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New Challenges for Urban Areas Facing Flood Risks

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NEW CHALLENGES FOR URBAN AREAS FACING FLOOD RISKS

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A flood doesn't exist except in our memory banks. It's a temporal event. It is not the river and it's not the land. It's neither here nor there.[1]

INTRODUCTION

Hurricane Sandy has delivered another painful reminder that urban areas need to find new ways to confront the increasingly difficult task of flood preparation. A flood occurs "when water runoff from the land exceeds the capacity of the stream channel."[2] Excepting the Inner Mountain West and Southern California, a map of vulnerable flood areas picks up almost all major urban areas in the United States.[3] Between 1929 and 2003, urban floods in the United States caused an estimated $171 billion in property damage.[4] Floods have caused the most losses of any natural disaster in the United States.[5] Billions of dollars have been invested in flood prevention structures. But, as "first responders" in the battle to prevent and respond to flood damage, local governments will see urban flood damages rise for four primary reasons. First, federal flood control policy over eighty years has created the illusion that infrastructure and post-disaster relief can provide maximum protection from flood damages.[6] Second, more cost-effective avoidance strategies, such as

1. Carol Kino, *Maya Lin's New Memorial is a City*, N.Y. TIMES, Apr. 25, 2013, http://www.nytimes.com/2013/04/28/arts/design/maya-lins-here-and-there-at-pace-gallery.html?pagewanted=all&_r=0. Maya Lin considered the floods associated with Hurricane Sandy a wake-up call to reconsider how we should live with nature in the future. *Id.* For a thorough analysis of why this will be difficult, see Jedediah Purdy, *American Natures: The Shape of Conflict in Environmental Law*, 36 HARV. ENVTL. L. REV. 169 (2012), and for a fictional view of what Mother Nature may have in store for the United States, see NATHANIEL RICH, ODDS AGAINST TOMORROW (2013).

2. JAMES M. WRIGHT, NATIONAL ASSOCIATION OF FLOOD PLAIN MANAGERS, THE NATION'S RESPONSES TO FLOOD DISASTERS: A HISTORICAL ACCOUNT 12 (2000), *available at* http://www.floods/org/PDF/hist_fpm.pdf.

3. *See Flooding: Devastating Floods and Heavy Rains*, NAT'L RES. DEF. COUNCIL, www.nrdc.org/health/climate/floods.asp (last visited Oct. 14, 2013) (presenting the map of vulnerable flood areas).

4. *National Flood Damages*, U.S. ARMY CORPS ENGINEERS, http://www.corpsnedmanuals.us/FloodDamageReduction/FDRID008NatlFldDamage.asp (last visited Oct. 14, 2013).

5. ASS'N OF STATE FLOOD PLAIN MANAGERS, FLOOD MAPPING THE NATION: A COST ANALYSIS FOR THE NATION'S FLOOD MAP INVENTORY 3 (2013) (citing NAT'L RESEARCH COUNCIL, MAPPING THE ZONE: IMPROVING FLOOD MAP ACCURACY (2009)).

6. WRIGHT, *supra* note 2, at 12 (citing DENNIS S. MILETI, DISASTER BY DESIGN: A REASSESSMENT OF NATURAL HAZARDS IN THE UNITED STATES (1999)) ("[T]he . . . flood control laws of the early 20th century, were due, in part, to the prevailing view

less intensive flood plain development and restoration, have been undermined by the federal flood insurance program, which has encouraged intense development in river and coastal flood plains instead of redirecting it to less vulnerable areas.[7] Third, global climate change is projected to produce more intense flood and coastal storm surge events.[8] Fourth, damage prevention responsibility is being de facto devolved to local governments as the federal government and the states, with notable exceptions, are investing less of the scant, available dollars in flood infrastructure construction.[9]

This Article examines the challenges and opportunities that urban areas face in developing effective flood control strategies in light of climate change and decreasing federal and state flood control expenditures.[10] The evolution of flood control policy and law in the United States reveals a gradual shift in thinking from the concept of "maximum protection," provided largely by the federal government, toward the notion that flood damage must be viewed as a risk that can be minimized, but not totally avoided. These risks can be managed at the local and regional level under the principles of

that we could build our way out of almost any problem, with engineers revered in American society then as only rock stars and sports heroes are today. Many still believe technology can be used to control nature, although engineers no longer enjoy such reverence in our society.").

7. Retreat from areas vulnerable to floods has been an integral part of flood damage prevention strategy since Gilbert White's pioneering work in the 1940s, discussed *infra* notes 96–99. Retreat runs through all modern discussions of flood management. *See, e.g.*, WORLD HEALTH ORG., FLOODS: CLIMATE CHANGE AND ADAPTATION STRATEGIES FOR HUMAN HEALTH 6 (2002), *available at* http://www.wmo.int/pages/prog/wcp/wcasp/meetings/documents/floodresult.pdf ("Disincentives to building in flood plains are also likely in the future with the refusal of insurance companies to insure new developments.").

8. *See infra* notes 78–88 and accompanying text.

9. See ROBERT A. CARO, THE YEARS OF LYNDON JOHNSON: THE PATH TO POWER 369 (1990).

10. To limit the Article's scope, we draw a somewhat artificial distinction between floods and flooding. Flooding, as we define it, refers to localized accumulations of water from the small-scale alteration of land surfaces and stream channels. To a victim, unwanted water is unwanted water. Existing laws do much less to encourage the prevention of damage from major river and coastal floods than the variety of legal doctrines and statutes that address liability for localized flooding damage. *See, e.g.*, Stillwater of Crowne Point Homeowners Ass'n v. Kovich, 865 F. Supp. 2d 922, 946 (N.D. In. 2011) (holding the city liable for issuing permits to block flow of creek in violation of state Flood Control Act); *see also* Maxine Burkett, *Litigating Climate Change: Adaptation: Theory, Practice, and Corrective (Climate) Justice*, 42 ENVTL. REP. NEWS & ANALYSIS 11144, 11152–56 (2012), *available at* http://elr.info/news-analysis/42/11144/litigating-climate-change-adaptation-theory-practice-and-corrective-climate.

integrated flood plain management (IFPM). Integrated flood plain management uses a combination of structural measures, flood management to produce less intensive flood plain development, and flood plain restoration to reconnect rivers to their flood plains to take advantage of the landscape's ability to retard the spread of water.[11] While the United States has not developed comprehensive or mandatory requirements regarding flood management or the use of IFPM, the European Union's Floods Directive requires its member states to develop risk-based flood management.[12] With the EU Floods Directive as a framework for assessing innovative local approaches to flood management, this Article argues that flood management theory has advanced considerably but that flood management practice has not kept the pace needed to avert massive flood damages.

Part I of this Article surveys the flood risks that local governments confront during "normal" flood events as well as from climate change. Part II briefly traces the evolution of United States flood control policy from local responsibility to the federal government and back to local governments in partnership with state and federal governments. This shift reflects the growing recognition that effective flood control requires partnerships among multiple levels of government that can each contribute distinct expertise and resources. Part III addresses the available options for local governments, as they play a more prominent role in flood management. Part IV reviews innovative local or regional flood damage prevention programs in Fargo-Moorhead, North Dakota, Cedar Rapids, Iowa, and Sacramento, California, and it evaluates these programs against the emerging model of integrated flood plain management.

11. NAT'L WILDLIFE FED'N, CHANGING COURSE: WHY PROTECTING FLOOD PLAINS IS GOOD FOR PEOPLE AND WILDLIFE 28 (2013). This idea is very slowly being put into practice in the Puget Sound area of Washington State after a Biological Opinion for the National Flood Insurance Program defined "the minimum requirements necessary to prevent further harm to floodplain habitat from new development." *Id.* To implement the opinion, "FEMA must revise its implementation of the NFIP in Puget Sound to fully comply with the requirements of the Biological Opinion and the Endangered Species Act. This includes making flood insurance rate maps more accurate and incorporating future conditions such as climate change . . . ." *Id.*

12. *See infra* notes 146–56 and accompanying text.

I. URBAN AREAS FACE INCREASED FLOOD RISKS

"Water draws people to it."[13] Rivers operate to channel rainwater and move it to the sea or to a closed basin. When the amount of water exceeds the channel capacity, the water flows on to adjoining land, the flood plain. In places such as Ancient Egypt, flood cycles were originally seen as blessings because they sustained riverine ecosystems and the flood plain economies dependent on them.[14] Floods caused social problems when they did not come.[15] However, as more people settled in flood plains, floods became a social problem because they both disrupted agricultural production and caused extensive damage to settlements. Nations such as China soon responded by accepting flood control responsibility.[16]

Most inland United States urban settlements were drawn to the advantages of rivers and lakes.[17] These areas face three types of flood risks. The first is that heavy rain events have always been are part of "natural" climate variability.[18] Factors such as cyclical changes in the temperature of the surface of the sea can both decrease and increase precipitation.[19] Second, climate change is projected to exacerbate flood risks because heavier, prolonged rain events will occur. Similar to all climate change science controversies, debate persists about the impact that rising greenhouse levels have on flood events.[20] The authoritative United States Geological Service recently found only the Southwest, the region least vulnerable to floods, showed a relationship between increased CO_2 levels and the size of floods over

13. WRIGHT, *supra* note 2, at 3.

14. TOBY WILKINSON, THE RISE AND FALL OF ANCIENT EGYPT 29 (2010).

15. *Id.*

16. The construction of dykes to halt the spread of flood waters and to increase the current to flush silt downstream dates back to at least the tenth century C.E. in China. RANDALL A. DODGEN, CONTROLLING THE DRAGON: CONFUCIAN ENGINEERS AND THE YELLOW RIVER IN LATE IMPERIAL CHINA 14 (2001) (explaining that efforts to control flooding on the Yellow River using levees and canals were documented as early as the tenth century B.C.E.).

17. *See, e.g.*, JOHN REPS, TOWN PLANNING IN FRONTIER AMERICA 59 (1965).

18. Martin Hoerling et. al., *Regional Precipitation Trends: Distinguishing Natural Variability from Anthropogenic Forcing*, 23 J. CLIMATE 2131, 2143 (2010), *available at* http://dx.doi.org/10.1175/2009JCLI3420.1.

19. *Id.* at 2142.

20. Part of the problem is that current General Circulation Models "are not designed to provide information" at the scale "for making flood planning decisions." EPA & CAL. DEP'T OF WATER RESOURCES, CLIMATE CHANGE HANDBOOK FOR REGIONAL WATER PLANNING 5–57 (2011), *available at* http://www.water.ca.gov/climatechange/docs/Climate_Change_Handbook_Regional_Water_Planning.pdf.

the past 100 years.[21] In the end, the causal debate is largely irrelevant for urban areas. Extreme weather events, such as floods, have clearly increased.[22] Because the international community has been unable to agree on an effective mitigation strategy, the only choice for at-risk areas is to adapt by trying to minimize the possible adverse consequences. The primary consequence for all those involved in flood management is that historic assumptions of stationarity have been undermined. Hydrology has long assumed that water behaves in a predictable fashion and that variations in floods and droughts occur within a relatively narrow band.[23] As applied to flood control, the Federal Emergency Management Agency (FEMA) has required that flood plain maps and land use regulation rely on the concept of the 100-year flood.[24] A 100-year flood is a flood that has a probability of occurring once in a 100 years. The standard has been widely criticized because it gives the false illusion that such a flood will in fact occur only every 100 years.[25] Floods are much more variable and climate change will produce more "statistically frequent"[26] and more extreme flood "events."

The third problem is the legacy of past local, state and federal flood control strategies. The country's investment in levees, dams and floodways have prevented damage, but they also have had a perverse effect: structural flood plain protection encourages more settlement, which in turn increases the number of people and property impacted

21. U.S. Dept. of the Interior, *Have Floods Changed with Increasing CO2 Levels?*, U.S. GEOLOGICAL SURV. (Oct. 24, 2011), http://www.usgs.gov/newsroom/article.asp?ID=3006 (discussing Robert Hirsch & K.R. Ryberg, *Have Floods Changed With Increasing CO2 Levels?*, 57 J. HYDROLOGIC SCI. 1 (2012)).

22. Sarah Lyall, *Heat, Flood or Icy Cold, Extreme Weather Rages Worldwide*, N.Y TIMES, Jan. 10, 2013, http://www.nytimes.com/2013/01/11/science/earth/extreme-weather-grows-in-frequency-and-intensity-around-world.html.

23. Robin Kundis Craig, "*Stationarity is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 33 HARV. ENVTL. L. REV. 9, 37 (2010).

24. The concept dates to 1973 and was a compromise between Corps of Engineers flood estimates for dams and levees, which ranged from 200 to 500 year events, and calculations that cities used to construct storm water run-off facilities. FEMA, THE 100 YEAR FLOOD MYTH, *available at* http://training.fema.gov/EMIWeb/edu/docs/hazrm/Handout%203-5.pdf.

25. Jessica Ludy & G. Matt Kondolf, *Flood Risk Perception in Lands Protected by 100-Year Levees*, 61 NAT. HAZARDS 829, 831–32 (2012), *available at* http://www.floods.org/ace-files/documentlibrary/Hot_Topics/LudyKondolf2012_FloodRiskPerceptionPaper.pdf; *see also* Rodger Pielke, Jr., *Nine Fallacies of Floods*, 42 J. CLIMATE CHANGE 413, 416 (1999), *available at* http://sciencepolicy.colorado.edu/admin/publication_files/resource-78-1999.15.pdf.

26. *Id.* at 418.

when a flood occurs.[27] The result is a classic moral hazard problem. A moral hazard is a socially undesirable, often inefficient, behavior encouraged by the expectation that it will not be punished and often will be rewarded.[28]

The moral hazard problem is especially acute in flood prone areas where the existence of levees often leads to an illusionary sense of safety for flood plain residents. The illusion is a dangerous one, because our infrastructure is old and increasingly unsafe. Congress acknowledged this problem when, in 2007, it ordered the United States Army Corps of Engineers (the Corps) to undertake an assessment of levees over which it has oversight, including levees initially constructed by the Corps and subsequently turned over to the states.[29] A 2013 follow-up Associated Press article, based on Freedom of Information Act requests, found that "[i]nspectors taking the first-ever inventory of flood control systems overseen by the federal government have found hundreds of structures at risk of failing and endangering people and property in 35 states."[30] Many dams are also

27. *See infra* notes 100–08 and accompanying text.

