institutions and facilities, accepted agricultural and silvicultural practices, as well as power generation, transmission, and telecommunication facilities. The issuance of permits aims to ensure that development exempt from municipal regulation within flood hazard areas and river corridors prioritizes public safety, welfare, and prevents disruptions to commerce, the tax base, and stream functionality.

Vermont is one of a few states without a compulsory flood risk disclosure law for real estate deals. This absence of regulation leaves potential homebuyers and renters with insufficient information when making decisions about where to reside, leaving them susceptible to being displaced when the next floods hit.<sup>241</sup> As of this writing, the current Vermont House omnibus bill, H.723, proposes flood disclosure provisions.<sup>242</sup> Under this bill, home sellers would be obligated to disclose whether their property is situated within a federally or locally-designated flood hazard area, whether the property has experienced flooding previously, and what the seller's flood insurance rate entails.<sup>243</sup> While there has been some legislative push behind formalizing flood disclosure requirements in state law, some lawmakers predict potential resistance from homeowners worried about the impact of disclosure on their property values.<sup>244</sup>

# 5 STAKEHOLDER PERSPECTIVES

## 5.1 Methodology

We explored stakeholder opinions on flood resilience policies, the grant application process, and interactions between levels of governance through expert interviews. We also proposed possible solutions that could be created in the state through the reallocation of funds or the application and appropriation of federal funds. We targeted three primary categories of individuals and organizations for our interviews: nonprofits, state officials, and federal officials. Nonprofit organizations are experts on grant application processes, state and federal funding opportunities, the needs of specific localities, and how solution implementation might occur on the ground. State officials provided insight into the



feasibility of new resilience measures, the process of Vermont grant applications, existing funds available for flood resilience projects, and reallocation possibilities to create new programs or grants. Federal officials explained how federal funds influence state grant availability and what federal programs the state of Vermont could apply to for future flood resilience funding. Within each category, we identified specific areas of interest: agriculture, economic development, environmental, and infrastructure. We targeted individuals within these areas for interviews as they are most involved in previous and current flood recovery efforts. See Appendix A for list of interviewees.

## 5.2 Capacity Needs

The issue of capacity—short staff and lack of funding—has faced many organizations interviewed. The high-skill labor shortage has been an issue for organizations trying to coordinate infrastructure projects (e.g. the removal of dams and energy infrastructure projects). One nonprofit official in the role of project manager commented that their job involves receiving calls from landowners, conservation committees, and select board committees to go out to different towns to evaluate damages. These positions require extensive training, education, and time commitment. It has been difficult for nonprofit organizations to pay project managers or attract volunteers, so they are short-handed in their operations.

More generally, these organizations lack the staff to reach out to the businesses and communities in need. The towns of Marshfield and Chester have been particularly under-resourced in their flood resilience efforts, unable to set up long-term recovery committees, unlike other larger communities affected by the floods. Officials reported they would accomplish more if they had more capacity on the ground. Across the board, the most sought-after positions are full-time project managers—ones that can mediate relations with FEMA, assess town needs, and point towns to the right resources, etc.

One organization mentioned the restrictions of issue-specific funding policies—the amount of money granted to helper agencies and organizations for an issue and whether it should be targeted to address specific projects.

One stakeholder commented that a solution to alleviate some of the effects of capacity shortages other than increasing the workforce is expanding education initiatives for communities on flood management and resilience efforts. Landowners along rivers should know how to identify stable river corridors and dams. Business owners and municipalities should know where and how to apply for grants and loans, especially from the most accessible sources like the Business Emergency Gap Assistance Program. Having Vermonters be more self-sufficient and know the basic procedures for flood assistance can streamline recovery and resilience efforts for these helper organizations that have experienced staffing shortages.

