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LESSONS LEARNED FROM IRENE

Climate Change, Federal Disaster Relief, and Barriers to Adaptive Reconstruction

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Executive Summary

This case study examines the challenges encountered by Vermont localities in trying to use federal disaster relief funds to rebuild their transportation system to be more resilient to future impacts in the aftermath of Hurricane Irene.

Irene dumped more than 7 inches of rain on the state over the course of two days, which washed out hundreds of miles of roads and bridges. In the aftermath of the disaster, Vermont set about rebuilding its roads and bridges to higher state standards, but encountered legal barriers when FEMA initially refused to reimburse communities for the added costs.

Vermont's standards required that culverts be designed to accommodate additional streamflow and to minimize impacts to aquatic species; permits are issued based upon a site-specific analysis. Requiring culverts to be upgraded will increase the resilience of roads and bridges because they will be less likely to be washed out in extreme rain events, which are projected to increase for the state under climate change scenarios.

FEMA, however, initially denied reimbursement arguing that the state standards for rebuilding culverts provided state regulators with too much discretion and thus did not comply with FEMA requirements that standards be "uniform." The state appealed the decision and ultimately FEMA allowed one locality to be reimbursed and is considering the appeals of other localities.

We use this story of the Vermont appeal to highlight some of the challenges that states and localities face in trying to adapt to climate changes when rebuilding differently after natural disaster.

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I. Introduction: Chronology of Events

On August 28, 2011, Hurricane Irene swept up the coast of the Northeastern United States and made landfall in New York. When the storm hit the Atlantic seaboard it was downgraded to a tropical storm, but still had a devastating impact on the region.

Winds exceeded 40 miles per hour (mph) as Irene crawled slowly across Vermont and upstate New York dumping torrential rains. In a period of two days, Irene unloaded a staggering 7 inches of rainfall in areas of both states.[1] Saturated soil and the steep topography of Vermont funneled the rainwater down cascading hills into valleys. Heavy rain combined with years of human alteration of the waterbodies at the base of those valleys lead to catastrophic flooding of historic proportions across the state.[2]

The impact of the storm on the small communities of Vermont, most of which were located along the banks of the many streams and rivers that flow throughout the state, was devastating: 225 of Vermont's 246 municipalities incurred significant damage. Six deaths were attributed to the storm in Vermont alone. Thirteen communities were completely cut off from the rest of the state, with no passable roads in or out of town, relying on National Guard helicopter airlifts to ferry critical supplies until bridge access could be restored.[3] More than 1,500 residences sustained severe damage, directly affecting over 7,000 people. Over 73,000 homes lost power, some for almost a week. Twenty thousand acres of farmland were inundated. Water supplies were contaminated by floodwaters; sewage treatment facilities were

Image 1: *Irene's Impacts to Infrastructure*

These photos show the devastation that Irene caused to Vermont's transportation infrastructure. The stormed washed out bridges and blew out culverts across the state.

Credit: Vermont Agency of Natural Resources/Vermont Agency of Transportation

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1 National Weather Service, Burlington, VT (August 30, 2011).

2 *See*, New York Times, *Storm's Push North Leaves Punishing Inland* Floods (August 29, 2011), http://www.nytimes.com/2011/08/30/us/30vermont.html?pagewanted=all&_r=3&; Associated Press, *Helicopters Rush Food, Water to Vermont Towns Cut-Off by Irene Floods* (August 30, 2011), http://www.masslive.com/news/index.ssf/2011/08/helicopters_rush_food_water_to.html; *and Municipal Guide to Fluvial Erosion Hazard Mitigation*, Vermont Agency of Natural Resources, River Management Program (2010).

3 *Id*.

compromised; and hazardous material spills put public health at risk.[4]

The storm was particularly devastating to Vermont's transportation infrastructure. The Vermont Agency of Transportation (VTrans) would eventually detail the scope of the destruction: More than 200 miles of state-owned rail was damaged and 146 state road segments and 34 bridges were closed. Of locally maintained assets, 2,260 road segments and 289 bridges were affected when 963 culverts were damaged, destroyed, or blown-out.[5] Culverts are structures that allow water to pass underneath roads and bridges. Prior to Irene, many Vermont roads had outdated "pipe" culverts. These culverts failed on account of the sheer force of the water and debris that was carried downstream by the floodwaters causing the supported bridges and roads to crumble and collapse. The total damage to infrastructure in the state was estimated at between $250 and $300 million dollars, all for a state of just over 600,000 residents.[6]

Recognizing the impending danger from Irene, Governor Peter Shumlin declared a state of emergency on August 27, 2011. The Governor identified the primary risks from the storm as damage from high winds, heavy rainfall, and flooding, and mobilized the state's emergency management agency and National Guard.[7] Nothing, however, could have prepared the Governor or any of those in his administration for the magnitude of those impacts. Vermont woke up on August 29th to a scene unlike anything it had seen since the historic flood of 1927.[8] On September 1, 2011, President Obama declared Vermont a major disaster area, setting in motion the full spectrum of Federal disaster relief operations as authorized by The Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121 *et seq*., herein after "Stafford Act") administered by the Federal Emergency Management Agency (FEMA).[9]

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4 Sacha Pealer, Vermont Agency of Natural Resources, *Lessons from Irene: Building Resiliency as We Rebuild* 1-5 (January 4, 2012).

5 Vermont Agency of Transportation, *Tropical Storm Irene, VTrans Response* (August 28, 2011), *available at* http://www.aot.state.vt.us/Documents/Irene/TropicalStormIrenePresentation.pdf.

6 Pealer, *supra*, at 1.

7 VT Digger, *Shumlin Declares State of Emergency* (August 27, 2011), http://vtdigger.org/2011/08/27/shumlin-declares-state-of-emergency/.

8 The 1927 flood was the worst flood event on record. It claimed 84 lives and 1,285 bridges. National Weather Service, Burlington, VT, *The Flood of 1927*, http://www.erh.noaa.gov/btv/events/27flood.shtml (last visited April 5, 2013).

9 FEMA DR-4022, *Vermont, Tropical Storm Irene* (September 1, 2011).

Image 2: *Culverts Before and After Irene*

Old 7 foot "pipe" culvert. These types of culverts were common in the state prior to Irene. 963 culverts were damaged, destroyed or blown-out during the storm.

Credit: Vermont Agency of Natural Resources/Vermont Agency of Transportation

New 16 by 8 foot precast arch culvert, which were installed in the after to replace blown-out pipe culverts and comply with Vermont's stream crossing requirements.