28. RICHARD POSNER, AN ECONOMIC ANALYSIS OF LAW 136–37 (8th ed. 2011). The concept originated with insurance company efforts, such as deductibles, to induce beneficiaries to refrain from activities that would trigger the liability under policy.

29. Water Resources Development Act of 2007 Pub. L. No. 110-114, § 2035, 121 Stat. 1041, 1091 (codified at 33 U.S.C. § 2344 (2006)). The Army Corps determined that 122 levees under its control were at risk of failure. NAT'L RESEARCH COUNCIL, LEVEES AND THE NATIONAL FLOOD INSURANCE PROGRAM: IMPROVING POLICIES AND PRACTICE, at ix (2013), *available at* http://www.nap.edu/openbook.php?record_id=18309&page=R1.

30. John Flesher & Cain Burdeau, *AP Impact: Deficient Levees Found Across America*, ASSOCIATED PRESS, Jan. 17, 2013, http://bigstory.ap.org/article/ap-impact-deficient-levees-found-across-america. Not even New Orleans' upgraded levees are completely safe. The $10 billion upgrade of the levees around New Orleans has provided greater security but is not keeping pace with their rate of changing risk according to a report commissioned by the South Louisiana Flood Protection Authority-East. Mark Schleifstein, *New Orleans Area Levee Improvements Already Outpaced by Science, Engineering, Engineer Says*, TIMES-PICAYUNE (New Orleans), Jan. 17, 2013, http://www.nola.com/environment/index.ssf/2013/01/science_engineering_already_ou.html. The report, which is intended to guide future upgrades of the system, notes that risk factors such as soil subsidence and sea level rise are unfolding at higher rates than designers had hoped and planned for. Without additional enhancements or changes to development patterns the area could face higher flooding risks and the potential for changes in its eligibility for flood insurance. The Association of Civil Engineers' 2013 Report Card of America's Infrastructure gave the grade of D-, at risk, to the condition of levees in the United States. *See 2013 Report Card of America's Infrastructure: Levees*, AM. SOC'Y CIV. ENGINEERS, http://www.infrastructurereportcard.org/a/#p/levees/overview (last visited Oct 14, 2013).

unsafe.[31] Post-flood compensation available through flood insurance and ad hoc disaster payments from the federal government feed the illusion and subsidize the cost of moral hazard behavior.[32] The rub is that "since lump-sum government-relief payments usually do not relate to risk, no incentives are provided to potential victims to take effective preventative measures."[33]

II. FLOOD CONTROL POLICY: LOCAL OR FEDERAL RESPONSIBILITY?

Flood control in the United States sprung up locally as the need to halt the water arose. Over time, the federal government has taken a larger or smaller role in the endeavor depending on the reigning philosophy and resources. In the nineteenth century, Jeffersonian ideologies ensured that flood damage prevention was a local or state responsibility.[34] That legacy is still with us. Today, the United States still has no unified levee system; there are over 100,000 miles of levees in various states of disrepair and deterioration, and eighty-five percent are locally owned.[35] In the twentieth century, many cities began relying more heavily on the federal government to protect them from flood damage through upstream storage reservoirs and

31. *See* JEFFREY OPPERMAN ET AL., INTEGRATED FLOODPLAIN-RESERVOIR MANAGEMENT AS AN ECOSYSTEM-BASED ADAPTATION STRATEGY TO CLIMATE CHANGE (2011), http://ecosystemcommons.org/sites/default/files/andrewwarner_floodplains_climate_change.pdf; *see also Report Card of America's Infrastructure: Dams*, AM. SOC'Y CIV. ENGINEERS, http://www.infrastructurereportcard.org/a/#p/dams/overview (last visited Oct 14, 2013) (noting that the average age of the 84,000 dams in the United States is fifty-two years old).

32. *See* David R. Conrad & Edward A. Thomas, *Reforming Federal Support for Risky Development*, *in* THE HAMILTON PROJECT: 15 WAYS TO RETHINK THE FEDERAL BUDGET 4 (2013) (advocating for the elimination of federal subsidies for risky development, including grants for infrastructure development and assumption of costs for individual property losses in the wake of a catastrophe, because these subsidies incentivize risky behavior).

33. Véronique Bruggeman et al., *Insurance Against Catastrophe: Government Stimulation of Insurance Markets for Catastrophic Risk*, 23 DUKE ENVTL. L. & POL'Y F. 185, 208 (2012).

34. *See generally* A. Dan Tarlock, *United States Flood Control Policy: The Incomplete Transition From the Illusion of Total Protection to Risk Management*, 23 DUKE ENVTL. L. & POL'Y F. 151, 158 (2012); *see also* ROBERT KELLEY, BATTLING THE INLAND SEA: FLOODS, PUBLIC POLICY, AND THE SACRAMENTO VALLEY (1989) (telling the story of the increasing centralization and scale of flood control in California's Sacramento River Valley).

35. *2013 Report Card of America's Infrastructure: Levees: Conditions & Capacity*, AM. SOC'Y CIV. ENGINEERS, http://www.infrastructurereportcard.org/a/#p/levees/conditions-and-capacity (last visited Oct. 14, 2013).

levee systems. For the first six decades of the twentieth century, increased understanding of river hydrology[36] and the development of engineering technology for large dams increased the options for structural flood control. These developments paved the way for the acceptance of a powerful, central state in the twentieth century as the entity to control nature,[37] thus promoting human progress. But, since the rise of the environmental movement in the late 1960s, which strongly opposed new dams, the federal government decreased its investment in water resources development, although flood control projects remain politically popular.[38] The federal investment in proactive flood control measures has further decreased.[39] In addition, the recognition that local governments have a better understanding of local conditions has contributed to the shift away from federal responsibility and towards multi-level governmental or local responsibility.[40]

A. The Transition from Local to National Control

The ancient technique of levee construction was used extensively in the United States in the nineteenth century, especially along the lower Mississippi. New Orleans began constructing levees even earlier, some time between 1718 and 1727.[41] After the Civil War, a battle between two competing flood control theories, levees designed

36. *See generally* NAT'L RESEARCH COUNCIL, OPPORTUNITIES IN HYDROLOGIC SCIENCES (1991), *available at* http://www.nap.edu/catalog.php?record_id=1543 (tracing the development of hydrologic sciences from the Greeks to the present day).

37. *See* MICHELE LANDIS DAUBER, THE SYMPATHETIC STATE: DISASTER RELIEF AND THE ORIGINS OF THE AMERICAN WELFARE STATE (2012) (tracing the evolution of the central premise of federal disaster relief: disaster victims are the moral equivalent of victims of an act of God).

38. *See infra* Part III.

39. *See* D. ANDREW AUSTIN, TRENDS IN DISCRETIONARY SPENDING 27 (2012) ("Spending in some policy areas, such as community and regional development, agriculture, natural resources and environment, and general government, has grown very slowly or has been cut. Spending in other areas, such as war costs, veterans' programs, international affairs, and Medicare administration has expanded rapidly in the last decade."); *see also* STATE OF CALIFORNIA ET AL., CALIFORNIA'S FLOOD FUTURE: RECOMMENDATIONS FOR MANAGING THE STATE'S FLOOD RISK 3–4 (2013) ("[M]ost agencies believe that Federal funding programs will be reduced, if not eliminated. Reductions in Federal spending signal that USACE might not continue to fund studies or ongoing projects at the same rate as in the past.").

40. *See infra* notes 74–83.

41. J. David Rogers, *Evolution of the Levee System Along the Lower Mississippi River*, MO. UNIV. SCI. & TECH., http://web.mst.edu/~rogersda/levees/Evolution%20of%20the%20Levee%20System%20Along%20the%20Mississippi.pdf (last visited Oct. 14, 2013).

to deepen the channel versus jetties at the mouth of the river, raged.[42] The Corps, which had begun to link levee construction with its then sole mission of navigation enhancement along the River, opted for a "levees only" policy.[43]

The "levees only" approach prevailed until the Great Mississippi flood of 1927 revealed its flaws. The Corps's policy could not prevent flood damage, in part, because coverage was fragmented due to the failure of local governments and private parties to coordinate their projects.[44] In 1879, the Mississippi River Commission was formed to address this problem and, in 1882, it adopted a coordinated levee construction policy.[45] However, this strategy failed because the Corps could not compel the construction of a coordinated system.[46] In 1917, Congress took a first step toward federal responsibility for flood prevention with the passage of the Flood Control Act of 1917 (1917 Act).[47] The 1917 Act authorized federal levee construction but only on the condition that the levees would be turned over to local interests for maintenance.[48]

It took the 1927 Mississippi River flood to change fundamentally United States policy. The response to the 1927 flood led directly to increased federal responsibility. The Flood Control Act of 1928 (1928 Act)[49] made flood control a Corps mission of equal if not greater

42. *See* Christine A. Klein & Sandra B. Zellmer, *Mississippi River Stories: Lessons from a Century of Unnatural Disasters*, 60 SMU L. REV. 1471, 1479 (2007) (describing the "levees-only" theory); *see also* Richard G. Weingardt, *James Buchanan Eads*, 5 LEADERSHIP & MGMT. IN ENGINEERING 70, 73 (2005).

43. For a history of the alternative theory which involved working with natural riverine processes, and dominated nineteenth century flood control theory, see JEREMY PURSEGLOVE, TAMING THE FLOOD: A HISTORY AND NATURAL HISTORY OF RIVERS AND WETLANDS 150 (1988). *See generally* Weingardt, *supra* note 42.

44. *See* MISS. RIVER COMM'N, THE MISSISSIPPI RIVER & TRIBUTARIES PROJECT: HISTORY OF THE LOWER MISSISSIPPI RIVER LEVEE SYSTEM 5 (2007), *available at* http://www.mvd.usace.army.mil/Portals/52/docs/Levees%20info%20paper.pdf.

45. *Id.* at 6.

46. *See* Klein and Zellmer, *supra* note 42, at 1482–83.

47. Flood Control Act of 1928, ch. 569, 45 Stat. 534 (codified as amended at 33 U.S.C. §§ 702a–702m, 704 (2006)).

48. *Id.* § 1(d).

49. Flood Control Act of 1928, ch. 569, 45 Stat. 534 (codified as amended at 33 U.S.C. §§ 702a–702m, 704 (2006)). Section 2 stated that in view of the extent of national concern for the control of these floods in the interests of national prosperity, the flow of interstate commerce, and the movement of the United States mails; and, in view of the gigantic scale of the project, involving flood waters of a volume and flowing from a drainage area largely outside the States most affected, and far exceeding those of any other river in the United States, no local contribution to the

importance to navigation and forced the Corps to recant its long-standing opposition to the Progressive Conservation idea of basin-wide, multiple purpose water projects.[50] The 1928 Act itself continued the levees only policy, but took a major step toward federal responsibility for comprehensive river basin management by authorizing $325 million for the federal construction of levees and outlets on land subject to flood easements.[51] More importantly, the 1928 Act laid the foundation for the construction of upstream reservoirs and formally committed the Corps to the Progressive Conservation Era vision of a river basin-wide approach to water management. For the first time, the Corps was directed to include "the establishment of a reservoir system" in its basin-wide planning for the Mississippi.[52]

Flood control dams date from the third or second millennium B.C.E.,[53] but they did not come into widespread use until the nineteenth century in Europe.[54] In the United States, the modern flood control dam is the legacy of a visionary engineer, Arthur Morgan.[55] In response to the disastrous 1913 flood in Dayton, Ohio,[56] Morgan convinced the city to build upstream flood control storage

project therein adopted was required. However, Congress did not expressly endorse federal responsibility until 1936. *See infra* notes 64–69.

50. Klein & Zellner, *supra* note 42, at 1484–85.

51. Flood Control Act of 1928, ch. 569, 45 Stat. 534, 535.

52. *See* 33 U.S.C. § 702j (2006). The roots of the legislation go back to the Act of Mar. 3, 1925, ch. 467, 43 Stat. 1186, 1190 (1925), which mandated joint Federal Power Commission and Corps studies of the feasibility of power development on navigable streams. The resulting 308 studies, H.R. Doc. No. 69-308 (1927), laid the foundation for the subsequent expansion of the Corps's planning responsibility and mission expansion.

53. *See* Robert B. Jansen, *Dams from the Beginning*, U.S. SOC'Y ON DAMS, ussdams.com/ussdeducation/Media/damsfrombegin.doc (last visited Oct. 14, 2013) (discussing the early history of dams, especially dam projects on the Nile River); *see also* STEVEN MITHEN, THIRST: WATER AND POWER IN THE ANCIENT WORLD 90–92 (2012) (reporting that the Mycenaens built a dam across the Manessi River and diverted flood flows into another river below the city of Tyrins).

54. Asit K. Biswas & Cecilia Tortajada, *Development and Large Dams: A Global Perspective,* 17 WATER RESOURCES DEV. 9, 9–10 (2001).

55. J. David Rogers, *The 1913 Dayton Flood and the Birth of Modern Flood Control Engineering in the United States*, MO. UNIV. SCI. & TECH, http://web.mst.edu/~rogersda/umrcourses/ge301/Dayton%20Flood-Updated.pdf (last visited Oct. 14, 2013).

56. The flood is well documented. *See The Great Dayton Flood of 1913*, DAYTON HIST. BOOKS ONLINE, http://www.daytonhistorybooks.com/page/page/1566099.htm (last visited Oct. 14, 2013) (listing links to information about, and personal accounts of the flood).

reservoirs on the Miami River.[57] Well into the 1920s, the Corps initially opposed dams as its new rival, the Bureau of Reclamation, was building multiple purpose dams, primarily for irrigation and hydroelectric power production.[58] The Corps was dragged into dam building by Congress. Starting in 1925, Congress required that the Federal Power Commission and the Corps prepare river basin plans for the "improvement" of streams for navigation, hydroelectric power, irrigation and flood control.[59] The 308 Reports, named after the section of the statute, were submitted to Congress in 1927,[60] and the 1928 Flood Control Act required that a 308 Report for the Mississippi be prepared which included, *inter alia*, a determination of whether additional flood control could be "attained through the control of flood waters in the drainage basins of the tributaries by the establishment of a reservoir system."[61]

The acceptance of floodwater retention was enshrined in United States law and policy during the Great Depression and the aftermath of World War II. During his four terms, President Franklin Roosevelt first embraced dams as engines of employment to deal with unemployment.[62] After the Allied victory became certain, he saw them as sources of employment for returning World War II veterans.[63] Congress agreed, and two New Deal statutes committed the United States to multiple purpose dams where flood control was a primary purpose. The 1936 Flood Control Act[64] declared that flood control on navigable rivers and their tributaries was a "proper activity of the Federal Government in cooperation with States, their political subdivisions and localities."[65] It also introduced benefit-cost as the standard for project construction,[66] in an attempt to rationalize

57. *See* Rogers, *supra* note 55.