## 5.3 Funding Sources

The organizations from the expert interviews we conducted derived their funding from numerous sources, with several commonly used sources across organizations and departments. The most frequently cited sources for flood relief and resilience efforts were as follows:

### Federal

- Federal Emergency Management Agency’s Disaster Relief Fund and Hazard Mitigation Grant Program (FEMA’s DRF and HGMP)
- National Flood Insurance Program (NFIP)
- U.S. Department of Housing and Urban Development’s Community Development Block Grants (HUD’s CDBGs)
- Small Business Administration (SBA)
- U.S. Department of Agriculture (USDA)

### State

- The Flood Resilient Communities Fund (FRCF)
- Municipal Technical Assistance Program (MTAP)
- Business Emergency Gap Assistance Program (BEGAP)
- Vermont Agency of Transportation

A commonly cited problem across organizations is how businesses across Vermont were expecting to receive emergency loan or grant support they had received following Irene but did not. The SBA Economic Injury Disaster Loans (EIDLs) are long-term loans the federal government administers to businesses in crisis at lower interest rates than conventional loans. However, many did not qualify because of debt incurred due to the pandemic. With little federal support, many businesses had to turn to state programs like BEGAP for financial assistance.

The application process for federal loans has been challenging for most towns and businesses. They struggled to identify which organizations to contact for financial assistance and how to begin the funding application process. Regional planning commissions (RPCs) and regional development corporations (RDCs) assisted municipalities, especially smaller ones, in that process. Some officials stated that the process could take up to a year and a half to receive their loan after applying.

One participant commented on how, in general, in the loan process, the government and community-support organizations have slowed the process of administering loans and grants to communities and businesses due to concerns about dishonest claims, ensuring that parties receive the appropriate amount of money. One individual commented, “During emergency times, we need different expectations of how we make dollars available... We need to be nimbler [and] have fewer accountability measures in place, since we have struggling businesses that need capital.”

One nonprofit official explained the role of private philanthropic money in allowing organizations to provide rapid grant assistance as these funds are “nimble and can move quickly” to individuals and businesses. Using private donations, organizations can grant assistance in many rounds continuously learning and adapting to the situation on the ground. These funds also supplement federal assistance or support projects or programs that do not fit within the existing grant framework.

On the contrary, another official argues the reason for barriers and low grant provision numbers “is that businesses do not keep good books, so a grant system is not realistic. Many small businesses are so focused on operating their business day-to-day that it’s hard for them to work long term.” Some government and community-support organizations do not want to hand people blank checks because they feel the recipients will not know what to do with them.

Ultimately, there seem to be many funding services available for communities at the state and federal level, but barriers and information gaps have prevented money from getting to all people in need.

## 5.4 Regional/Higher Level Organization

Nonprofits, state officials, and federal officials all identified challenges with the structure and organization of the recovery response following the July flooding events. Many believe the absence of an overarching body for disaster response has placed the burden of recovery on individual towns that lack the capacity to deal with such efforts. Some further indicated that the lack of continuity from one disaster to the next placed further strain on systems already stretched thin. One individual voiced the need for “not recreating the wheel” each time a disaster occurred. Instead, they stated the need for a system in which when a “disaster happened in this part of the State, here's the system we're using. Here's what we're deploying. Here's the funding for some caseworkers to get moving to help people immediately, so that we don't have the 7 to 8-month gap that we've had now.”

Interviewees frequently cited the strength of local and municipal power as the primary reason Vermont lacks county-level governance. Many expand beyond this initial assertion in the context of flood response and recovery to state the necessity for some higher level or regional entity for management purposes. Several interviewees expressed different ideas as to the structure of such a body. There were four prevailing ideas: a state/quasi-state body, county-level organization, expansion of the role of regional planning commissions, and watershed-level organization.

One interviewee described how a quasi-state body would function. It would have the support and funding from the state but could also leverage the support of private philanthropy. The organization would facilitate project management of flood resilience initiatives, run the buyout program, and create a systematic approach to disaster response. In essence, the entity would “buy the property... do the stuff [maintain the property] ... [and] own it afterwards.”

Two interviewees suggested the creation of a county-level government. Each county would create and implement hazard mitigation plans, facilitate flood resilience project development, and raise funds to support their initiatives. They also acknowledged the challenge of creating county-level government because “local control is very important in Vermont” and towns want to maintain power over decisions in their jurisdiction.