Credit: Vermont Agency of Natural Resources/Vermont Agency of Transportation

With the promise of federal reimbursement, state agencies and localities set to work assessing the damage and rebuilding after the disaster. This case study will focus on Vermont's work to restore or replace washed out roads and bridges, including hundreds of pipe culverts. In replacing the culverts, the towns implemented the design standards mandated by Vermont law. The law required that washed-out pipe culverts be replaced with larger, open bottom "box" culverts (depicted above), which would be able to withstand a future storm of Irene's proportions and take into account fish and wildlife passage.[10] For some towns this meant an outlay of $200,000 to $400,000 per culvert, an enormous financial burden given that some towns had entire annual budgets of just $900,000.[11] State agencies and localities anticipated to be reimbursed for a portion of the expense with federal disaster relief assistance through FEMA's Public Assistance program authorized by the Stafford Act. Thus, Vermont steadily moved forward with reconstruction and by December 31, 2011, just 21 local roads and 43 local bridges remained closed.[12]

By March 2012, however, a disagreement between FEMA and the state began to form over reimbursement for the additional costs needed to install the larger box culverts. Using the example of the dispute between Vermont and FEMA over federal disaster relief funds, this case study will consider Vermont's efforts to rebuild to be more resilient to future climate impacts in the wake of Tropical Storm Irene. This report analyzes Vermont's efforts to adapt its infrastructure when rebuilding after Irene and how federal disaster relief laws and policies impeded Vermont's efforts to rebuild in a resilient manner. The report concludes with lessons that can be learned from Vermont's experience.

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[10] Vermont Public Radio, *Post-Irene, Towns Consider Larger Culverts* (November 28, 2011), http://www.vpr.net/news_detail/92581/post-irene-towns-consider-larger-culverts/.

[11] VT Digger, *Shumlin Administration Appeals FEMA Denial for Culvert Repair* (December 20, 2012), http://vtdigger.org/2012/12/20/shumlin-administration-appeals-fema-denial-for-culvert-repair/.

[12] *Tropical Storm Irene, VTrans Response*, *supra*.

II. Climate Change, Stream Alteration Permits, and the Response to Irene

A. Vermont and Climate Change

Even before Irene, Vermont recognized that climate change was likely to impact the state. Vermont agencies, in particular VTrans and Vermont Agency of Natural Resources (ANR), recognized and began planning for these impacts as far back as 2008.[13] One of the major predicted effects for the state is an increase in precipitation falling as rain and more extreme storm events.[14] In its 2008 Climate Change Action Plan, VTrans recognized the need "to protect Vermont's transportation infrastructure against the effects of climate change."[15] Specifically, the Plan recognized the need to design bridges and culverts to handle anticipated increased water flow and debris. The plan proposed that the state analyze the costs and benefits of adapting infrastructure, specifically measures to increase inspection and to protect structures from scour, which is the erosion around bridge piers or stream crossings caused by swiftly moving water.

B. Stream Alteration and Permitting

In rebuilding after Irene, state agencies and localities rebuilt washed-out culverts and stream-crossings to comply with a state law that required crossings be designed in a way, "to maintain natural stream conditions and improve protection of roads and property from some of the damaging effects of floods."[16] Although this law was not passed specifically to address climate impacts, its requirements will help build the resilience of Vermont's transportation system to the increased precipitation anticipated for the state. The larger culverts are less likely to fail in extreme weather events because they allow for greater volumes of stream flow to pass through the culverts and they are not as prone to blockage from debris. The added expense required to replace the outdated pipe culverts with open-bottom box culverts, however, became the root of the dispute over reimbursement with FEMA. Thus, it is important to understand how regulators applied Vermont statutory requirements when rebuilding after Irene.

Vermont law prohibits the creation of obstructions in streams that prevent the passing of fish and other aquatic organisms, unless authorized.[17] A separate statute then sets forth three relevant criteria by which to assess applications for stream alteration permits. The applicant must show that the stream alteration will not increase flood or erosion hazards, damage fish or wildlife, damage the rights of riparian owners.[18]

While the latter statute was enacted in the 1960s, many years prior to any public concern about climate change, it was intended to be a flexible permitting scheme. Rather than establish a mandatory design standard based on water flow alone, the statute requires that the above statutory criteria be addressed in the permitting process. The permitting process includes performance standards that require proposed

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[13] *See VTrans Climate Change Action Plan*, *supra*; *and* Vermont Agency of Natural Resources, *Vermont Stream Crossing Handbook* (2010).

[14] *See*, Alan K. Betts, *Vermont Climate Change Indicators*, Weather, Climate and Society, Vol. 3 (2011); Alan K. Betts, *Climate Change in Vermont* (2011), *and* Vermont Agency of Transportation, *VTrans Climate Change Action Plan* 15-17 (June 2008).

[15] *VTrans Climate Change Action Plan* at 15.

[16] *Vermont Stream Crossing Handbook* at 1.

[17] 10 V.S.A. § 4607.

[18] 10 V.S.A. § 1023.. The general statute for stream alteration permits states that "The permit shall be granted, subject to such conditions determined to be warranted, if it appears that the change: (1) will not adversely affect the public safety by increasing flood or fluvial erosion hazards; (2) will not significantly damage fish life or wildlife; (3) will not significantly damage the rights of riparian owners; and (4) in case of any waters designated by the secretary as outstanding resource waters, will not adversely affect the values sought to be protected by designation."

alterations to attain and maintain stream equilibrium, defined as "when water flow, sediment, and woody debris are transported by the stream channel in such a manner that the stream maintains its dimension, general pattern, and slope without unnaturally aggrading (raising) or degrading (lowering) the channel bed elevation."[19] The permitting process also includes a connectivity standard that prevents obstruction of or barriers to aquatic organism passage. These performance standards are implemented by Vermont river engineers on a river-by-river basis, taking into account both the hydrology and fluvial geomorphology of the site. As such, these principles can continue to be applied by Vermont river engineers as the science advances on hydrology,[20] fluvial geomorphology,[21] and aquatic organisms (including scientific understanding about how climate change may exacerbate flood and erosion hazards).[22]

The U.S. Army Corps of Engineers (ACE), in its Vermont General Permit, has explicitly endorsed this standard by stating, "[a]ll temporary and permanent crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed to withstand and to prevent the restriction of high flows, to maintain existing low flows, and to not obstruct the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction."[23] With regards to design standards, the ACE permit lists criteria similar to those listed in Vermont's definition of stream equilibrium, citing ANR's "Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont" as the guiding reference for any proposed stream crossing projects."[24] The ACE permit further requires that, "[a]pplicants shall use the least intrusive and environmentally damaging method to construct the stream crossing, following this sequential minimization process: bridge spans, open bottom arches or embedded culverts."[25]

The statutory and permit requirements are further supplemented by a host of detailed guidance documents and project tools issued by both VTrans and ANR.[26] Pipe culverts, most of which were installed prior to the current design standards and still exist in the state, do not meet the standards above as they are prone to failure as a result of debris blockages and stream flows that exceed the capacity of the culvert. Additionally, pipe culverts have adverse impacts on fish and wildlife because they prevent aquatic organisms from passing through the culvert. The design standards set forth above, and incorporated by

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[19] *See* Vermont Agency of Natural Resources, *Stream Alteration General Permit* (April 18, 2011); *and*, Vermont Agency of Natural Resources, *Introduction to the Vermont ANR Stream Alteration General Permit Program* (April 16, 2011).