58. *See* SAMUEL P. HAYS, CONSERVATION AND THE GOSPEL OF EFFICIENCY: THE PROGRESSIVE CONSERVATION MOVEMENT, 1890–1920, at 208–11 (1959) (explaining the hostilities of the Corps towards dam construction).

59. *See* Act of Mar. 3, 1925, ch. 467, 43 Stat. 1186, 1190.

60. *See* H.R. Doc. No. 69-308 (1926).

61. *See* 33 U.S.C. § 702j (2006).

62. *See generally* JOHN R. FERRELL, THE BIG DAM ERA (1993).

63. *Id.*

64. Pub. L. No. 74-738, 49 Stat. 1572 (1936) (codified as amended at 33 U.S.C. § 701a (2006)).

65. *Id.*

66. United States v. W. Va. Power Co., 122 F.2d 733, 736–37 (4th Cir. 1941). Although the Corps and the Office of Management and Budget are committed to formal benefit-cost analysis, Congress is not bound by good practice and has

federal spending. Retention was first put into large-scale practice by the Tennessee Valley Authority (TVA).[67] During World II an effort was made to apply the lessons of the TVA to the Missouri River.[68] Other flood control dams followed in the 1950s and 1960s. Nationwide, the Corps currently operates approximately 700 flood control dams on large and small rivers.[69]

The dream of comprehensive federal river basin development lived on until the 1970s. After the New Deal, federal support for large dam construction continued, but only on an individual project-by-project basis. The Eisenhower Administration (1953–1961) followed a "no-new starts" water resources development policy, and stressed increased local responsibilities for new projects.[70] This policy was reversed in the Kennedy-Johnson administrations (1961–1969); new Corps dams were built in the 1960s in the Southeast and Midwest.[71] President Johnson was a committed dam builder,[72] and he tried to revive New Deal-style river basin planning. The Water Resources Planning Act of 1965 authorized the creation of regional river basin commissions coordinated by the federal Water Resources Council.[73]

In the 1970s, though, Congress turned away from large-scale, basin-level project financing. Instead, periodic Water Resource Development Acts (WRDAs)[74] authorized water projects passed on by the House Committee on Transportation or the Senate Committee on Environment and Public Works.[75] Even if a project is included in a

unlimited discretion to decide whether a project it chooses to approve meets the statutory standard.

67. *See* RICHARD N.L. ANDREWS, MANAGING THE ENVIRONMENT, MANAGING OURSELVES: A HISTORY OF AMERICAN ENVIRONMENTAL POLICY 161–69 (1999).

68. For example, today there are thirty-seven flood-control projects (including dams) in West Virginia. *See Flood Control,* W. VA. ENCYCLOPEDIA, http://www.wvencyclopedia.org/articles/2196 (last visited August 17, 2013).

69. NAT'L RESEARCH COUNCIL, NATIONAL WATER RESOURCE CHALLENGES FACING THE U.S. ARMY CORPS OF ENGINEERS 13 (2011).

70. *See* DANIEL MCCOOL, COMMAND OF THE WATERS: IRON TRIANGLES, FEDERAL WATER DEVELOPMENT, AND INDIAN WATER 103–04 (Univ. of Ariz. Press, 1994) (1987).

71. Pub. L. 89-80, 79 Stat. 244 (1965).

72. CARO, *supra* note 9, at 767.

73. Water Resources Planning Act of 1965, Pub. L. No 89-80, §201, 79 Stat. 246 (1965) (codified as amended at 42 U.S.C. § 1962b (2006)).

74. *See* Tarlock, *supra* note 34, at 175 (noting that the last WRDA was enacted in 2007); *see also* Water Resources Development Act of 2007, Pub. L. No. 110-114, 121 Stat. 1041.

75. *Id.*

WRDA, it must also receive an appropriation.[76] The project-by-project nature of the WRDA, including the need to seek appropriations for individual projects, necessarily has impacted the Corps's institutional approach to managing levee projects.[77] This movement away from large-scale project financing symbolizes a reduction in federal flood management engagement more generally.

B. The Retreating Federal Role

The pendulum of responsibility for flood control is swinging back toward local governments.[78] First, budget woes and a growing resistance to spending federal dollars on local flood control have called into question federal financial support. Second, the federal government has begun to take the position that it can serve best as a consultant or guide to local governments, which are better situated to understand the regional circumstances.

The federal government's investment in flood management has plateaued or declined over the last thirty years. The amount of federal money available for both new flood management projects has decreased with the exception of money made available for emergency response and post-emergency infrastructure projects.[79] Congressional authorization of Corps's projects through the WRDAs had for many years been the epitome of "pork-barrel" politics where more powerful representatives were more successful in getting their home projects authorized, regardless of the objective merit or need of the competing projects.[80] Now, projects are competing for fewer dollars as Congress has signaled a shift to pushing the responsibility back to states and local governments; indeed, the moratorium on earmark appropriations has responded to "pork barrel" concerns but also stymied Corps's projects.[81] Even when a project is authorized, it may

76. NICOLE T. CARTER & H. STEVEN HUGHES, CONG. RESEARCH SERV., RL32065, ARMY CORPS OF ENGINEERS WATER RESOURCE ACTIVITIES: AUTHORIZATION AND APPROPRIATIONS 6 (2005).

77. *Id.*

78. This is a worldwide trend. *See* Olive Heffernan, *No Going Back: With Nations Doing Little to Slow Climate Change, Many People Are Ramping Up to Adapt to the Inevitable*, 491 NATURE 659, 659–60 (2012).

79. *See* NAT'L RES. COUNCIL, *supra* note 69, at 2, 10–13 (noting that from 1983 to 2011, the Corps's capital stock portfolio value decreased by $85 billion dollars).

80. *See* CARTER & HUGHES, *supra* note 76, at 6.

81. *See* NICOLE T. CARTER & CHARLES V. STERN, CONG. RESEARCH SERV. R41243, ARMY CORPS OF ENGINEERS WATER RESOURCE PROJECTS:

await appropriations for several more years, leaving local governments in limbo and at risk for more catastrophic flooding. Currently, more than 1000 authorized studies and construction projects await money.[82] The President's budget requests have included few new studies and new construction activities in recent years.[83] While the budgeted project funding has declined, emergency funding through supplemental appropriations has been substantial since 2001;[84] the reactive nature of flood control funding raises questions regarding the cost-effectiveness and safety of the current reliance on emergency measures.

As the federal role shrinks, federal agencies such as the Corps, the Environmental Protection Agency (EPA) and FEMA are redefining their role as information providers and one of many actors in state and local efforts to address flood management.[85] Out of necessity, the federal government also has taken the position that local governments are best situated to understand the conditions and make planning decisions for the flood-prone areas in question.[86] Under this rationale, the federal government can serve as an expert advisor/consultant. For example, sparked by flooding in Iowa, the EPA worked with state and local governments to consider how land use planning can incorporate adaptation principles to factor in climate change.[87] The EPA's collaboration through this pilot project in Iowa grew from and reflects the philosophy outlined in the White House Council on Environmental Quality's 2010 report regarding adapting to climate change:

In particular, Federal leadership, guidance, information, and support are vital to planning for and implementing adaptive actions. Because climate impacts span political boundaries, the Federal Government must respond in partnership with communities, tribes, and states—many of which are already beginning to implement

AUTHORIZATION AND APPROPRIATIONS 1 (2013), *available at* http://www.fas.org/sgp/crs/misc/R41243.pdf.

82. *Id.* at 2.

83. *Id.* at 3.

84. *See generally* CARTER & HUGHES, *supra* note 76.

85. *See* COMM. ON U.S. ARMY CORPS OF ENG'RS WATER RESOURCES SCI., ENG'G, AND PLANNING, CORPS OF ENGINEERS WATER RESOURCES INFRASTRUCTURE: DETERIORATION, INVESTMENT, OR DIVESTMENT? 49–50 (2013).

86. *See infra* notes 198–202 and accompanying text.

87. *See* Robert R.M. Verchick & Abby Hall, *Adapting to Climate Change While Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods*, 2011 BYU L. REV. 2203, 2236–37 (2011).

adaptation measures. Effective adaptation requires that stakeholders in affected regions coordinate their responses to climate impacts on shared infrastructure and resources.[88]

As local governments take more of a leadership role in adaptation, their approaches to flood management must be evaluated closely.

III. LOCAL GOVERNMENT OPTIONS

Local governments have at least six options to limit flood damage: (1) passive adaptation, (2) reliance on federal protection through upstream dams, levees and floodways government, (3) floodplain retreat, (4) prohibition of risky new flood plain development, (5) regional flood management participation, and (6) practice risk-based integrated flood management planning.[89] Some of these approaches require proactive land use planning and regulation, while others involve accepting a range of possible flood conditions, partially reacting to flood conditions, or looking to state or federal government to prepare for or react to flood conditions to develop flood management plans and to finance the infrastructure necessary to implement them. None of the options is mutually exclusive, and each has a role to play in responding to the challenges of minimizing urban flood damages. This part will address each of these options in turn.

A. Passive/Reactive Options

A city can elect to undertake no permanent flood control measures and engage in passive adaptation by retreating when floods come or using temporary measures to prevent the waters from spreading. Few cities can now retreat, but some cities practice a variant of passive adaptation by trying to site structures in the floodplains only if they can tolerate high water and rely on temporary dykes to prevent the spread of water.[90] This strategy has been used by cities with narrow flood plains and ample bluffs and hills as Davenport, Iowa has.[91]

88. THE WHITE HOUSE COUNCIL ON ENVTL. QUALITY, PROGRESS REPORT OF THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE: RECOMMENDED ACTIONS IN SUPPORT OF A NATIONAL CLIMATE CHANGE ADAPTATION STRATEGY 7–8 (2010).

89. *See* STATE OF CALIFORNIA ET AL., *supra* note 39, at 4-4 to 4-5.

90. The Mississippi River city of Davenport, Iowa is a prime example of this strategy. Unlike its neighbors, Davenport does not have a flood wall. Instead, it has purchased buildings along the River and developed an extensive park system. However, it has now obtained federal funding to put a wall around its water

Cities can also do nothing and let the federal government assume responsibility for flood damage prevention. For example, the Corps's six mainstem dams on the Missouri River provide flood protection for the downstream cities of Omaha, Kansas City and Saint Louis,[92] but sole reliance on upstream dams is too risky. Upstream dams must be supplemented by levees.[93] In addition, the federal government enjoys immunity from damages stemming from the operation of a federal flood control project to manage a flood.[94] The strategy can, however, work for some cities. New Orleans, of course, is the poster child of reliance on the federal largesse. After Hurricane Katrina, the federal

treatment plant. Ryan J. Foley, *Davenport, Iowa Building Flood Wall, but Is it Too Late?*, OMAHA.COM (Mar. 27, 2011), http://www.omaha.com/article/20110327/AP09/303279960.

91. *Id.*

92. In 1987, the Corps estimated that it had prevented $25 billion in downstream flood damages in lower Missouri River basin states. *North Dakota's Usage of the Missouri River*, GARRISON DIVERSION, http://garrisondiversion.org/pdf/North_Dakotas_Usage_of_the_Missouri_River.pdf (last visited Oct. 14, 2013); *see also* U.S. ARMY CORPS OF ENG'RS, NORTHERN DIVISION, MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM: POST 2011 FLOOD EVENT ANALYSIS OF MISSOURI RIVER FLOOD CONTROL STORAGE, at iv (2012) (discussing the possibility of increasing flood protection storage on the Missouri by concluding "that increasing the volume of flood control storage in the [Missouri River Mainstem Flood Control] System would enhance flood risk reduction in a repeat of the 2011 flood event, but would not have prevented record releases from the reservoirs or widespread damages"). For example, a Corps analysis of the possibility of increasing flood protection storage on the Missouri concluded "that increasing the volume of flood control storage in the System would enhance flood risk reduction in a repeat of the 2011 flood event, but would not have prevented record releases from the reservoirs or widespread damages." *Id.*

93. *See supra* note 90.

94. The Flood Control Act of 1928 immunized the federal government for liability from damage from the operation of a federal flood control project. *See* Pub. L. No. 70-391, 45 Stat. 534 (codified as amended at 33 U.S.C. §§ 702a–702m, 704 (2006)). The Supreme Court engrafted a significant limitation of this immunity by limiting the federal government's liability to damages determined by the character of waters that caused the harm, as opposed to the character of a federal flood-control project that was supposed to prevent the harm. *See* Central Green Co. v. United States, 531 U.S. 425, 434–36 (2001). In re *Katrina Canal Breaches Consolidated Litigation*, 647 F. Supp. 2d 644, 648 (E.D. La. 2009), applied *Central Green*, and held that the federal government was liable for the negligent construction of the Mississippi River Gulf Outlet (MRGO) navigation channel's levee system. On appeal, the court upheld the district court's interpretation of 33 U.S.C. § 702, but ultimately reversed and remanded the case because, in keeping with *Central Green*, the flooding damage was not caused by flood-control activity or negligence therein, but rather, due to the construction of the MRGO, which fell within the discretionary function exemption of the Federal Tort Claims Act. *See In re* Katrina Canal Breaches Consol. Litig., 675 F.3d 381, 444 (5th Cir. 2012).

government built a $14.5 billion levee system for the city,[95] ignoring all suggestions for a more passive approach to future, inevitable flood events.[96] For cities not "blessed" with New Orleans' heritage, this strategy faces the fact that the Corps currently has a backlog of $60 billion in approved, but unfunded, flood control projects.[97] The bottom line is that there is an undue emphasis on levees, which can never prevent all damage, at the expense of passive solutions such as the restoration of the pre-modification river flows and adjacent flood plains.