Several officials proposed the idea of watershed or river corridor entities. These entities would approach flood response similarly to county-level governments, developing hazard mitigation plans and running projects. Regional resources, such as resource navigators and project management staff, could be shared among towns. Unlike county-level groups, watershed organizations would run through the Department of Environmental Conservation, so they would be conservation-focused and have more state-level oversight.

Nonprofit and state officials suggested expanding the role of RPCs to assume responsibility for hazard mitigation plan development and watershed management. They identified the current role of RPCs as providing technical assistance but recently they have been taking on an expanded role. For instance, Clean Water Service Providers are regional organizations set up by regional planning commissions across the state. The state official elaborated that role expansion has lacked resource increases, creating capacity issues for many RPCs.

## 5.5 Community Support

Virtually all officials interviewed play a role in offering programs to support communities through disaster recovery and resilience. Several nonprofits and organizations have worked to facilitate specific programs to aid Vermont communities through disaster recovery and resilience. Many created internet access hubs to make information accessible to impacted communities. One organization provides ongoing technical support to businesses navigating flood recovery through the Small Business Technical Assistance Exchange program. Another formed the Community Leadership Network, bringing together 3,000 community volunteers, running workshops, and conducting conversations with those responding to flooding in communities and community members. They conduct technical assistance meetings on creating and utilizing community funds. The CLN has shifted gears from response to recovery and resilience, restructuring conversations (for example, regarding community mental health and well-being).

Many organizations serve as full-time liaisons between the community and federal and state organizations like FEMA and the Small Business Administration. Regional planning commissions, for example, assist with handling the paperwork of FEMA and VEM buyouts for towns, alleviating some of the administrative burden for overwhelmed communities. To ensure aid from the Municipal Technical Assistance Program, some helper organizations conduct community needs assessments for hard-hit towns eligible for funding.

Several provide grant application assistance to their communities. For example, the Vermont Emergency Management Division of the Department of Public Safety updates the state hazard mitigation plan every five years to ensure that the state qualifies for funding under the FEMA Hazard Mitigation Grant program, listing past disaster events and proposing specific strategies for recovery and mitigation. They were able to help the state receive an estimated \$75 to \$90 million in response to the July flooding.

These are just a few ways the organizations we interviewed interact with and support their communities. Officials like these, committed to serving Vermonters, are the backbone of flood resilience and recovery.

## 5.6 Additional Strategies

This section details additional flood resilience measures or input recommended by experts that did not fit into the four main repetitive themes. Specific individuals highlighted these strategies, and they were stand-alone recommendations rather than recurring throughout the interview process.

### Agriculture

A state official and farmer interviewed identified the extent to which farmers were affected by the 2023 July flooding and other similar flooding events throughout the year. Following Hurricane Irene, some farms implemented changes on their properties to build flood resilience and decrease flood risk;

as of now, data has not been collected on the efficacy of these solutions. A statewide survey could be conducted on properties that made post-Irene changes to determine which solutions worked and which ones did not. State programs could then be created to help farmers implement the proper solutions. Both interviewees also acknowledged the continued role of climate-driven extreme weather events on farmers. A program could be developed to aid farmers in developing climate resilience plans for their businesses.

### Infrastructure

One state official highlighted the destruction of infrastructure during the July flooding event. According to the officials, much of the destroyed infrastructure was rebuilt in the same location with slight modifications to comply with FEMA's good road standards, such as updating culvert size. They cited the Vermont Transportation Resilience Planning Tool as a way of identifying infrastructure at risk of flood damage. They suggested the expansion of training programs using the TRPT and the development of community conversations to create plans for infrastructure development that would improve flood resilience.

## 6 CONCLUSION

As climate change intensifies global weather patterns, the frequency of extreme flooding and other disaster events will increase. Vermont will need to adopt flood mitigation and resilience strategies to protect resident safety, economic security, and prepare for a future with more large-scale flooding events. Based on an analysis of several case studies and interviews with Vermont stakeholders, we distilled key takeaways for the Vermont Senate Committee on Economic Development, Housing and General Affairs to consider as it examines different flood resilience policies in Vermont.