[20] Hydrology is the science that encompasses the occurrence, distribution, movement and properties of the waters of the earth and their relationship with the environment, *see* U.S. Geological Survey, *What is Hydrology and what do Hydrologists do?* http://ga.water.usgs.gov/edu/hydrology.html (last visited on April 29, 2013).

[21] Fluvial geomorphology is the science of understanding how the natural setting and human land use in a watershed determine the shape of a river channel, *see* Field Geology Services, *What is Fluvial Geomorphology?*, http://field-geology.com/ (last visited on April 29, 2013).

[22] Telephone interview with Mike Kline, River Program Manager, Vermont Agency of Natural Resources (March 27, 2013)

[23] Department of the Army, *General Permit*, State of Vermont, paragraph 21(a) (December 6, 2012) (Note that the 2011 General Permit in effect during Irene was substantially similar for the purposes of stream crossings).

[24] *Id*., *and* Vermont Agency of Natural Resources, *Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont* (March 2009).

[25] ACE *General Permit*, paragraph 21(f).

[26] See *Municipal Guide to Fluvial Erosion Hazard Mitigation*; *Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont*, *and Vermont Stream Crossing Handbook*, *supra*; *and* Vermont Agency of Natural Resources, *The Vermont Culvert Aquatic Organism Passage Screening Tool* (March 2009).

reference into these documents, have generally resulted in an open-bottom or box culvert design for new culvert construction or reconstruction as it allows for adequate water flow, sediment transport, and aquatic organism passage. In rebuilding after Irene, Vermont agencies and localities complied with these culvert design standards that rest on established principles of river engineering. The rebuilt culverts increased the resilience of the state's transportation system because the culverts are of adequate size to account for increased heavy precipitation events (like those anticipated from climate change), and sediment loading, while taking into account the health of the ecosystem.[27]

III. Federal Disaster Relief

A. The Stafford Act's Public Assistance Program

The problem, however, arose when FEMA refused to reimburse Vermont localities for the increased costs of installing the larger box culverts with federal disaster relief funds under the Stafford Act. The dispute was partially caused by provisions of the Act that prevent FEMA from reimbursing communities for any upgrades to public facilities.

The Stafford Act was enacted to provide a vehicle for the federal government, through FEMA, to provide funding to assist states with disaster response and long-term recovery in presidentially-declared disasters areas, such as Vermont after Irene.[28] The main program that supports the rebuilding of public facilities and infrastructure is the Public Assistance (PA) program authorized by Section 406 of the Stafford Act.[29] Through the PA program, states and municipalities can be reimbursed for the costs incurred in repairing or rebuilding damaged facilities based upon the applicable statutory federal cost-share amount (typically 75 percent).[30] PA is the source of funding normally associated with the rebuilding of local roads damaged or destroyed by natural disasters, as well as other public facilities.

The PA eligibility process begins with a project worksheet (PW) generated by FEMA and the state or municipality. The PW is used by FEMA to determine the obligation to reimburse disaster-affected entities. In the PW, the state or local applicant must describe the location and description of damage, the scope of work for which the entity is seeking reimbursement, and provide an estimate of the costs.[31] Once complete, each PW is submitted for review and approval to the FEMA Joint Field Office (JFO) designated for the disaster. If the PW is approved, FEMA will reimburse the state or municipality for the federally approved share of the cost incurred to repair, replace or rebuild the facility.

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[27] Interview with Mike Kline, *supra*.

[28] *See* 14 A.L.R. Fed. 2d 173 (2013).

[29] 42 U.S.C. § 5172. The Hazard Mitigation Grant Program (HMGP) authorized by Section 404 of the Stafford Act also can be used to support measures to increase the resilience of a facility to future disasters. 42 U.S.C. § 5170c. The main difference between the HMGP and the PA program in the infrastructure context is that HMGP provides funding for mitigating hazards to structures that were *not* damaged by the disaster but that are at risk for future damage, whereas PA provides funding to repair or replace parts of a structure that were damaged by the disaster, to potentially include hazard mitigation measures in such repairs. Federal Emergency Management Agency, *Recovery Policy 9526.1, Hazard Mitigation Funding under Section 406 (Stafford Act)* paragraph VI.a.2 (March 30, 2010). The HMGP takes a more prospective approach in that funds can be used by states to undertake post-disaster projects designed to reduce the risk of future damage so long as the project meets FEMA's cost benefit analysis. However, the HMGP is subject to a statutory cap on funding, whereas PA is not. HGMP grant awards are requested from FEMA via the State Hazard Mitigation Officer, and must be consistent with broader state and local FEMA-approved hazard mitigation plans, and, if approved, are managed by a responsible state official.

[30] *Id*.

[31] FEMA, PUBLIC ASSISTANCE PROGRAM GUIDE at Ch. 3.

The PA program, however, presents challenges to using the funds to rebuild an asset to be more resilienct to future impacts. Section 406(e)(1) of the Stafford Act states that FEMA may contribute to rebuild a public facility (*e.g.*, infrastructure) as it existed immediately prior to the disaster. Thus, PA funds are typically used to simply rebuild or repair an asset to its pre-disaster design. However, the statute creates two exceptions to this rule which were relevant to the dispute between Vermont and FEMA: (1) communities can be reimbursed for an upgrade to a facility where that upgrade is required by codes that were in effect prior to the disaster, (2) FEMA also has discretion to reimburse communities for the costs of installing measures to mitigate future impacts to the facility.

1. Pre-existing codes

First, Vermont anticipated that it would be fully reimbursed for the costs of rebuilding the larger culverts because the laws on the books at the time of the disaster required the larger culverts. Section 406 of the Stafford Act allows FEMA to reimburse states and localities to rebuild facilities "in conformity with current applicable codes, specifications, and standards." As such, under the PA program FEMA may fund the restoration or replacement of a damaged facility in a manner different than that pre-existing design if the applicable codes at the time of the disaster dictate a change in the design of the facility.