Retreating from the intensive use of existing developed land in harm's way is not impossible. Cities can attempt to maximize the amount of undeveloped flood plain so that flood waters do not damage property. Retreat has generally not been deemed feasible because it is a politically unpopular and expensive strategy, which requires the purchase of existing developed properties. However, it is slowly emerging as a viable approach in both rural and urban areas. Several small towns along the Mississippi River were relocated after the 1993 flood.[98] This strategy may be more widely used in the future as the link between floods and climate change is better established. In his 2013 State of New York address, "[Governor Cuomo] said homeowners in flood-prone zones should be allowed to sell their homes back to the government and move out of the area, while others could elevate their homes to protect from future flooding."[99] Ultimately, retreat is closely related to the more proactive approach of land use planning that prevents flood plain development.

95. John Schwartz & Campbell Robertson, *New Orleans Levees Hold, and Outsiders Want In*, N.Y. TIMES, Sept. 6, 2012, http://www.nytimes.com/2012/09/07/us/new-orleans-levees-hold-and-outsiders-want-in.html?_r=0.

96. *See* Oliver Houck, *Can We Save New Orleans?*, 19 TULANE ENVTL. L.J. 1, 50–54 (2006).

97. *See* NAT'L RESEARCH COUNCIL, *supra* note 69, at 15.

98. Marisol Bello & Peter Eisler, *Ill. Town Finds Life Does Go on After Flood*, U.S.A TODAY, June 20, 2008, http://usatoday30.usatoday.com/weather/floods/2008-06-19-flood-town_N.htm.

99. Laura Nahmias & Lisa Fleisher, *Gun Laws, Rebuilding Set Agenda for Cuomo*, WALL ST. J., Jan. 9, 2013, http://online.wsj.com/article/SB10001424127887323442804578232194190548254.html. However, the nesting urge is strong and the state estimates that only ten to fifteen percent of the 10,000 affected homeowners will accept buyouts. Thomas Kaplan, *Homeowners in Flood Zones Opt to Rebuild, Not Move*, N.Y. TIMES, Apr. 26, 2013, http://www.nytimes.com/2013/04/27/nyregion/new-yorks-storm-recovery-plan-gets-federal-approval.html?_r=0.

B. Proactive Options

1. Prohibit Risky Flood Management

More effective flood damage reduction requires greater human adjustment to floods in the form of settlement patterns and building construction.[100] This is now the conventional wisdom among flood experts. In the United States, human adjustment is the legacy of the late geographer Gilbert White, one of the great students of water and disaster policy in the twentieth century. His seminal 1942 University of Chicago thesis, *Human Adjustment to Floods*,[101] remains the Bible of modern flood control thinking. "Few publications can claim to have transcended the original field in which they were written, by shaping a wide range of research areas and philosophies."[102] At the height of the New Deal and its faith in engineering solutions to nature's imperfections, *Human Adjustment to Floods* posited the then heretical argument that structural flood defense created a classic moral hazard problem; the expectation that dams and levees (as disaster relief) would protect flood plains led governments to encourage flood plain development.[103] Ironically, when the structural defense failed to stop the inevitable flood waters, property and other damages were actually greater than before.

White's thesis fundamentally changed decision-makers' thinking about floods and helped bring about the federal flood insurance program. White's vision, as articulated by the policy forum honoring his work, still applies to goals for flood management in the mid-twenty-first century:

> There is a stronger trend in 2050 toward higher density development, clustering, in-filling of urban areas, and planning for green infrastructure. The full range of flooding events is taken into account in planning, including low-probability, high-consequence storms. Many no-build zones—such as deep coastal storm surge zones, deep riverine floodplains, and other high-hazard or environmentally sensitive areas—are in place, analogous to the

100. *See, e.g.*, ASSOCIATED PROGRAMME FOR FLOOD MGMT., WMO-NO. 997, LEGAL AND INSTITUTIONAL ASPECTS OF FLOOD MANAGEMENT 23 (2006).

101. GILBERT FOWLER WHITE, HUMAN ADJUSTMENT TO FLOODS: A GEOGRAPHICAL APPROACH TO THE FLOOD PROBLEM IN THE UNITED STATES (1945).

102. Neil Macdonald et al., *The Significance of Gilbert White's 1945 Paper* Human Adjustment to Floods *in the Development of Risk and Hazard Management*, 36 PROGRESS PHYSICAL GEOGRAPHY 125, 125 (2011), *available at* http://ppg.sagepub.com/content/36/1/125.full.pdf+html.

103. *See generally* WHITE, *supra* note 101.

> floodways and coastal barrier resources system units of the 20th century. These no-build areas are respected in order to sustain the natural benefits they provide to society, including high-quality water, appropriate habitat for fish, wildlife, and flora; groundwater recharge; recreation; and open spaces, in addition to flood damage abatement. Some communities have been relocated in whole or in part.[104]

But practice does not often follow theory no matter how good it is. With the exception of a few leaders, elected representatives and local zoning and building regulators have not fully absorbed the message.[105] It is easier to compensate victims and promise better engineering solutions. In 2013, Congress appropriated $51.5 billion for Hurricane Sandy relief.[106] However, many observers, including large segments of the insurance industry, are concerned that expenditures for rebuilding homes and businesses and dune restoration continue to encourage building in flood-prone areas.[107]

Thus, government promotion of moral hazards along the nation's shorelines and floodplains by encouraging people to remain or return to an unsafe situation is a hard cycle to break. Yet, the Stanford University Climate Adaptation Poll, conducted in March 2013, shows that "Americans overwhelmingly believe that people and businesses most at risk from sea level rise and damaging storms, not the general

104. GILBERT F. WHITE NAT'L FLOOD POL'Y FORUM, FLOODPLAIN MANAGEMENT 2050, at 13 (2007).

105. New York Governor Andrew Cuomo has proposed spending $400 million in federal funds to purchase homes destroyed in whole or in part by Hurricane Sandy. "The land would never be built on again. Some properties would be turned into dunes, wetlands or other natural buffers . . . ." Thomas Kaplan, *Cuomo Seeking Home Buyouts in Flood Zones*, N.Y. TIMES, Feb. 3, 2013, http://www.nytimes.com/2013/02/04/nyregion/cuomo-seeking-home-buyouts-in-flood-zones.html?pagewanted=all&_r=1&. New Jersey Governor Chris Christie has not proposed such a drastic step but he has agreed to adopt FEMA floodplain maps, which will require many homeowners to raise their homes and perhaps not rebuild at all. James Osborne, *Many at Shore Will Be Forced to Raise Their Homes to Protect Against Future Storms*, PHILA. INQUIRER ONLINE, Jan. 23, 2013, http://articles.philly.com/2013-01-26/news/36550334_1_new-flood-maps-floodplain-maps-flood-insurance.

106. H.R. Con. Res. 41, 113th Cong. (2013) (enacted).

107. As a Forbes article noted, "taxpayers should be rightfully disappointed that the package contains no provisions requiring stronger planning measures to protect against more powerful future storms." Mindy Lubber, *Rethinking Our Place in a Post-Hurricane Sandy World,* FORBES, Feb. 7, 2013, http://www.forbes.com/sites/mindylubber/2013/02/07/rethinking-our-place-in-a-post-hurricane-sandy-world/.

public or government, should foot the bill for related preparation and recovery efforts."[108]

Cities have long had the discretion to try and minimize flood damage by limiting flood plain development proactively.[109] Thanks to Gilbert White, this strategy is at the heart of modern flood control policy driven by the Flood Control Act of 1968. Section 1301 provides:

> It is the further purpose of this chapter to (1) encourage State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses, (2) guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards, (3) encourage lending and credit institutions, as a matter of national policy, to assist in furthering the objectives of the flood insurance program, (4) assure that any Federal assistance provided under the program will be related closely to all flood-related programs and activities of the Federal Government, and (5) authorize continuing studies of flood hazards in order to provide for a constant reappraisal of the program and its effect on land use requirements.[110]

The Act is administered by FEMA and it instructs the Director to, "[f]rom time to time develop comprehensive criteria designed to encourage, where necessary, the adoption of adequate State and local measures which, to the maximum extent feasible, will (1) constrict the development of land which is exposed to flood damage where appropriate . . . ."[111]

Community participation in the National Flood Insurance Program is technically voluntary, but in fact it is not. For example, 1466 out of

108. Rob Jordan, *What's Ahead for Adaptation: Making America More Resilient*, STANFORD WOODS INST. ENVT (Apr. 4, 2013), http://woods.stanford.edu/news-events/news/whats-ahead-adaptation-making-america-more-resilient (summarizing a panel discussion addressing the policy implications of the survey).

109. The courts have long accepted the proposition that the police power extends to preventing people from engaging in risk behavior when it damages them. *See, e.g.*, Vartelas v. Water Res. Comm'n, 153 A.2d 822, 825–26 (Conn. 1959); Gove v. Zoning Bd. of Appeals of Chatham, 831 N.E.2d 865, 871–72 (Mass. 2005) (flood plain ordinance which reduced the value of 1.8 lot on Cape Cod from $192,000.00 to $23,000.00 was not a taking, *inter alia*, because a flood would pose risk to rescue workers as well as the planned home's occupants).

110. Flood Control Act of 1968, Pub. L. No. 90-483, § 1301, 82 Stat. 739 (codified at 42 U.S.C. § 4001(e) (2006)).

111. 42 U.S.C. § 4102(c)(1) (2006).

1550 New York cities, town and villages participate.[112] The carrot that the Act provides is federally subsidized flood insurance. The stick is that the Act prohibits lenders from lending in flood plains unless the community has a FEMA-approved land use ordinance.[113] The assumption is that the insurance program "could also link the availability of flood insurance to land-use regulation and building codes that would, in theory, reduce long-term flood risk."[114] The Act has not reduced flood damage risks as much as the drafters hoped.[115]

The federal flood insurance program has stimulated a great deal of flood prevention land use regulation, but the Act, as administered, has allowed local governments to encourage too much moral hazard behavior.[116] The nub of the problem is that cities must steer between the enormous pressure to develop land and the regulatory incentives provided by the program. The reasons are legal and political. Land use law recognizes that the prevention of risky flood plain development, even if partially done for parental reasons, is a valid

112. N.Y. DEP'T OF STATE, LOCAL GOVERNMENT HANDBOOK 139 (6th ed. 2011), *available at* http://www.dos.ny.gov/lg/publications/Local_Government_Handbook.pdf.

113. The role that lenders can play in increasing the amount of flood insurance has begun to play out in the courts. *Skansgaard v. Bank of America* illustrates the continuing resistance to the flood insurance program. *See* Skansgaard v. Bank of Am., 896 F. Supp. 2d 944, 946–47 (W.D. Wash. 2011). A mortgagor, located in a floodplain, initially purchased flood insurance to cover only the principal balance of the loan. After the mortgage was sold, the new bank required insurance for the replacement value of the improvements. The deed of trust provided that "[b]orrower shall insure all improvements on the property, whether now in existence or subsequently erected, against loss by floods to the extent required by the Secretary of HUD." *Id.* at 947. The district court held that the clause was ambiguous as to whether the lender had the discretion to require the additional insurance, and thus plaintiff's action for both breach of contract and the implied covenant of fair dealing survived summary judgment. *Id.* at 949. *But see* McKenzie v. Wells Fargo Home Mortg., Inc., No. C-11-04965 JCS, 2012 WL 5372120, at *19 (N.D. Cal. Oct. 30, 2012) (dismissing plaintiff's breach of contract claim because defendants "did not breach their contract . . . simply by requiring flood insurance above the minimum amount specified in the NSFH [Notice of Special Flood Hazard]"). As the issue of lenders requiring increased flood insurance plays out in courts across the country, the courts may help determine whether increased flood insurance becomes more accepted in the future.

114. RAWLE O. KING, CONG. RESEARCH SERV., R42850, THE NATIONAL FLOOD INSURANCE PROGRAM: STATUS AND REMAINING ISSUES FOR CONGRESS 12 (2013).

115. *See infra* notes 116–20 and accompanying text.

116. The reasons lie deep in the human psyche. The recent Congressional Research Service report observed that "[b]ehavioral scientists have noted that many individuals in flood-prone areas often dismiss low-probability catastrophic events, misunderstand the risk spreading function of insurance, and tend to be optimistic regarding the prospects of damage to their property." *See* KING, *supra* note 114, at 3.

police power objective.[117] Ordinances typically do not prohibit all development but allow a variety of compatible uses such as agriculture and recreation that does not destroy the character of the district.[118] Even existing pre-ordinance structures need not remain forever. These are non-conforming uses, and there is no constitutional right to build after a substantial portion of a building is destroyed by an "Act of God."[119] A model ordinance provides:

> Any non-conforming structure that is located less than the required setback from the normal high water mark of a water body, tributary stream or upland edge of a wetland, or from the property line, or which otherwise fails to meet the dimensional requirements of this Ordinance, and which is removed, or damaged or destroyed by more than 50 percent of the market value of the structure before such damage, destruction or removal may be reconstructed or replaced provided that a permit is obtained within one year of the date of said damage, destruction or 85 removal and provided that such reconstruction or replacement is in compliance with the setback or other dimensional requirements to the greatest practical extent as determined by the Planning Board . . . .[120]

Flood control ordinances face the risk of a Fifth Amendment takings challenge.[121] Courts have rejected many Fifth Amendment challenges to flood plain ordinances,[122] but cities are reluctant to use

117. *See, e.g.*, Vartelas v. Water Res. Comm'n, 153 A.2d 822, 870–71 (Conn. 1959); Turnpike Realty Co. v. Town of Dedham, 284 N.E.2d 891, 899 (Mass. 1972); Mansoldo v. State of New Jersey, 898 A.2d 1018, 1022 (N.J. 2006). For an early, influential articulation of this position, see Allison Dunham, *Flood Control Via the Police Power*, 107 U. PA. L. REV. 1098, 1107 (1959). *See generally* J.B. Ruhl & James E. Salzman, *Climate Change Meets the Law of the Horse*, 62 DUKE L. REV. 975, 975 (2013) (presenting an analysis of how climate change might impact existing law including the law of land use controls).