Building a flood resilient Vermont is an immense and complex task in terms of geographic area, economic and temporal constraints, and implementation capacity. Considering potential limitations, a three phased approach to resilience building appears to be most appropriate. Our solution phases are based on the projected time it would take to see an impact on flood resilience capacity and estimated implementation time, creating three phases: short-term, intermediate term, and long term.

Short-term solutions would have a near immediate impact and/or would take the least amount of time to stand up. Capacity building initiatives would help municipalities hire more support staff and create education opportunities for current local officials to develop a better understanding of disaster response. Integrating a flood warning system into the existing VT-Alert system would provide individuals and municipalities with critical information about upstream/river flooding conditions, enabling early evacuation and elevation efforts. Creating a tandem platform that would garner community member feedback on proposed resilience measures and offer them support in the form of grant application assistance and mental health care would build overall community resilience to disaster events. Supporting current legislation on flood disclosure for house sale and mandating that towns adopt zoning laws that prohibit additional development in river corridors would reduce flood risk for these areas.

Intermediate-term solutions would take longer to have an impact and/or take an estimated one to five years to complete. Completing buyouts of properties already damaged in the July flooding events and of properties likely to be impacted in future flooding events would dramatically reduce the safety threat to people living in these homes and create floodplain space. Creating a regional or state level organization for flood and disaster response would have a significant impact; however, it will likely require further study to determine the most appropriate body and what powers should be delegated. Smaller gray infrastructure projects, like culvert installation would decrease flood risk for many towns by channeling water away from their residents.

Long-term solutions would take the longest to have an impact and/or take the longest to complete, estimated at more than five years, but would likely have the greatest impact on overall flood resilience. Implementing nature-based solutions, such as riparian buffers and wetland restoration increase Vermont's water storage capacity by a significant amount, creating more flood and climate resilience. Studying the ways in which agricultural upgrades after Irene succeeded and failed in the July storm would provide a foundation for future agriculture resilience planning. Conducting a statewide survey of local infrastructure to determine flood vulnerability would produce a framework for infrastructure updates and relocation. Removing channelizing structures within Vermont's waterways and restoring rivers' original braided structures would slow down flood waters and increase the ability of the land to absorb influxes of water.

## APPENDIX A: List of Contacts for Expert Interviews

- A) Melissa Bounty - Central Vermont Economic Development Corporation
- B) Laura Calvin Bailey - Climate Economy Program Manager of the Vermont Council on Rural Development
- C) Keith Cubbon - Transportation & Emergency Management Planner Central Vermont Regional Planning Commission
- D) Karina Dailey - Restoration Ecologist Vermont Natural Resources Council
- E) Douglas Farnham - Chief Recovery Officer Vermont Agency of Administration
- F) Erik Filkorn - Principal Assistant Vermont Agency of Administration
- G) Bob Flint - Springfield Regional Development Corporation
- H) Kevin Geiger - Chief Planner Two Rivers Ottauquechee Regional Commission
- I) Adam Grinold - Brattleboro Development Credit Corporation
- J) Jon Groveman - Policy and Water Program Director of the Vermont Natural Resources Council
- K) Jenna Koloski - Community Engagement and Policy Director Vermont Council on Rural Development
- L) Norah Lake - Farmer Sweetland Farms
- M) Francis Magilligan – Professor of Geography Dartmouth College
- N) Holly Morehouse - VP of Grants and Community Impact Vermont Community Foundation
- O) Pat Moulton - Central Vermont Recovery Officer Vermont Agency of Administration
- P) Morgan Peach – Lecturer of Environmental Studies Dartmouth College
- Q) Amanda Sidler - Business Navigator Springfield Regional Development Corporation
- R) Teddi Stark - Watershed Forestry Program Manager PA Department of Conservation and Natural Resources
- S) Stephanie Smith - State Hazard Mitigation Officer VT FEMA Flood Mitigation Assistance Grant Program
- T) Abbey Willard - Agricultural Development Division Director Vermont Agency of Agriculture, Food, and Markets

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