The pre-existing codes must meet the criteria set forth in the FEMA's regulations. The implementing regulations for the PA program (44 C.F.R. § 206.226(d)(1)-(5)) state, in substantial part, "for funding of the costs of Federal, State, and local repair or replacement standards which change the pre-disaster construction of facility to be eligible, the standards must:

(1) Apply to the type of repair or restoration required;

(2) Be appropriate to the pre-disaster use of the facility;

(3) Be found reasonable, in writing, and formally adopted and implemented by the State or local government on or before the disaster declaration date or be a legal Federal requirement applicable to the type of restoration;

(4) Apply **uniformly** to all similar types of facilities within the jurisdiction of owner of the facility; and,

(5) For any standard in effect at the time of a disaster, it must have been enforced during the time it was in effect."[32]

The determination of whether a state standard meets the aforementioned five criteria lies solely within the discretion of FEMA.[33]

FEMA has issued several policy documents to interpret the guidance set forth in the Stafford Act and Code of Federal Regulations (CFR).[34] With regards to standards that mandate the upgrade of a facility or structure, and as noted above, FEMA has clearly stated that those standards (also referred to by FEMA in policy documents as "codes") must meet all five criteria contained in the CFR provisions above or the project will only be eligible for funding up to the pre-disaster design.[35] FEMA has also further elaborated on each of the five criteria, in particular the language in 44 C.F.R. 206.226(d)(3) and (5) (quoted above). Pertaining to subsection (d)(3), FEMA policy focuses on the general reasonableness of the code or

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[32] 44 C.F.R. § 206.226(d)(1)-(5) [emphasis added].

[33] Federal Emergency Management Agency, *Disaster Assistance Policy 9527.4, Construction Codes and Standards* paragraph VII.B.4 (February 5, 2007).

[34] *Id.*; *Disaster Assistance Policy 9527.4, Construction Codes and Standards*; *and* Federal Emergency Management Agency, *FEMA 322, Public Assistance Guide* (June 2007).

[35] *Disaster Assistance Policy 9527.4, Construction Codes and Standards, supra*, at paragraph VII.B.1.c.

standard with regard to an engineering perspective and whether those standards have been adopted into local building codes or local ordinances.[36] Importantly, the policy goes on to explain that "design standards, guidelines, policies, industry practices, or other non-mandatory provisions are not acceptable."[37] With regard to subsection (d)(5), FEMA policy explains that for a code to be "deemed to be in effect" at the time of the disaster, "the code cannot be subject to discretionary enforcement by building or permitting officials."[38] Taken together with the fact that the FEMA JFO has delegated approval authority for PA projects, the regulations bestow upon that JFO a significant amount of subjective discretion in ascertaining whether or not a state's permitting standards meet the aforementioned regulatory criteria.

2. *Hazard Mitigation[39] under the PA Program*

Second, FEMA has also interpreted its authority under Section 406 to allow for reimbursement of additional hazard mitigation measures when required by the FEMA Regional Administrator as part of a PA project.[40] Under this provision, FEMA has funded additional mitigation measures in conjunction with the repair of a disaster-damaged facility when the measure will enhance the facility's ability to withstand damage in the future and where the mitigation measure is cost effective.[41] In order to be eligible for reimbursement, mitigation measures must be preapproved by FEMA for their cost-effectiveness and statutory and regulatory compliance.[42]

Per FEMA policy, mitigation measures are generally deemed to be cost effective if (1) they do not exceed 100 percent of the eligible cost of the eligible repair work, (2) will prevent future similar damage, (3) are technically feasible, and (4) are environmentally compliant.[43] Under Section 406 hazard mitigation, cost-effectiveness can be established even if the project's actual cost exceeds the structure's eligible cost if the additional cost mitigates future damage to the structure. The cost-effectiveness is determined by FEMA's Benefit Cost Analysis software, which takes into account the total project cost as compared to the total value of the benefits of the mitigation measures, including: (1) damage to the facility and its damaged contents, (2) emergency protective measures required as a result of that damage, and (3) temporary facilities required due to the damage.[44]

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[36] *Id*., at paragraphs VII.C.3.a. and b.

[37] *Id*., at paragraph VII.C.3.b.

[38] *Id*., at paragraph VII.C.5.b.

[39] Hazard mitigation measures are measures that are designed to mitigate (i.e., reduce or avoid) future damages to a facility. Climate change adaptations are measures that are designed to mitigate future impacts based upon projections of how impacts may intensify as the climate changes. The term hazard mitigation should not be confused with the term "mitigation," as it is ordinarily used in the climate context, to mean reducing greenhouse gas emissions to limit the magnitude or rate of long-term climate change. The term mitigation used throughout this paper refers to hazard mitigation.

[40] 44 CFR § 206.226 (e).

[41] 42 U.S.C. § 5172(e); *and Recovery Policy 9526.1, Hazard Mitigation Funding Under Section 406 (Stafford Act)*.

[42] *Hazard Mitigation Assistance Unified Guidance*; and *Recovery Policy 9526.1, Hazard Mitigation Funding under Section 406 (Stafford Act)* paragraphs VI.A.3 and 4.

[43] *Recovery Policy 9526.1, Hazard Mitigation Funding Under Section 406 (Stafford Act) at* Appendix A.

[44] *Id*., at paragraph VII.B.3.

B. The Dispute Over Reimbursement and the Ultimate Compromise

After the storm, Vermont's municipalities began to rebuild their infrastructure to the Vermont stream crossing permitting standards previously discussed. As they did so, they began to coordinate with FEMA's Vermont JFO for PA reimbursement. Townshend, a town of approximately 1,100 residents in Southeastern Vermont, replaced a pipe culvert that was destroyed during Irene. In compliance with the Vermont and ACE stream alteration standards, the town replaced a pre-existing pipe culvert that blew out during Irene with an open-bottom, pre-cast arch culvert that allowed for increased water flow relative to the previous structure and allowed for aquatic organism passage.[45] On March 27, 2012, the JFO sent the town an e-mail stating that FEMA would not fund the cost of the upgrade, attaching to that e-mail a document dated that same day entitled "FEMA DR-4022, Culvert/Bridge Guidance."[46] In that guidance, FEMA explained that they would only fund infrastructure upgrades necessary to meet specific requirements of reasonable and currently enforced codes and standards. The JFO deemed Vermont's stream alteration permitting process to be discretionary and not uniformly applied. As such, FEMA stated that it would only fund the least-cost structure that met specific hydraulic criteria, namely the pre-existing pipe-design.[47] In a two-page document, the JFO had in essence made a blanket determination not to fund any culvert upgrades based upon Vermont stream alteration permits, leaving nearly all such projects in the state deficiently funded. This decision left the town of Townshend with an immediate $100,000 deficit, and created a statewide deficit estimated at well over $3 million for the replaced culverts throughout the state.[48]