118. Gove v. Zoning Bd. of Appeals of Chatham, 831 N.E.2d 865, 870–71 (Mass. 2005).

119. JULIAN CONRAD JUERGENSMEYER & THOMAS H. ROBERTS, LAND USE PLANNING AND DEVELOPMENT REGULATION LAWS § 4.37, at 141 (2003). Of course, the city must prove that the structure suffered the requisite percentage of damage. *See* L.B. Stanon v. Town of Pawleys Island, 455 S.E.2d 171, 172 (S.C. 1995).

120. MAINE STATE PLANNING OFFICE, HOW TO PREPARE A LAND USE ORDINANCE: A MANUAL FOR LOCAL OFFICIALS 84–85, (2011), *available at* http://www.maine.gov/doc/commissioner/landuse/docs/HowToPrepareALandUseOrdinance_2011.pdf.

121. The problem is especially acute for retreat strategies. *See* J. Peter Byrne, *The Cathedral Engulfed: Sea-Level Rise, Property Rights, and Time*, 73 LA. L. REV. 69, 96–100 (2012).

122. In 2003, the leading expert on flood plain zoning concluded that:

> Courts have only held regulations invalid in a few of the more than 125 appellate state and federal cases addressing floodplain regulations over the last decade including many challenges to regulations as a taking of private

the full extent of their police powers for legal and political reasons. The Supreme Court's takings jurisprudence still has somewhat of a chilling effect on local regulation because the Court has not given as much weight to the paternal and neighbor damage prevention rationales compared to state courts.[123] Thus, the law encourages ordinance challenges and increases the risk of costly legal challenges.[124]

The National Flood Insurance Program relieves some of the legal and political pressures, but cities have not taken advantage of the opportunity to maximize floodplain management. Cities need to participate in the flood map program so that development qualifies for mortgage financing. FEMA's primary means of controlling local land use is its power to map local flood plains.[125] The agency has long used the 100-year flood standard to delineate flood plains and to map 100-year flood elevations, and thus cities need only prevent development within this mapped area.[126] The result is that many communities adopt only minimum floodplain regulations for the

property. For cases upholding regulations, see, for example Beverly Bank v. Illinois Department of Transportation, 579 N.E.2d 815 (Ill. 1991) (Court held that Illinois legislature had the authority to prohibit the construction of new residences in the 100-year floodway and that a taking claim was premature.). State of Wisconsin v. Outagamie County Board of Adjustment, 532 N.W.2d 147 (Wis. App., 1995) (Court held that variance for a replacement of fishing cottage in the floodway of the Wolf River was barred by county shore-land zoning ordinance.). Bonnie Briar Syndicate, Inc. v. Town of Mamaroneck, et al, 94 N.Y.2d 96 (N.Y. 1999) (Court rejected claim that the rezoning of 150 acre golf course property important for flood storage from residential to solely recreational use was a taking of private property.). Wyer v. Board of Environmental Protection, 747 A.2d 192 (Me. 2000) (Court held that denial of a variance under sand dune laws not a taking because property could be used for parking, picnics, barbecues, and other recreational uses).

JOHN A. KUSLER, ASS'N OF STATE FLOODPLAIN MANAGERS, COMMON LEGAL QUESTIONS ABOUT FLOODPLAIN REGULATIONS IN THE COURTS 2 (2003).

123. *E.g.*, First English Evangelical Lutheran Church of Glendale v. Cnty. of Los Angeles, 482 U.S. 304 (1987). *See generally* Tarlock, *supra* note 34, at 178–80.

124. *See generally* Stueve Bros. Farms, LLC v. United States, 107 Fed. Cl. 469 (Fed. Cl. 2012); Town of Nags Head v. Toloczko, 863 F. Supp. 2d 516 (E.D.N.C. 2012) (section 1983 action against town which prevented rebuilding of a cottage which rested on public trust land after storm washed away a significant amount of sand around the building).

125. *See generally Unit 5: The NFIP Floodplain Management Requirements*, FEMA, http://www.fema.gov/pdf/floodplain/nfip_sg_unit_5.pdf (last visited Oct. 14, 2013).

126. THOMAS V. CECH, PRINCIPLES OF WATER RESOURCES: HISTORY, DEVELOPMENT, MANAGEMENT, AND POLICY 78 (2003).

mapped floodplain allowing development in the rest of the community.[127] The focus on the 100-year flood plain ignores other at-risk areas in the community and provides disincentives to adopt a more comprehensive local flood damage mitigation strategy.[128] Cities can be proactive throughout their jurisdiction; for example, the subdivision approval process provides opportunities for cities to require retention and absorption areas.[129]

Cities that join the program have actively sought to constrict the reach of FEMA's flood plain map with administrative variances.[130] The Act provides a procedure to challenge a FEMA map. Each year the agency issues thousands of Letters of Map Change that often constrict previously mapped flood plain boundaries.[131] As an extra development bonus, cities have benefitted from FEMA's lack of enforcement of the insurance mandate. The Congressional Research Service estimated that only fifteen to twenty-five of at-risk properties in the Northeast have flood insurance.[132]

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127. There is extensive literature linking urban development, which decreases surface absorption capacity, and subsequent flooding. *E.g.*, C.P. Konrad, *Effects of Urban Development on Floods*, U.S. GEOLOGICAL SURVEY (Jan. 9, 2013, 7:36 PM), http://pubs.usgs.gov/fs/fs07603/.

128. WILL HEWES & ANDREW FAHLUND, WEATHERING CHANGE: POLICY REFORMS THAT SAVE MONEY AND MAKE COMMUNITIES SAFER 5–6, *available at* http://www.americanrivers.org/assets/pdfs/global-warming-docs/weathering-change/weathering-change-full-report.pdf.

129. Smith v. Town of Mendon, 822 N.E.2d 1214 (N.Y. 2004) (condition of issuance of a building permit requiring that the property owner grant a conservation easement for some portions of the site, including flood hazard areas upheld in 5-4 decision).

130. 42 U.S.C. § 4101b(e) (2006) provides:

> Upon the adoption by the Administrator of any recommendation by the Technical Mapping Advisory Council for reviewing, updating, or maintaining National Flood Insurance Program rate maps in accordance with this section, a community that believes that its flood insurance rates in effect prior to adoption would be affected by the adoption of such recommendation may submit a request for an update of its rate maps, which may be considered at the Administrator's sole discretion. The Administrator shall establish a protocol for the evaluation of such community map update requests.

42 U.S.C. § 4101b(e) (2006).

131. For a review of the process and the difficulty of members of the public getting accurate information on the scale of the appeals process, see U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-17, FEMA FLOOD MAPS (2010).

132. KING, *supra* note 114, at 3 (citing Anita Lee, *Sandy Catches Northeasterners Without Flood Coverage*, SUN HERALD, Nov. 2, 2012, http://www.weather.com/news/sandy-northeasterners-no-insurance-201211.

Out-of-date flood maps also have enabled city development. Many flood maps have not been updated based on more accurate methodologies, do not include detailed topography, or reflect real estate growth.[133] FEMA is preparing new maps, which must delineate a range of flood plains up to a 500-year flood and factor in topography and projected rainfall.[134] Since 2009, FEMA has used a Risk Mapping Assessment and Planning (Risk MAP) program, which is an integrated flood-risk management approach. In 2012, Congress reauthorized the National Flood Insurance Program, after an impasse of several years, and required FEMA to develop risk models and flood zones that account for "non-accredited levee scenarios."[135] However, "climate change" was expressly stripped from the final version of the bill, but FEMA can "reincorporate" climate change data because it must use the best science in projecting sea level rise.[136] The stakes are high. New maps include more homes in a risk area, thus triggering an insurance mandate. An inaccurate flood map could result in flood damages to uninsured properties and larger than expected expenditures of federal disaster assistance.[137] An analysis of the new maps being prepared for New York City reveals both strengths and weaknesses:

> When the federal government released updated flood maps for the New York City region last week, residents were shocked to find that the number of houses and businesses in the region's flood zone had doubled since the maps were last revised, in 1986. But it now appears that those maps might have underestimated the extent of New York's flood risk, because they don't factor in the effects of future climate change. Scientists say that by the 2080s, sea levels off the city's coast could rise by as much as five feet from melting

133. HEWES & FAHLUND, *supra* note 128, at 6.

134. Several provisions of the Flood Insurance Reform Act of 2012 contain new standards, including the 500-year flood and the new mapping program. *See, e.g.*, Flood Insurance Reform Act of 2012, Pub. L. No. 112-141, § 100219, 126 Stat. 405 (amending 42 U.S.C. § 4101(f)(2) (2006)); *see also* ASS'N OF STATE FLOODPLAIN MANAGERS, *supra* note 5; JESSICA GRANNIS, ANALYSIS OF HOW THE FLOOD INSURANCE REFORM ACT OF 2012 (H.R. 4348) MAY AFFECT STATE AND LOCAL ADAPTATION EFFORTS ANALYSIS (2012), *available at* http://www.georgetownclimate.org/sites/default/files/Analysis%20of%20the%20Flood%20Insurance%20Reform%20Act%20of%202012.pdf.

135. Flood Insurance Reform Act of 2012, Pub. L. No. 112-141, 126 Stat. 405 (2012).

136. Evan Lehmann, *'Global Warming' Disappears from Flood Legislation*, CLIMATE INFO.: RESPONDING TO USER NEEDS (Jul. 3, 2012), http://www.climateneeds.umd.edu/climatewire-08-01-12/article-01.php.

137. KING, *supra* note 114, at 22–23.

glaciers, making storm surges more severe and causing floods much further inland than the new maps indicate.[138]

2. Regional Flood Management Program Participation

Flood damage is best addressed at large scales—at a river basin, for example, or at least a sub-part that faces common flood risks. However, many local governments, especially upstream communities, simply shift risks to other communities.[139] Localities can avoid passing on their flood problems to their neighbors when they participate in a regional flood management program. Collaboration across communities in a particularly flood prone area not only reduces risk shifting, but it also provides opportunities for cost sharing and restoration of the broader ecosystem. Regional collaboration could feed into a risk-based, integrated flood management approach.

3. Risk-Based Integrated Flood Management

Throughout the world, modern flood control proceeds from the assumption that risk-based adjustment will provide the basis for future flood protection strategy,[140] and that strategy will represent a crucial element of the transition from unsustainable to sustainable urban development.[141] Interest in integrated flood risk management reflects the acceptance of the proposition that total structural damage is unattainable. An analysis of two major flooding events in recent years, the 1993 Upper Mississippi Flood and Hurricane Katrina in 2006, supports this view. After the Mississippi flood, which caused

138. Katherine Bagely, *New NYC Flood Maps Miss Climate Threat to Sandy Rebuilding*, BLOOMBERG, Feb. 7, 2013, http://www.bloomberg.com/news/2013-02-07/new-nyc-flood-maps-miss-climate-threat-to-sandy-rebuilding.html.

139. When private citizens attempt to take matters into their own hands, as some have done in Southampton, New York, without coordinating with efforts of other members of the community, risk shifting can cause substantial harm. *See* Michael Schwirtz, *Dispute in Hamptons Set Off by Attempt to Hold Back Ocean*, N.Y. TIMES, Region Section, April 17, 2013, http://www.nytimes.com/2013/04/18/nyregion/southampton-homeowners-build-barricades-to-hold-back-sea.html?_r=0 ("Some local officials said they were worried that the owners were engaging in an arms race with nature, installing higher and higher barricades that could rapidly hasten erosion—essentially sacrificing public beaches to save private homes.").

140. The literature is vast. *See generally* ADVANCES IN URBAN FLOOD MANAGEMENT (R. Ashley et al. eds., 2007); WORLD METEOROLOGICAL ORG., URBAN FLOOD RISK MANAGEMENT: A TOOL FOR INTEGRATED FLOOD MANAGEMENT (2008).

141. *E.g.*, U.N. HUMAN SETTLEMENTS PROGRAMME, PLANNING SUSTAINABLE CITIES: GLOBAL REPORT ON HUMAN SETTLEMENTS 2009, at 5 (2009).

from $12 to $16 billion in damages, a federal task force was formed to investigate the causes of the flood led by Brigadier General Gerald E. Galloway, a distinguished water resources planner.[142] The resulting "Galloway Report" endorsed Gilbert White's call for a comprehensive federal flood management program rather than the piecemeal, uncoordinated one that existed then and continues to this day, and promoted the adoption of the principle of watershed-based flood management.[143] The Report is also especially notable for its exploration of the role that the undeveloped or restored riparian areas and wetlands could play in flood water retention.[144]

In the United States, agencies such as the Corps have embraced risk-based planning, but compared to Europe the United States lacks a coherent and binding flood control strategy. One can find many endorsements of risk-based planning in various plans and policy reviews. For example, after Hurricane Katrina damaged some 350 miles of flood walls and levees, the Corps and National Research Council undertook evaluations of what went wrong and reached two major conclusions.[145] First, the system of levees and flood walls in place was not an integrated, coordinated, and well-maintained system. The second was that flood protection in at-risk areas such as New Orleans must be based on an integrated risk-based system that expressly rejects the expectation that complete structural protection against all hydrologic contingencies is possible.

Despite this acknowledgement of the need for a risk-based approach, the only binding legal model of risk-based flood management is the 2007 EU Floods Directive (Directive).[146] European Union directives are binding on the member states.[147] While they state only general outcomes that must be achieved in the member states through a combination of management and new

142. *See* INTERAGENCY FLOODPLAIN MGMT. REVIEW COMM., SHARING THE CHALLENGE: FLOODPLAIN MANAGEMENT INTO THE 21ST CENTURY (1994).

143. *Id.* at 74.

144. *Id.* at 105–12.

145. *See* NAT'L RESEARCH COUNCIL, THE NEW ORLEANS HURRICANE PROTECTION SYSTEM: ASSESSING PRE-KATRINA VULNERABILITY AND IMPROVING MITIGATION AND PREPAREDNESS 4–5 (2009); S.L. Stockton & K.D. White, *U.S. Army Corps of Engineers' Collaborative Approach to Twenty-First Century Challenges Posed by Global Change*, *in* CLIMATE: GLOBAL CHANGE AND LOCAL ADAPTATION (Igor Linkov & Todd S. Bridges eds., 2011) (discussing the Corps's report).