Vermont officials were displeased with FEMA's position, stating that the upgraded culverts were built to a mandatory state standard, were necessary to withstand future storms of the magnitude of Irene, and were beneficial to the natural and built environments.[49] Sue Minter, Vermont's Irene Recovery Officer at the time, cited the effects of climate change and the likelihood that Vermont would have more intense flooding events in the future as two factors that led the state to pursue "building back stronger."[50]

Using the culvert in Townshend as their flagship case, Vermont appealed the JFO's decision to FEMA's Region 1 Administrator. The appeal was denied by the Region 1 Administrator on the grounds that the state permits did not meet the standards set forth in the CFR in that they did not require any specific design or performance criteria which mandated the upgrades, and that they were discretionary in nature.[51]

Undeterred, the State of Vermont filed a second, final appeal with FEMA Headquarters via the Region 1 Administrator.[52] In a 25-page memorandum, complete with the approved ACE stream alteration permit

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[45] *Memorandum in Support of the Town of Townshend's Second Appeal from Project Worksheet 1803, Denying Public Assistance for the Dam Road Culvert, supra*, at 1.

[46] *Id*., at 2.

[47] Federal Emergency Management Agency, *FEMA DR-4022, Culvert/Bridge Guidance* (March 27, 2012).

[48] Telephone Interview with Dave Rapaport, Vermont Irene Recovery Officer, and Ben Rose, Vermont Public Assistance Officer (March 26, 2013).

[49] Vermont Public Radio, *FEMA Turns Down State's Request for Larger Culverts* (October 26, 2012), http://www.vpr.net/news_detail/96363/fema-turns-down-states-request-for-larger-culverts/; and Associated Press, *Vermont, FEMA Clash over New Culvert Funding*, (February 6, 2013), http://www.boston.com/news/local/vermont/2013/02/06/post-irene-vermont-wants-better-culverts/jxRfaG39f80AtR5NCiqTiP/story.html.

[50] *Id*.

[51] *Memorandum in Support of the Town of Townshend's Second Appeal from Project Worksheet 1803, Denying Public Assistance for the Dam Road Culvert*, *supra*, at 3.

[52] *See*, 44 C.F.R. § 206.46; *and* FEMA 322, *Public Assistance Guide*, *supra*, at 113.

as an appendix, Vermont argued that FEMA's denial of funding had violated both the letter and spirit of the Stafford Act and its implementing regulations.[53] Specifically, Vermont argued in part that: (1) the Vermont stream alteration statute was nondiscretionary and the permit merely implemented the statute, (2) that the permit was nondiscretionary because it required stream equilibrium and aquatic organism passage, (3) that FEMA was applying only hydrologic standards to the exclusion of sediment transport and ecological standards, (4) that the open bottom design was the least-cost means of complying with ACE permitting requirements, and (5) that FEMA was ignoring its responsibilities under Executive Orders 11988 and 11990, and 44 C.F.R. §§ 9 and 10, which collectively require FEMA to minimize or avoid activity that adversely affects floodplains and wetlands, and carry out its activities consistent with existing national environmental policies. Vermont also made a compelling public policy argument, stating that Vermont's statutorily required design standard was based on the most up-to-date science on hydrology, fluvial geomorphology, and ecological considerations. The state argued that FEMA's decision to only reimburse for the cost of replacing culverts to an outdated hydrology-only standard was a bad use of public dollars and bad public policy.[54]

On March 21, 2013, FEMA Headquarters answered Vermont's appeal, standing by the opinion of the Region 1 Administrator in stating that neither the Vermont statute nor the permit established any specific engineering design standards or measureable performance criteria against which FEMA could evaluate the regulatory requirements (namely that the standards be applicable, appropriate, reasonable, uniform, and timely required by 23 C.F.R. § 206.226(d)).[55] As such, the decision concluded that Vermont's stream alteration permits did not meet FEMA's regulatory requirements for an eligible standard.[56] Notably, the letter did not address FEMA's responsibilities under the aforementioned Executive Orders and 44 CFR § 9 and 10 to avoid activity that adversely affects floodplains and wetlands, and to carry out their activities consistent with environmental policies.

FEMA, however, ultimately granted Vermont relief. FEMA Headquarters reasoned that the Townshend culvert could be considered a Section 406 hazard mitigation project, and made a *sua sponte* finding[57] that the project was both cost-effective and technically feasible. FEMA agreed to reimburse the cost of the upgraded culvert with PA funding, waiving the pre-approval requirement in doing so.

As a result of the appeal, Vermont officials are currently in the process of reviewing all culvert projects which may qualify as 406 hazard mitigation and intend to resubmit the PWs that they believe meet the criteria set forth by FEMA in the appeal. FEMA will review each PW and make an independent, discretionary determination as to whether that specific project qualifies as 406 hazard mitigation; in particular whether that project is cost-effective.

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[53] Letter from Ben Rose, Vermont Public Assistance Officer, to Paul Ford, FEMA Acting Regional Administrator (December 18, 2012)(on file with author); and *Memorandum in Support of the Town of Townshend's Second Appeal from Project Worksheet 1803, Denying Public Assistance for the Dam Road Culvert*, *supra*.

[54] *See*, *Memorandum in Support of the Town of Townshend's Second Appeal from Project Worksheet 1803, Denying Public Assistance for the Dam Road Culvert*; *and* Telephone Interview with Dan Dutcher, Vermont Assistant Attorney General (February 28, 2013).

[55] Letter from Deborah Ingram, Assistant Administrator, FEMA Recovery Directorate, to Joe Flynn, Director, Vermont Emergency Management (March 21, 2013)(on file with author).

[56] *Id*.

[57] *Sua sponte* findings are made by an arbiter (e.g., a judge) without any prior request by the parties. BLACK'S LAW DICT. 993 (6th ed. 1991).

IV. Legal, Regulatory, and Policy Solutions

Vermont's towns, it seems, may have been spared the worst of the potential financial hardship because of the decision of FEMA Headquarters. In the wake of the Townshend appeal, both sides were able to claim a victory. FEMA, for its part, had stood its ground on its determination that the Stafford Act and its implementing regulations require states and municipalities to apply non-discretionary standards when requesting PA funding for upgraded infrastructure projects. FEMA is undoubtedly under pressure to protect scarce disaster relief funds from states or localities seeking to "gold-plate" rebuilt assets. Thus, FEMA's decision on the Townshend appeal prevents that decision from setting a precedent that could open strapped federal coffers to abuse after future disasters. Any allowable hazard mitigation measures must be pre-approved by FEMA and are subject to cost effectiveness requirements. Vermont (and its Congressional delegation which had extensively lobbied the Secretary of the Department of Homeland Security (DHS) and FEMA Administrator for a change in FEMA reimbursement determination) also welcomed the decision as good news, stating that it would allow Vermont's towns to rebuild from Irene in a resilient fashion that makes wise use of taxpayer dollars.[58]

However, should another storm of Irene's magnitude hit Vermont in the future the legal dispute over funding the rebuilding of any damaged infrastructure could repeat itself, albeit with both FEMA and the state a bit wiser as to the lay of the land. The chain of appeals and the ultimate mechanism chosen by FEMA to allow for reimbursement of the larger culverts leaves great ambiguity for other states about whether they will be reimbursed for upgrading assets to withstand increasing impacts from climate change. It is also not clear whether federal assistance can reliably be used to fund states and localities in their efforts to rebuild in a resilient fashion.

In light of the overwhelming scientific evidence that climate change will bring more extreme storms to states like Vermont, the Stafford Act may need to be amended to affirmatively give FEMA authority to reimburse states and municipalities for the additional cost needed to reconstruct in a way that is cost-effective and meets both modern resilience and environmentally compliant design standards. Fiscal and public policy would dictate that the federal government enables this type of adaptive reconstruction, if only out of a desire to protect the Treasury from having to pay to rebuild the same structure from repetitive damage as climate impacts intensify.

FEMA could also amend its regulations to clarify what are reasonable, uniform design standards that will be honored in the post-disaster recovery process. Modern design standards, such as Vermont's stream crossing standards often vary the design of a project based upon multiple site-specific factors. Such flexible design standards are often necessary to address the unique hydrological and environmental conditions present at different sites and necessary for different types of projects. FEMA's application of its regulations in the case of Vermont localities took a narrow interpretation of the Stafford Act and clearly cut against the overarching mandate that FEMA minimize impacts on floodplains and the environment.[59]

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[58] *See* Vermont.gov, *Gov. Shumlin: FEMA Agrees to Funding for Flood Resistant Culverts* (March 22, 2013), http://governor.vermont.gov/newsroom-fema-culvert-decision; *and* VT Digger, *FEMA Grants Funding Eligibility for Culvert Replacement in Townshend* (March 27, 2013), http://vtdigger.org/2013/03/27/fema-grants-funding-eligibility-for-culvert-replacement-in-townshend/.

[59] FEMA regulations require the agency to avoid, minimize, and mitigate floodplain and environmental impacts in both their operations and funding decisions. See 44 C.F.R. §§ 9-10. Executive Order 11988, Floodplain Management, also states that, "each federal agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities." Exec. Order No. 11988 (1977). Executive Order 11990, Protection of Wetlands, likewise dictates that federal agencies, "shall take action to minimize the

It should also be noted that DHS and FEMA have already made significant steps towards evaluating programs and policies in light of anticipated changes in the climate. In June 2012, DHS (FEMA was absorbed into DHS as of 2003) released its Climate Change Adaptation Roadmap. In that plan, DHS lists as one of its strategic objectives, "ensuring resilience to more frequent and extreme weather events."[60] The plan recognizes that current funding grants (*e.g.*, the Stafford Act) are not flexible enough to take into account sound rebuilding practices that account for changing conditions. The plan then directs FEMA to take key actions with regard to adaptation: (1) develop a climate change adaptation policy; (2) promote building standards with state and local governments that consider the future impacts of climate change and move away from the traditional reliance on historical data, including historical water flow; (3) develop a workforce that is educated about climate change.[61] By doing so, FEMA can ensure that it is enabling states and localities to rebuild in a manner that is resilient to future climate impacts, rather than hindering these efforts.

Although FEMA has a current climate change adaptation policy dated November 2011, the policy addresses only FEMA programs and lacks detailed direction on how to implement its directives in the field particularly with disaster relief programs.[62] Thus it is unlikely to be a true driver of adaptation in the post-disaster recovery environment. A revised climate change adaptation policy addressing the issues identified by DHS could allow FEMA to mainstream adaptation into the focus of its disaster relief mission. Directing staff to consider long-term climate risks as part of all discretionary decision-making would undoubtedly favor resilient rebuilding practices.

V. Comparison to the Federal-aid Highway Act Emergency Relief Program

FEMA's administration of the PA program can be contrasted to the Federal Highway Administration's (FHWA) administration of its Emergency Relief (ER) program authorized by Section 125 of the Federal-Aid Highway Act.[63] FHWA has taken steps to enable states to adapt to climate change impacts when rebuilding Federal-aid highways after a disaster. Under FHWA's ER program, states can be reimbursed for the costs to repair or reconstruct a "comparable facility".[64] A "comparable facility" is defined as a facility "that meets the current geometric and construction standards required for the types and volume of traffic that the facility will carry over its design life."[65] As such, the statute's use of the term "comparable facility" rather than pre-disaster design, allows for reconstruction of facilities that account for current state and local construction standards. Additionally, Section 125 may also allow FHWA to reimburse states to reconstruct facilities in a manner that will increase their resilience to impacts over the "design life" of the facility.[66]

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destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities." Exec. Order No. 11990 (1977).

[60] Department of Homeland Security, *Climate Change Adaptation Roadmap* (June 2012).

[61] *Id*.

[62] Federal Emergency Management Agency, *Climate Change Adaptation Policy Statement* (November 1, 2011).

[63] *See* 23 U.S.C. § 125; *and* 23 C.F.R. § 688.

[64] 23 U.S.C. § 125(a) and (d).

[65] 23 U.S.C. § 125(d)(2)(A).

[66] *See* Robert S. Kirk, CRS Report for Congress, R42804, *Emergency Relief Program: Federal Aid Highway Assistance for Disaster Damaged Roads and Bridges* at 4 (Nov. 2012).