146. Council Directive 2007/60/EC, 2007 O.J. (L 288) 27, 27.

147. *E.g.*, Case C-147/07, Comm'n v. France, 2008 E.C.R. 1-0000 (France failed to meet water quality objectives of the Water Framework Directive).

legislation,[148] they require new management processes and laws. The Directive integrates flood management into the previous Water Framework Directive.[149] The Directive requires that all member states develop river basin management plans, and corrects a deficiency in the Water Framework Directive by including flood risk minimization as a management objective.[150]

The Floods Directive proceeds from the premise that floods cannot be totally prevented, but rather the major risks can be managed.[151] To this end, all member states must identify the portions of rivers within their boundaries with significant flood risks and then prepare flood hazard maps that display three scenarios, as well as the probable adverse consequences should such a flood occur.[152] The scenarios are:

> (a) floods with a low probability, or extreme event scenarios;
>
> (b) floods with a medium probability (likely return period ≥ 100 years);
>
> (c) floods with a high probability, where appropriate.[153]

The maps form the basis for risk management plans, which, the Floods Directive instructs,

> [s]hall take into account relevant aspects such as costs and benefits, flood extent and flood conveyance routes and areas which have the potential to retain flood water, such as natural floodplains, the environmental objectives of Article 4 of Directive 2000/60/EC [The Water Framework Directive], soil and water management, spatial planning, land use, nature conservation, navigation and port infrastructure.
>
> Flood risk management plans shall address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the particular river basin or sub-basin. Flood risk management plans may also include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.[154]

148. *See* Council Directive 2007/60/EC, *supra* note 146, at 32.
149. *Id.*
150. *Id.*
151. *Id.* at 27 ("Floods are natural phenomena which cannot be prevented.").
152. *Id.* at 30.
153. *Id.*
154. *Id.* at 31.

EU Directives face many implementation problems, but they can lead to the development of new and useful science-based standards[155] and innovative national legislation.[156]

IV. EVALUATION OF FLOOD MANAGEMENT CASE STUDIES

As local governments take on more responsibility for flood management, they will inevitably look to other local governments for successful models. This section considers three case studies which can provide guidance to other cities around the nation: (1) Fargo, North Dakota-Moorhead, Minnesota, (2) Cedar Rapids, Iowa, and (3) Sacramento, California. These regions make effective case studies because they are particularly vulnerable to flooding based on their topography and development history. More importantly, each city has advanced innovative flood management initiatives consistent with principles described in the EU Floods Directive.

Fargo-Moorhead, Cedar Rapids, and Sacramento have taken steps that will help them manage floods in a more integrated manner, including the recognition of uncertainty in weather conditions and the need for better flood forecasting and the development of regional plans, and the use of some nonstructural solutions to reduce flood damage. Despite the advances in planning, however, implementation remains challenging. For instance, local governments have not consistently turned the language of integrated management into changes in land use ordinances. These local governments that have worked to develop more regional solutions have at times confronted obstacles relating to lack of coordination. These cases also demonstrate that the lack of federal requirements, substantial guidance, or consistent funding support continues to impede state and

155. The Water Framework Directive requires that pollution management decisions be based on ecological effects rather than sole reliance on the standard parameters of pollution, and this has led to innovative monitoring and ecological assessment systems. *See* Daniel Hering et al., *The European Water Framework Directive at Age 10: A Critical Review of the Achievements with Recommendations for the Future*, 408 SCI. TOTAL ENV'T 4007 (2010). For a less sanguine conclusion, see Henrik Josefsson & Lasse Baaner, *The Water Framework Directive—A Directive for the Twenty-First Century?*, 23 J. ENVT'L LAW 463 (2011).

156. Scotland Used the Floods Directive in 2009 to enact The Flood Risk Management Act, "which deliberately focuses attention on the extent to which the reduction of flood risk might be achieved through both structural and non-structural options . . . including the potential for 'natural features' in the landscape to help retain flood water . . . ." Chris Spray, Tom Ball & Josselin Rowlland, *Bridging the Water Law, Policy, Science Interface: Flood Risk Management in Scotland*, 20 WATER L. 165, 172 (2009).

local governments from achieving optimal flood management planning.

A. Background—Case Study Areas

1. Fargo, North Dakota-Moorhead, Minnesota

The Red River of the North originates at the confluence of the Otter Tail and Bois de Sioux Rivers south of Fargo, North Dakota. It flows northward into Canada and forms most of the boundary between Minnesota and North Dakota.[157] The Red River's northward flow, distinctive in North America, contributes to more substantial spring floods because snow in the southern headwaters of the basin often melts before snow in the northern areas, leading to ice jams as the flow travels northward.[158] In addition, the Red River Basin is located within the broad, flat bottom valley of glacial Lake Agassiz. This topography causes the main stem and tributary rivers in the glacial lake plain area of the basin to overflow frequently onto broad floodplains.[159] The Red River Basin includes a large percentage of agricultural land, and the urban areas of Fargo, North Dakota and Moorhead, Minnesota.[160] These metropolitan areas have a combined total population of 200,000.[161]

The Red River floods regularly. Flood damage has, on occasion, been catastrophic and has included severe structural damage to private and public facilities and infrastructure, extensive crop loss, major environmental degradation, and loss of life. Basin-wide flood damages (including both Canada and the U.S.) after the flood of 1997 were estimated at $5 billion.[162] Wetland destruction for farmland and climate change have increased the amount of precipitation and flooding in the region; the Red River has exceeded the National Weather Service flood stage of 18 feet in 48 of the past 109 years, and

157. RED RIVER BASIN COMM'N, RED RIVER BASIN NATURAL RESOURCE FRAMEWORK PLAN 12 (2005).

158. *Id.* at 4.

159. *Id.* at 9–10

160. *Id.* at 13.

161. U.S. ARMY CORPS OF ENG'RS, FINAL FARGO MOORHEAD METRO FEASIBILITY STUDY AND ENVIRONMENTAL IMPACT STATEMENT: FARGO-MOORHEAD FLOOD RISK MANAGEMENT PLAN at ES-2 (2011).

162. N. GREAT PLAINS WATER CONSORTIUM, CLIMATE CYCLICITY AND THE ECONOMIC VITALITY OF THE NORTHERN GREAT PLAINS, *available at* http://www.undeerc.org/Water/pdf/Climate-Cyclicity.pdf.

every year from 1993 through 2011.[163] The flood of record at Fargo-Moorhead was the 2009 spring flood with a stage of 40.8 feet on the Fargo gage.[164] Equivalent expected annual flood damages in the Fargo-Moorhead metropolitan area are estimated to be over $194.8 million in the future if no further action is taken.[165]

2. Cedar Rapids, Iowa

Cedar Rapids, located in east-central Iowa, is the state's second largest city with a population of 125,850 and sits on both banks of the Cedar River.[166] It is located within a shallow bowl surrounded by gentle rolling slopes. Iowa's rolling prairies and hilly oak woodlands meet at Cedar Rapids. Upland water from the entire watershed flows into Cedar Rapids. The Cedar River channel that flows through downtown does not allow for high volumes of water. Development patterns upland and the reduction of wetlands and natural vegetation, associated with development, have increased runoff and impacted the quantity and quality of the river's waters within Cedar Rapids. Much of downtown Cedar Rapids lies within the 100-year floodplain of the Cedar Rapids River. A combination of rainfall and snowmelt or heavy rainfall alone has caused the major floods.[167]

As with many American cities, the development of Cedar Rapids necessarily relied on and altered the river. Industry's rise in Cedar Rapids correlates with the development of navigation on the Cedar River upstream to Cedar Falls/Waterloo and downstream to ports along the Mississippi River.[168] As urban and industrial development led to more flooding, efforts were undertaken to prevent the river from impairing business and residential development. The first dam was built across the Cedar River in 1841 to provide hydropower to a

163. U.S. ARMY CORPS OF ENG'RS, *supra* note 161, at ES-4.

164. *Id.*

165. *Id.*

166. U.S. ARMY CORPS OF ENG'RS, FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT, CEDAR RIVER, CEDAR RAPIDS, IOWA, FLOOD MANAGEMENT PROJECT 101, 102 (2011), *available at* http://www.mvr.usace.army.mil/Portals/48/docs/FRM/CedarRapids/CRMainReport-Jan11.pdf.

167. BATTELLE MEM'L INST., FINAL INDEPENDENT EXTERNAL PEER REVIEW REPORT: CEDAR RIVER—CEDAR RAPIDS, IOWA, FLOOD RISK MANAGEMENT FEASIBILITY STUDY WITH INTEGRATED ENVIRONMENTAL ASSESSMENT, at i (2010), *available at* http://www.usace.army.mil/Portals/2/docs/civilworks/Project%20Planning/cedar_rapids_rep.pdf.

168. U.S. ARMY CORPS OF ENG'RS, *supra* note 166, at 97.

sawmill.[169] More millworks were developed approximately 1.4 miles upstream from Cedar Rapids.[170] The arrival of the first railroad in mid-1859 further shaped Cedar Rapid's growth by enabling the city's business to transport goods to Chicago.[171]

3. Sacramento, California

Sacramento, the capital city of California, was founded in 1849.[172] It is located at the confluence of the Sacramento and American Rivers.[173] The city of Sacramento has a population of 472,178, and the larger metropolitan area is home to approximately 1.4 million people.[174] Sacramento sits in the north-central part of the Central Valley.[175] The Central Valley is a broad, gently sloping valley, bounded on the west by the Coast Range, on the north by the Cascade Range, and on the east by the Sierra Nevada Range.[176] The Valley drains into the Sacramento-San Joaquin Delta (Delta). The lower-lying lands along the Valley's two major rivers, the Sacramento River and the San Joaquin River, were floodplains that were regularly inundated for long periods during large, seasonal flood events.[177] The most devastating floods are caused by warm Pacific winter storms that sweep in from the west or southwest, picking up moisture over thousands of miles of ocean, causing torrential rains when intercepted by the mountains surrounding the Valley.[178]

Like Cedar Rapids, the rivers' current condition necessarily reflects the region's development. John Marshall's discovery of gold at Sutter's Mill in 1848 and the ensuing Gold Rush changed California

169. *See id.*

170. *See id.*

171. *See id.*

172. *See A Brief History of Sacramento*, CITY OF SACRAMENTO, http://www.cityofsacramento.org/brief-history.html (last visited Oct. 14, 2013).

173. *Id.*

174. *Sacramento (City), California*, U.S. CENSUS BUREAU, http://quickfacts.census.gov/qfd/states/06/0664000.html (last visited Aug. 30, 2013).

175. *Sacramento Valley Bioregion—An Overview*, CA.GOV, http://ceres.ca.gov/geo_area/bioregions/Sacramento_Valley/about.html (last visited Oct. 14, 2013).

176. MARK W. COWIN ET AL., 2012 CENTRAL VALLEY FLOOD PROTECTION PLAN 1-2 (2011), *available at* http://www.water.ca.gov/floodsafe/fessro/docs/flood_tab_cvfpp.pdf.

177. *Id.*

178. *Id.*

dramatically.[179] The rapid industrialization of the mining and resulting debris load on the river amplified flooding in Sacramento and the Central Valley.[180] Agricultural development also contributed to the severity of floods and also led to the construction of levees at the edge of the Sacramento and San Joaquin river channels.[181] These levees were built up, rather than engineered, with readily available material including waste from the gold mining operations.[182] The vegetation that would have provided natural buffers for the water flow is almost entirely demolished.[183] Current environmental conditions and population growth place the Central Valley in a position that if a mega flood, such as those from the early 1860s, occurred now, the damage to property and business would be more than $725 billion.[184]

With these pictures in mind, the next section uses the lens of the EU Floods Directive to evaluate current efforts to manage floods in these three areas.

B. Evaluation of Case Studies

The EU Floods Directive provides a model for integrated flood management against which we can evaluate the innovative flood management efforts in Fargo-Moorhead, Cedar Rapids, and Sacramento. As outlined in Part III, the EU Directive requires member states to develop flood risk management plans that "address all aspects of flood risk management focusing on prevention, protection, [and] preparedness."[185] This section considers how Fargo-Moorhead, Cedar Rapids, and Sacramento address key elements of prevention and protection including the need to take into account climate change data, the importance of regional collaboration and

179. ELLEN HANAK ET AL., PUB. POL'Y INST. OF CAL., MANAGING CALIFORNIA'S WATER: FROM CONFLICT TO RECONCILIATION 22–24 (2011), *available at* http://www.ppic.org/content/pubs/report/r_211ehr.pdf.

180. *Id.* at 24.

181. *See* CAL. LEVEES ROUNDTABLE, CALIFORNIA'S CENTRAL VALLEY FLOOD SYSTEM IMPROVEMENT FRAMEWORK 15 (2009).

182. Paterno v. State, 113 Cal. Rptr. 3d 998, 1002 (2003). For a discussion of *Paterno*, see *infra* notes 285–87 and accompanying text.

183. *Cf. infra* note 212.

184. ASS'N OF STATE FLOODPLAIN MANAGERS, *supra* note 5, at 4. The projected damages from a mega flood are three times the level deemed realistic from an earthquake.

185. Council Directive 2007/60/EC, *supra* note 146, at 31

ecosystem restoration, the role of land use planning, and structural improvements.

1. Considering Climate Change Data

As local governments develop flood management plans, the usefulness of their plans depends on the ability to assess flood risk and their willingness to use climate change data in that process. The EU Floods Directive emphasizes the importance of factoring in climate change, but unlike in Europe the debate over the cause and existence of climate change lingers in the United States. The need to incorporate better flood forecasting has not escaped planners addressing floods in Sacramento, Cedar Rapids, and Fargo-Moorhead. The three regions have acknowledged climate change to varying degrees.