To implement the ER program, FHWA has also adopted regulations that allow for "betterments" to facilities during rebuilding. FHWA defines betterments as "added protective features, such as rebuilding of roadways at a higher elevation or the lengthening of bridges, or changes which modify the function or character of a highway facility from what existed prior to the disaster or catastrophic failure, such as additional lanes or added access control."[67] Betterments may be allowed where there is clear economic justification that they will prevent future recurring damage, weighing the cost of betterment against the risk of eligible recurring damage and the cost of future repair.[68] Like Section 406 hazard mitigation, betterments must be approved by FHWA in advance.[69] The process for requesting ER is similar to requesting PA in that states first assess highway and road damage, prepare a report, and submit that report to the local FHWA Division Administrator (field office) for ER funding.[70] Once approved, the state can then make the specified repairs or reconstruction subject to final FHWA inspections.[71]

Taken on its face, the ER program gives FHWA more flexibility than the PA program gives to FEMA when it comes to funding measures needed to mitigate future impacts to reconstructed facilities. However, similar to the PA program, the ER program offers federal funding at the discretion of FHWA to reimburse states to rebuild a facility to either to its *pre-disaster design* or pursuant to current codes and standards in place at the time of the disaster. Additionally, the PA and ER programs also allow for funding of mitigation measures (or betterments) to reimburse states and localities for repairs that go above and beyond the pre-disaster design when those measures are necessary and cost-effective. In the case of Irene, however, state officials reported that FHWA allowed for the replacement of destroyed culverts situated on federal-aid highways in compliance with the state permitting standards without dispute.[72] This leaves open the question of why FHWA and FEMA interpret similar funding programs so differently when it comes to discretion over measures necessary to mitigate future hazards to the facility.

The answer may lie in agency policy and culture. The FHWA, an agency whose sole mission it is to construct, maintain and preserve the nation's highways, recently issued a forward leaning policy memorandum on climate change adaptation which allows state and local governments to consider climate change and weather events in developing their highway projects.[73] The policy explicitly states that structures on a federal-aid highway that are damaged by a presidentially-declare natural disaster are eligible for ER funding, and that reimbursement can include the costs of installing mitigation measures designed to reduce future damage, where those measures have been determined to be cost-effective. The cost-effectiveness of a measure is determined by taking into account the connection between the betterment proposed, the type of damage sustained, and the likelihood of future damage.[74] As an example of such betterments the memorandum lists deepening of channels and increasing the size or number of drainage structures, measures that clearly would have encompassed Vermont's upgraded, open bottom culverts.[75] As discussed earlier, there is no existing comparable FEMA policy. Although some of the

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[67] 23 CFR. § 688.103.

[68] 23 C.F.R. § 688.109(b)(1) and (6).

[69] 23 C.F.R. § 688.113(b)(i).

[70] 23 C.F.R. § 688.111.

[71] 23 C.F.R. § 688.113(b)(ii).

[72] Telephone Interview with Dave Rapaport and Ben Rose, *supra*.

[73] Memorandum from John R. Baxter, Associate Administrator for Infrastructure, Federal Highway Administration, *Eligibility of Activities to Adapt to Climate Change and Extreme Weather Events under the Federal Aid and Federal Land Highway Programs* (September 24, 2012).

[74] *Id*.

[75] *Id*.

restrictive provisions in the Stafford Act may be best fixed through legislative amendments to the statute, legislative fixes may not necessary to allow FEMA to authorize adaptive rebuilding with PA program funds. Similar to the method used by FHWA, FEMA could direct staff, through a climate change policy, to integrate adaptive reconstruction into their administration of disaster relief programs.

VI. Lessons Learned

Vermont state officials stress that preparation and training are the keys to successfully navigating any natural disaster.[76] Part of that preparation is having the proper legal and regulatory authorities in place to ensure FEMA will reimburse the state and municipalities for their expenditures when they begin to rebuild. In the context of PA, this means that states and municipalities need to take a hard look at state and local statutes and regulations governing the construction of public facilities and infrastructure and probe them for criteria that FEMA might interpret as not uniform or too discretionary. Although Vermont officials firmly believe that the state's stream alteration permit standards, as currently written, satisfy FEMA's regulatory criteria, the state is revising those standards and permitting processes to make them as detailed and objective as possible in order to avoid the same dispute in the future.[77] In particular, the state has proposed a rule to adopt specific design criteria (*e.g.*, opening size and alignment) to be considered for all new or rebuilt structural stream crossings. These considerations will be taken into account, along with water flow, sediment transport, and aquatic organism passage as required by the statute, so there will still be an independent analysis of each river crossing on the part of engineers based on these uniform criteria. As a final matter, the rule will require all stream crossing work to be reported to the state in all cases. This will allow the state's river management program to monitor stream crossing permits for consistent and uniform application.[78]

While the easiest solution from a purely legal perspective would be to simply mandate a set, worst-case hydrologic standard in the statutory or permitting standards, this would force the towns in certain circumstances to overbuild culverts that are then neither appropriate from an engineering perspective nor cost-effective. One example of such an approach is New Hampshire's 2009 stream crossing standards, which break stream crossings into three tiers based upon watershed size and then specify mandatory hydraulic and design criteria for each tier. In addition to taking into account such general factors as allowing for sediment flow and aquatic organism passage, the New Hampshire standards also mandate both water flow size for each tier (*e.g.*, will accommodate a minimum of the 50- or 100- year flood), and the design of the culvert (*e.g.*, closed or open bottom), unless such standards are not "practicable" taking into account cost, technology, and logistics.[79] While these standards might ultimately fare better under FEMA's interpretation of the Stafford Act's implementing regulations, Vermont is hesitant to put such standards in place as they would result in exactly the type of inflexible standards the state is trying to avoid under the current permitting scheme. Such inflexible standards might ultimately cost the towns more overall than under the current standards, since the towns might be required to overbuild in some cases where a large, open bottom culvert is not required based upon an engineering assessment of the site-

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[76] Telephone Interviews with Mike Kline, Dave Rapaport, Ben Rose, and Dan Dutcher, *supra*.

[77] Telephone Interview with Dan Dutcher, *supra*.

[78] Telephone Interview with Mike Kline, *supra*. (Note: on July 10, 2013 ANR published the proposed new rule which maintained the aforementioned statutory criteria and adopted flexible equilibrium and connectivity design standards.)

[79] University of New Hampshire, *New Hampshire Stream Crossing Guidelines* (May 2009); *and* New Hampshire Department of Environmental Services, *Permitting Background and Stream Crossing Rules Outreach Presentation* (Fall 2010), *available at* http://des.nh.gov/organization/divisions/water/wetlands/documents/stream-rules-presentation.pdf.

specific conditions.[80] The New Hampshire-type approach could also be deemed unreasonable under FEMA's eligibility criteria (*See*, 44 C.F.R. § 206.226(d)(3)(i)).

In addition to ensuring that state standards are consistent with FEMA's interpretation of its regulations, Vermont state officials recommend better coordination with FEMA staff, such as asking questions of FEMA before taking any actions that would result in an expenditure of funds. While local FEMA representatives were generally helpful and knowledgeable, many times officials and residents would ask a question and be given an answer, only to find out later, and to their detriment, that the answer was wrong.[81] In the case of the post-Irene recovery, the approach of Tropical Storm Lee only 10 days later exacerbated the coordination problem because many towns had to move quickly to remove debris and repair infrastructure in anticipation of a second big storm hitting the state. They therefore could not wait for a second opinion.[82]

2011 also set a record for federal disaster declarations, with 99 major declarations in total, 18 more than the next highest total in 1953.[83] This undoubtedly led to some amount of "disaster fatigue" on the part of FEMA, with the agency's workforce stretched thin. To combat this problem in the aftermath of Irene, FEMA rotated its staff in and out of the affected area on cycles akin to military deployments. However, when combined with the amount of discretion placed in the hands of the JFO as discussed above, these constant personnel shifts resulted in a lack of institutional knowledge and would often lead to conflicting or inconsistent guidance from personnel in the field.[84] Thus, a favorable funding position taken by one FEMA employee as to a particular issue would not necessarily be the same position taken by his or her relief.

As evidenced by FEMA's ultimate decision in the Townshend appeal, it is also critical for state and local municipalities to explore the feasibility of all funding sources. The PA program is just one source of disaster relief funding. Hazard mitigation funding is also available through Section 404 of the Stafford Act and these funds can be used to undertake cost-effective activities to reduce flood losses.[85] As discussed earlier, FHWA ER may also be available if the road is designated as a federal-aid highway. Additionally, Community Development Block Grant (CDBG) funds, in a program administered by the Department of Housing and Urban Development (HUD), are often appropriated to fund disaster recovery efforts. In the disaster relief arena, CDBG provides flexible grants to help states and municipalities recover from officially declared disasters through a broad range of eligible activities.[86] In the case of Irene, Vermont received about $21 million in CDBG funding.[87] Vermont then drafted a CDBG action plan with a proposed distribution of those funds across a wide variety of needs to include economic

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[80] Telephone Interview with Mike Kline, *supra*.

[81] Vermont Public Radio, *Owners Of Demolished Houses May Be Ineligible for Federal Funds* (March 25, 2013), http://www.vpr.net/news_detail/97905/owners-demolished-houses-may-be-ineligible-for-fed/.

[82] Vermont Public Radio, *Towns Still Seeking FEMA Reimbursement for Irene Debris Removal* (June 27, 2012), http://www.vpr.net/news_detail/94977/towns-still-seeking-fema-reimbursement-for-irene-d/.

[83] Federal Emergency Management Agency, *Disaster Declarations by Year*, http://www.fema.gov/disasters/grid/year (last visited April 18, 2013).

[84] Telephone Interview with Dave Rapaport and Ben Rose, *supra*.

[85] *See* note 28, supra.

[86] *See* HUD.gov, *CDBG Disaster Recovery Assistance*, http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/drsi (last visited April 5, 2013).

[87] *See,* State of Vermont, *Vermont's CDBG Disaster Recovery Action Plan* (July 20, 2012).

recovery, housing, infrastructure, and planning.[88] The cost of the rebuilding needs of the state well exceeded the amount of the grant, so the state was ultimately unable to use CDBG to cover all of the additional costs needed to upgrade culverts in the state that were denied by FEMA. In addition, Vermont was hesitant to use its CBDG grants for the purpose of infrastructure because the funds are a one-time injection of federal funding and using them for the purpose of making up costs that should rightfully be covered under the PA program limits the use of these funds for other recovery purposes, such as business development.

It should be noted that the Sandy Supplemental Appropriation legislation that was passed on January 29, 2013 includes some amendments to the Stafford Act that may provide greater flexibility for FEMA to allow for adaptive rebuilding in Sandy-affected areas and in response to future disasters. In particular, the legislation creates a pilot arbitration program that allows communities to arbitrate PA funding disputes of not less than $1 million before an independent panel.[89] The relevant provision of the legislation, Section 1105, went into effect 180 days after its passage on January 29, 2013, and does not limit arbitration to communities affected only by Sandy or to funds provided through the Sandy Supplemental.[90] Thus, Irene-affected communities could use this provision should FEMA deny reimbursement for other culvert-replacement projects. This provision sunsets on December 31, 2015.[91]

Finally, states should be prepared to implement their own climate change adaptation and resilience policies if they have not done so already. VTrans' adaptation plan was developed in 2008 and is currently under revision. The draft revised plan will assess the threats, vulnerabilities, and risks to the transportation sector and develop plans to improve the adaptive capacity of the system.[92] As part of this process, VTrans is identifying high-risk flood and erosion zones with Light Detection And Ranging (LIDAR) data, developing flood resiliency training programs, and preparing transportation resiliency plans.[93] VTrans is also exploring new ideas such as updating project prioritization guidelines and updating its hydraulics manual to include best practices for incorporating consideration of climate change.[94] While the plans acknowledge that not all changes will be easy to implement, such initiatives are a step in the right direction toward making the state's infrastructure more climate resilient.

VII. Conclusion

The impacts of climate change have forced states and municipalities to adapt to new and emerging threats to their infrastructure. Vermont and other similarly minded states have recognized these threats and begun to consider these anticipated impacts in their planning, and as a critical consideration in the design and construction of infrastructure. While the need to adapt becomes even more evident in the wake of a major disaster such as Irene, such disasters also present opportunities for states to rebuild resiliently.

As this case study has shown, FEMA has the potential to support these efforts, but the agency's outdated methodologies, wide discretion, and pressure to protect the public purse have frustrated these efforts in past disasters. Statutory and regulatory changes should be made to rein in this discretion and direct FEMA to recognize local design standards that are adaptive in nature, thereby making more efficient use

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88 *Id*.

89 Sandy Recovery Improvement Act of 2013, Pub. L. No. 113-2, 127 Stat 43, § 1105 (2013).

90 *Id*.

91 *Id*.

92 *See*, Gina Campoli, *VTrans Climate Change Adaptation White Paper Topic Outline* (March 2011); *and* Jacob Ebersole, *Transportation and Climate Change in Vermont* (February 2013).

93 *Id*.

94 *Id*.

of taxpayer dollars. Agency plans and policies reflecting the reality of climate change and its impacts should also be implemented to shift FEMA's disaster relief focus from that of simply helping a state get back on its feet, to one of actively preparing a state and its municipalities for future storm events that may be more frequent and intense. As evidenced by DHS' 2012 Climate Change Adaptation Roadmap and Vermont's experience with FHWA, the tools are already in place for this shift to occur.

Until this shift does take place, Vermont's battle over the funding of upgraded culverts in the wake of Tropical Storm Irene provides important lessons for other states and municipalities who may be placed in similarly difficult straits as they rebuild after future disasters. Irene surely dealt a heavy blow to the State of Vermont in terms of human, infrastructure, and environmental costs. While the science predicts that more storms of the magnitude of Irene may be in Vermont's future, the state will have rebuilt resiliently in a way that may protect communities and residents from events of Irene's magnitude in the future.

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