Leaving no doubt about its concern about climate change, the EU Floods Directive mentions climate change seven times.[186] It justifies the need for the directive by pointing out that "climate change contribute[s] to an increase in the likelihood and adverse impacts of flood events" and that previous directives do not "take into account the future changes in the risk of flooding as a result of climate change."[187] It directs member states to develop flood risk management plans that take into account the impacts of climate change and requires member states to update plans periodically to incorporate climate change data.[188]

The State of California has gone the farthest to demonstrate a commitment to better flood risk management and need for climate change modeling. The Central Valley Flood Protection Act of 2008 (also known as Senate Bill 5 (SB5)) directly acknowledges the inability of levees to "offer complete protection from flooding."[189] It requires the Department of Water Resources (DWR) to prepare a flood management plan for the Central Valley, and requires cities to enact a plan that follows the DWR plan.[190] SB5 and the resulting Central Valley Flood Protection Plan (CVFPP) represent unparalleled efforts for integrated flood risk management in the United States. They address the need to reassess flood risk, to

186. *Id. passim*.

187. *Id.* at 27

188. *Id.* at 30.

189. Central Valley Flood Protection Act of 2008, 2007 Cal. Legis. Serv. ch. 364, § 9 (S.B.5), (codified at Cal. Water Code § 9601(b) (West 2009)).

190. *Id.* ¶ 3.

improve existing structural approaches and to develop more nonstructural measures to reduce the impact of floods.

The CVFPP expressly recognizes the need to account for climate change:

> Climate change will lead to a greater fraction of seasonal precipitation occurring, as rain rather than snow and sea levels will rise. These trends appear to be already established and, if they continue as expected, they will put increasing stress on California's flood management system. Floodplain risk assessments and development constraints will likely be adjusted accordingly.[191]

DWR has gone further by working on the development of a methodology to estimate climate change impacts on flood hydrology.[192] It understands the risk in not digging deeper to understand climate change's impacts—"climate change impacts for extreme events, such as flooding and droughts, will result not from changes in averages, but from changes in local extremes."[193]

DWR also has been working on ways to manage the uncertainty associated with climate change, and make "prudent decision[s]" that emphasize investments that can "accommodate a broader range of climate change scenarios."[194] These efforts promise a better understanding of the impact of changed climate conditions on flood risk as well as the potential for better planning to account for these changes.

Scholars and leaders in Iowa also have been willing to consider climate change, but the State's responses fall short of California's efforts. In 2007, the Iowa Legislature created the Iowa Climate Change Advisory Council to develop a plan to reduce greenhouse gases.[195] While the council was disbanded after its first report in 2008, efforts to respond to climate change have not been forgotten. Iowa received a call to action during the epic floods of 2008—when eighty-

191. COWIN ET AL., *supra* note 176, at 1-16.

192. *Id.* at 3-22 to 3-24. DWR's new methodology, developed in collaboration with the National Oceanic and Atmospheric Administration, U.S. Geological Survey, the Corps and the Bureau of Reclamation, bases its analysis on the intensity of "fast-moving, concentrated streams of water vapor that can release heavy rains." CENT. VALLEY FLOOD MGMT. PLANNING PROGRAM, 2012 CENTRAL VALLEY FLOOD PROTECTION PLAN: VOL. II, ATTACHMENT 7, at 8-30 (2012), *available at* http://www.water.ca.gov/cvfmp/docs/2012CVFPP_Volume%20II_All_Files_June.pdf.

193. COWIN, ET AL., *supra* note 176, at 3-23.

194. *Id.* at 3-24. DWR has been piloting this approach on the Yuba-Feather river systems.

195. IOWA CODE ANN. § 455B.851 (West 2004).

five out of ninety-nine counties in Iowa received federal disaster designations. In the book, *Watershed Year: Anatomy of the Iowa Floods of 2008*, written shortly after the Iowa floods, Dr. Takle, Climate Science Program Director at Iowa State University, argues that "it is likely that the dice have been loaded toward a higher probability of extreme flood events, with more occurring now than 30 years ago, and with even higher-frequency precipitation conditions leading to such floods in the future."[196] In 2009, the Iowa Legislature created the Iowa Flood Center at the University of Iowa to develop models for "flood frequency estimation" and "real-time forecasting of floods."[197]

After the 2008 floods, local governments, the state, and the federal government took a broader look at flood control planning in Iowa and acknowledged changing weather conditions. What began as collaboration among the EPA, FEMA, and Iowa to provide smart growth technical assistance to communities hit by the flood[198] grew into a pilot project on climate change adaptation.[199] Acknowledging that local governments are on the front lines for handling floods and for planning for floods, the EPA worked directly with state and local partners in Iowa to provide guidance for adaptation plans for managing the impacts of climate change.[200] The EPA recommended that local governments do more to integrate hazard mitigation planning with land use planning, and it encouraged federal and state governments to provide incentives to local governments who

196. CORNELIA F. MUTEL, A WATERSHED YEAR: ANATOMY OF THE IOWA FLOODS OF 2008, at 116 (2010).

197. IOWA CODE ANN. § 466C.1 (West 2004).

198. Verchick & Hall, *supra* note 87, at 2236.

199. In 2009, these federal agencies, the Iowa Economic Redevelopment Office and other state agencies, as well as Cedar Rapids, collaborated to identify existing or potential barriers to more sustainable development in current development policies and codes. *See* EPA ET AL., EMBRACING THE RIVER: SMART GROWTH STRATEGIES FOR ASSISTING IN CEDAR RAPIDS' RECOVERY 3 (2009), *available at* http://www.epa.gov/smartgrowth/pdf/ia_cedar_rapids.pdf. FEMA and EPA subsequently entered into a Memorandum of Agreement to continue working together to factor in sustainably community growth and recovery into hazard mitigation planning. Memorandum of Agreement Between the Dept. of Homeland Sec., Fed. Emergency Mgmt. Agency, and the Evntl. Prot. Agency (May 12, 2010), *available at* http://epa.gov/smartgrowth/pdf/2011_0114_fema-epa-moa.pdf; *see also* EPA ET AL. *supra*, at 3 (discussing cooperative efforts between federal agencies to address the effects of flooding).

200. EPA, IOWA CLIMATE CHANGE ADAPTATION & RESILIENCE REPORT 2 (2011), *available at* http://epa.gov/smartgrowth/pdf/iowa_climate_adapation_report.pdf.

undertake this integrated approach to planning.[201] It also urged the better incorporation of climate change information into this planning by downscaling the national data into an understanding of local predictions and implications.[202] While receptive to the idea, Cedar Rapids' leaders were stretched during the aftermath of the floods and did not undertake a deep audit of its municipal code to identify opportunities to reduce risk.

Decision-makers in the Fargo-Moorhead area have not directly embraced a connection between climate change and increased flooding, but they cannot totally avoid the problem. The states of North Dakota and Minnesota issued a directive requesting a report, identifying long-term solutions for flooding, from the Red River Basin Commission (RRBC).[203] The RRBC represents a collaborative effort across boundaries, including representatives from Manitoba, Minnesota, North Dakota, and South Dakota in the United States and Canada and watershed management districts in each state.[204] The RRBC has for many years aimed to create a "vision of comprehensive, integrated watershed stewardship and management,"[205] that includes a mix of structural and non-structural proposals for the region. The RRBC plans guide decision-makers, but lack enforcement authority.[206]

The RRBC's most recent 2011 report considered the factors contributing to basin flooding.[207] In considering climate variability, the RRBC report states that "if changes in climate are going in predicted directions (illustrated, for example, in the rise in US coastal waters), we can expect impacts in the northern mid-section of the continent to include, among others, more vulnerability to both spring

201. *See id.* at 55.

202. *See id.* at 21.

203. *See* RED RIVER BASIN COMM'N, LONG TERM FLOOD SOLUTIONS (LTFS) PROJECT (2011), *available at* www.redriverbasincommission.org/LTFS_handout_04_04_11.pdf.

204. *LTPS Committees*, RED RIVER BASIN COMM'N, http://www.redriverbasincommission.org/Long_Term_Flood_Solutions/LTFS_Committees/ltfs_committees.html (last visited Oct. 14, 2013).

205. RED RIVER BASIN COMM'N, RED RIVER BASIN NATURAL RESOURCES FRAMEWORK PLAN 3 (2005), *available at* http://www.redriverbasincommission.org/Services/NRFPnonsdlstchFINAL.pdf.

206. *Id.* at 17.

207. *See* RED RIVER BASIN COMM'N, FINDING LONG TERM FLOOD SOLUTIONS TOGETHER: REPORT TO STATE AND FEDERAL OFFICIALS ON A COMPREHENSIVE PLAN OF FLOOD STRATEGIES FOR THE BASIN OF THE RED RIVER OF THE NORTH 2009–2011 (2011), *available at* https://www.llis.dhs.gov/sites/default/files/RedRiverBasin.pdf.

and summer flood events."[208] Yet, it then asks whether the increased frequency and magnitude of floods are a reflection of climate change.[209] To answer the question, the RRBC relies on a hydrologic, hydraulic, and climate report, prepared by engineers for the Army Corps of Engineers and the RRBC; the engineers' report stops short of linking the increased flooding and temperature changes to human-causes, but it emphasizes the need to "account for increased uncertainty as related to the Fargo Moorhead studies"[210]—i.e., the reader must take the additional steps to connect the dots.

When governments make a commitment to understand and utilize climate change data, they will likely develop better forecasting models as well as account for remaining uncertainty. Planning based on this richer analysis could improve the outcomes when floods do occur. Without the explicit recognition of climate change, local governments may not dedicate the resources needed to improve the value of the data and they may underestimate the extreme flood events.

2. Regional Collaboration and Ecosystem Restoration

As local governments take on more responsibility for flood control than the federal government, they may be tempted to focus narrowly on building visible structures within the city that demonstrate to their residents that they are ready for floods. These quick fixes often do not provide as many long-term benefits as regional approaches. Regional collaboration enables partners to improve ecosystems, avoid risk shifting, and reduce each city's share of project costs. The EU Floods Directive recognizes the importance of the big picture approach and requires collaboration among members and at appropriate scales. The Floods Directive requires member states to "coordinate within river basin districts" and to "refrain from taking measures or engaging in actions which significantly increase the risk of flooding in other Member States."[211]

208. *Id.* at 14 (also mentioning that Manitoba is incorporating climate change potential into its 700-year flood protection plan for Winnipeg).

209. *See id.*

210. BARR ENG'G CO., RED RIVER BASIN LONG TERM FLOOD SOLUTIONS app. B, at 61 (2011). In North Dakota, the language most often used to describe the increased frequency and magnitude of flooding is "wet cycle."

211. Council Directive 2007/60/EC, *supra* note 146, ¶ 14.

The case study areas also recognize the importance of developing regional plans. The RRBC's 2011 report calls for more collaboration and notes some of the benefits:

> [a] recent study of the emphases and actions of Red River basin water(shed) districts found, among other conclusions, that those water(shed) districts which had joint agreements with other boards saw more projects move ahead. The projects that were chosen, moreover, tended to promote areas such as water quality, retention, and restoration over more traditional emphases.[212]

In the Sacramento area, the CVFPP creates a regional plan and establishes guidelines and requirements for local government to develop supporting plans.[213] The DWR takes the big picture view of flood protection needs and it calls on local partners to ensure that the plan incorporated the knowledge and perspective of the region's many stakeholders. The DWR has assumed the responsibility to stay abreast of and coordinate its actions with the other actors and efforts in the region to promote better flood protection.[214] SB5 mandates that the CVFPP consider means for improving system-wide ecosystem function in its development of a plan, "including, but not limited to, establishment of riparian habitat and seasonal inundation of available flood plains where feasible."[215] Specifically, the CVFPP urges the movement away from a notion of environmental mitigation that happens at the end of plan development and toward a model where environmental benefits will be considered early in the process. Perhaps in a nod to the importance of consensus-building in flood control planning, it notes "[t]his will help improve overall flood project delivery and may broaden public support for flood projects."[216]

212. RED RIVER BASIN COMM'N, *supra* note 207, at 90.

213. *See generally* COWIN, ET AL., *supra* note 176.

214. *See id.* at 3-22.

215. *Id.* at 3-21 (quoting CAL. WATER CODE § 9614(j)). An interesting example of diverging approaches at the local and federal level has occurred regarding levee vegetation. In the aftermath of Katrina, the Corps determined that vegetation could pose a threat to levee integrity and developed a woody vegetation-free zone on all levees and within fifteen feet of levees on both sides. In contrast, DWR independently assessed the vegetation's impacts and concluded that any risk posed by the vegetation to levee integrity is small and that the vegetation has position ecosystem impacts. DWR has met with the Corps to try to resolve the difference and ultimately has taken the position that while it will adhere to the Army Corps's standard for vegetation for new levees, it will allow for flexibility with regard to legacy levee vegetation to manage regional differences. *Id.* at 3-25 to 3-28.

216. *Id.*

Cedar Rapids had started thinking more broadly about ways to improve the riverfront even before the 2008 flood. Utilizing the existing planning effort, the Cedar Rapids Corridor Redevelopment Plan (CRCRP), the city undertook a planning process after the flood that engaged the community in a conversation.[217] It examined flood impacts in context of the unique characteristics of Cedar Rapids and explored alternative redevelopment options for flood management, neighborhood redevelopment and downtown reinvestment. The CRCRP addressed six key themes: housing and neighborhood character, transportation and connectivity, recreation and open space, arts and cultural opportunities, business reinvestment, and community services. The community involvement generated widespread support for the end product.[218]

Iowa communities have looked for regional solutions as well. At the state level, the Rebuild Iowa Advisory Commission (RIAC) issued a 120-Day Report to the Governor in which it recommended that the state "lead in developing guidance and support for integrated, regional planning to address recovery and leverage multi jurisdictional strengths for ongoing initiatives" and noted "there is unequivocal unanimity in the call for multijurisdictional, regional planning across Iowa."[219] In its Iowa Climate Change Report, the EPA explained that "[a]s many Iowa communities have found, communities can get more out of their resources by collaborating on multijurisdictional hazard mitigation plans and using larger watershed planning and regional land use planning tools."[220] It specifically suggests that communities take advantage of Councils of Governments to work across jurisdictional boundaries and ensure that upstream and downstream communities are coordinating their efforts.[221]

The Iowa Flood Center at the University of Iowa, established by the Iowa Legislature in 2009,[222] recently received $1.5 million from

217. SASAKI ASSOCS., CITY OF CEDAR RAPIDS NEIGHBORHOOD PLANNING PROCESS: EXECUTIVE SUMMARY (2009), *available at* http://www.corridorrecovery.org/city/neighborhoods/Summary.pdf.

218. *See* Interview with Jennifer Pratt, Planner, Cmty. Dev. Dep't, Cedar Rapids, Iowa (April 19, 2013) (on file with author).

219. REBUILD IOWA ADVISORY COMM'N, 120-DAY REPORT TO GOVERNOR CHET CULVER 15, 42 (2008), *available at* http://publications.iowa.gov/7250/1/RIO_120_DAY_REPORT.pdf.

220. EPA, *supra* note 200, at 15.

221. *Id.*

222. 2009 Iowa Acts, ch. 184, § 15.

Department of Housing and Urban Development to fund construction of watershed improvement projects to support flood mitigation in three watersheds, including farm ponds and wetlands.[223] While Cedar Rapids is not included in the Upper Cedar River Watershed, which will be part of the program, these efforts likely represent the beginning of a series of projects that will improve regional planning. Moreover, Cedar Rapids will need to pay close attention to the Upper Cedar projects to evaluate potential downstream impacts on its community.

3. Nonstructural Approaches

As local governments develop flood management approaches based on regional environmental conditions, they can employ a number of nonstructural measures to reduce flood risk. The EU Floods Directive states that "[w]ith a view to giving rivers more space, they should consider where possible the maintenance and/or restoration of floodplains."[224] While the Floods Directive does not provide more specificity, member states have begun the process of considering how to "make room for the river," as the effort has been dubbed in the Netherlands. [225] The Dutch Government noted that although dyke reinforcement will reduce flood risks, when floods inevitably occur they will result in greater damage. Thus, it developed a plan to reduce development and levees in thirty cities; the goal of the project is to increase capacity of the river and avoid flooding while improving the overall "economical and environmental quality in the river region" and allowing for a longer term solution in light of climate change.[226]

In the case study areas, local governments have, in some instances, "made room for the river." Fargo, Moorhead, and Cedar Rapids

223. *$1.5M Grants to Benefit Residents of Three Iowa Watersheds*, IOWA FLOOD CENTER (Mar. 22, 2013), http://iowafloodcenter.org/1-5m-grants-to-benefit-residents-of-three-iowa-watersheds.

224. Council Directive 2007/60/EC, *supra* note 146, ¶ 14.

225. RUIMTE VOOR DE RIVIER, ROOM FOR THE RIVER: SAFETY FOR FOUR MILLION PEOPLE IN THE DUTCH DELTA 4, *available at* http://www.ruimtevoorderivier.nl/media/88721/rvdr_corp_brochure_eng__def._.pdf; *see also* Michael Kimmelman, *Going with the Flow*, N.Y. TIMES, Feb. 13, 2013, http://www.nytimes.com/2013/02/17/arts/design/flood-control-in-the-netherlands-now-allows-sea-water-in.html?pagewanted=all&_r=0 (comparing the Dutch government's approach to buying out farmers to create spillways with the incentive programs that characterize Governor Cuomo's vision for creating buffer zones in New York).

226. RUIMTE VOOR DE RIVIER, *supra* note 225, at 5.

have bought homes located in the most flood prone areas and turned the land into green space to give the river a buffer to spread without damaging property. Moorhead has a list of several low elevation properties adjacent to the river that it would like to buy to install higher levels of flood risk management;[227] to date, 101 properties have been purchased.[228] Fargo maintains a prioritized list of potential buyouts and actively seeks to purchase and remove floodplain homes; Fargo has purchased 125 homes from willing sellers since 1997.[229] As part of its recovery from the 2008 flood, Cedar Rapids—in collaboration with FEMA, Department of Housing and Urban Development (HUD), and LOST—identified structures to participate in voluntary property acquisitions.[230] At this point, 1700 homes have been bought and demolished.[231] These buyouts enable local governments to restore natural systems, reduce flood damage and move residents out of harm's way. Sacramento has not invested in purchasing flood-prone homes to the same degree, but has bought at least twenty homes, destroyed them, and turned the land into parkland.[232] These buyout transactions have important safety and flood management benefits. They can get bogged down, however, in bureaucracy of determining property value and the funding of the purchases, and during that waiting period homeowners may avoid

227. *See* Dan Gunderson, *Moorhead Buys Houses; Moves Them Out of Flood Zone*, MINN. PUB. RADIO (Mar. 1, 2010), http://minnesota.publicradio.org/display/web/2010/02/28/flood-housing; *see also Flood Mitigation Projects*, MOORHEAD MINN., http://www.ci.moorhead.mn.us/the_city/floodplain/mitigation.asp (last visited Oct. 14, 2013).

228. The City of Moorhead purchased forty-nine properties in low-lying riverfront neighborhoods after the 2009 flood using $9.3 million of combined federal, state and local funding for flood mitigation projects. The purchase of flood prone homes continued through a 2010 state appropriation, allowing for the acquisition of another fifty-one homes in 2010 and the first quarter of 2011. In total, 101 properties have been acquired (one property transferred from the State). These additional homes were acquired specifically for flood mitigation projects. CITY OF MOORHEAD, 2010 HOUSING REPORT, *available at* http://www.ci.moorhead.mn.us/housing/pdf/2010_Housing_Report.pdf.

229. U.S. ARMY CORPS OF ENG'RS, DRAFT INTEGRATED FEASIBILITY STUDY AND ENVIRONMENTAL IMPACT STATEMENT, FLOOD RISK MANAGEMENT PROJECT FOR FARGO-MOORHEAD 186 (2010).

230. U.S. ARMY CORPS OF ENG'RS, *supra* note 166, at 114.

231. *Anxious Cedar Rapids Takes Steps to Fight Flood*, THONLINE.COM (May 31, 2013, 11:18 AM), http://www.thonline.com/news/iowa-illinois-wisconsin/article_bcac9360-ca0d-11e2-a6a1-0019bb30f31a.html.

232. Brad Branan, *Many in Sacramento County Will Save on Flood Insurance for Several Years*, SACRAMENTO BEE, Mar. 19, 2013, http://www.sacbee.com/2013/03/19/5273725/many-in-sacramento-county-will.html#storylink=cpy.

investing in flood protection.[233] The expansion of greenways, through the purchase and destruction of residential structures, offers more room for the river but reduces tax revenue from those residential property owners. On the other hand, local governments are saving money in emergency response costs for homes that would likely get flooded.

The case study areas have changed building codes to require higher levels of flood protection in new buildings and in renovated buildings. Cedar Rapids developed increased standards of protections for buildings in the floodplain such as requiring them to be protected up to one foot above the 100-year flood level.[234] Moorhead imposes flood-proofing requirements for new construction, and limits construction in the floodway.[235] Fargo also addresses elevation and setbacks in its floodplain zone; it requires buildings to be raised 2.5 feet about the base flood level.[236] Fargo also "provides for a cost share of up to seventy-five percent by the city in improvements made by individual homeowners to improve their level of flood risk management."[237]

Despite these positive measures, none of the case study areas have incorporated climate change data into land use planning at this point. It is possible that one of the Central Valley local governments will make some zoning changes. SB5 and CVFPP contemplate that cities will change zoning ordinances to advance the flood management program and goals,[238] and provide as part of a summary that the plan aims to "[i]ncrease the engagement of local agencies willing to participate in improving flood protection, ensuring a better connection between state flood protection decisions and local land use decisions."[239] Nothing in this language, however, requires any particular land use changes nor does it provide examples. Cities

233. *See* Gunderson, *supra* note 227.

234. CEDAR RAPIDS, IOWA, MUNICIPAL CODE § 32B.05 (2010).

235. *See generally Flood Mitigation Projects*, MOORHEAD, MINN., http://www.ci.moorhead.mn.us/the_city/floodplain/mitigation.asp (last visited Oct. 14, 2013).

236. *See generally* CITY OF FARGO, BUILDING INSPECTION DIV., FLOOD PROOF CONSTRUCTION REQUIREMENTS, *available at* http://www.cityoffargo.com/attachments/d1c0c7b9-ec9f-4e11-a0c7-4dfe9985a0dd/floodhandout.pdf.

237. U.S. ARMY CORPS OF ENGINEERS, FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT, FARGO-MOORHEAD METROPOLITAN AREA FLOOD RISK MANAGEMENT 22 (2011).

238. CAL. WATER CODE §§ 65865.5, 65962, and 66474.5 (West 2004); COWIN ET AL., *supra* note 176, at 2-16.

239. COWIN ET AL., *supra* note 176, at 1-27.

within the Central Valley have until July 2015 to complete their implementation plans.[240]

Cedar Rapids' floodplain management ordinance requires the integration of current flood and hydrologic models in analyzing proposed projects in the floodway, floodplain, and flood-prone areas.[241] Arguably, it can incorporate climate change into the flood models. Still, Cedar Rapids has not prohibited building in the floodplain, but rather has incentivized rebuilding of property located in the 500-year flood area that was damaged by the 2008 flood. Incentives offered under the Community Development Block Grant program offer forgivable loans for the twenty-percent deposit needed to purchase the property.[242]

Along the Cedar River, one town changed its zoning ordinance to prohibit building in the 500-year floodplain. Upstream from Cedar Rapids, the small town of Cedar Falls, a Waterloo bedroom community with a population of 39,993,[243] followed through and enacted a zoning ordinance to prohibit new development and limit replacement of existing structures in the 500-year flood plain: "No new lots shall be established within the 500-year flood boundaries after January 1, 2010."[244] And, "[a]n existing structure located on the original lot of record, if located within the 500-year flood plain, will be allowed to be maintained and upgraded or enlarged in conformance with this section, but shall not be replaced with a new structure."[245] Critical facilities—hospitals, schools, and facilities for the disabled and elderly—must be located outside the 500-year floodplain boundaries.[246] Considering that nearly twenty-five percent

240. Central Valley Flood Protection Act of 2008, 2007 Cal. Legis. Serv. Ch. 364 (S.B.5).

241. CEDAR RAPIDS, IOWA, MUNICIPAL CODE § 32.B.04 (2012), *available at* http://library.municode.com/index.aspx?clientId=16256&stateId=15&stateName=Iowa. Note that the floodplain refers to the areas designated by FEMA as 100-year flood areas, while flood-prone areas also meet the one-percent change of flood as determined by state and local flood managers. *Id.* The floodway is defined in the ordinance as "[t]he channel of a river or other watercourses and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." *Id.* § 32.B.02.

242. *About ROOTs*, CEDAR RAPIDS, http://www.cedar-rapids.org/government/departments/community-development/housing/ROOTs/Pages/AboutROOTs.aspx (last visited Oct. 14, 2013).

243. *Cedar Falls (City), Iowa*, U.S. CENSUS BUREAU, http://quickfacts.census.gov/qfd/states/19/1911755.html, (last visited Aug. 30, 2013).

244. CEDAR FALLS, IOWA, CODE OF ORDINANCES § 29-156(c) (2011).

245. *Id.*

246. *Id.* § 29-156(d).

of the Cedar Falls is in the 500-year floodplain,[247] this is a significant decision. Following Cedar Falls's lead, an Iowa state legislator introduced the Cedar Falls ordinance as model legislation for the state.[248] The proposed legislation encouraged enhanced watershed management, better risk communication to residents, and more floodplain regulation. The legislation did not pass.[249]

The notion of prohibiting building construction or redevelopment in flood-prone riverfront areas challenges longstanding norms and the essential character of cities that grew up on rivers. Moving forward, communities that develop a better understanding of the flood risks—in terms of safety and emergency response costs—may decide that some of the most flood-prone areas should be used as green spaces. In cases where local governments cannot or will not make room for the river, they can ensure that the levees and floodwalls are as effective as possible. The issue will become even more important in the future because the International Panel on Climate Change has begun to include human settlement patterns in the discussion of mitigation and adaptation strategies.[250]

4. Structural Solutions and Federal Government Involvement

An integrated flood management plan necessarily includes the use of levees and floodwalls and dedicated floodways to protect cities from rising waters. The EU Floods Directive expects member states to assess the "effectiveness" of existing man-made flood infrastructure[251] and envisions plans that will include measures to reduce floods (which assumes man-made structures). As obvious and basic as this assessment and maintenance requirement sounds, a recent evaluation of the federally managed flood infrastructure in the

247. *Case Study: Cedar Falls, Iowa*, AM. PLANNING ASS'N, https://www.planning.org/research/postdisaster/casestudies/cedarfalls.htm (last visited Oct. 14, 2013).

248. S.F. 2316, 2012 Gen. Assemb. (Iowa 2012), *available at* http://coolice.legis.iowa.gov/Cool-ICE/default.asp?Category=billinfo&Service=Billbook&ga=84&hbill=SF2316.

249. Brian McDonough et al., *Advice Ignored: Climate Change and Iowa Water Quality Policy*, IOWA POL'Y PROJECT (May 21, 2012), http://www.iowapolicyproject.org/2012Research/120521-climate-water.html.

250. S. Kahn Ribeiro et al., *Transport and Its Infrastructure*, *in* CLIMATE CHANGE 2007: MITIGATION, CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (B. Metz et al. eds., 2007); *see* Margaret E. Byerly, *A Report to the IPCC on Research Connecting Human Settlements, Infrastructure, and Climate Change*, 28 PACE ENVTL. L. REV. 935, 955–56, 968–69 (2011).

251. Council Directive 2007/60/EC, *supra* note 146, at 30.

United States revealed extensive vulnerabilities.[252] Fargo-Moorhead, Cedar Rapids, and Sacramento all have plans in process designed to improve existing flood infrastructure. Because these projects can be extremely expensive and have broader implications for the surrounding area, federal involvement is appropriate. In each of these cases, however, the federal government's involvement in developing structural solutions has done more to highlight the weaknesses of United States flood policy than to demonstrate effective, innovative solutions.

In the Red River Basin, Fargo and Moorhead requested that the Corps help them develop a flood management plan, but the resulting flood management plans have created a risk-shifting problem, by increasing flooding in other areas, and ultimately threaten the project's political viability at the state level. The Corps's first proposal, set forth in the *Draft Environmental Impact Statement* in June 2010, proposed the structural solution of a thirty-six-mile-long diversion canal around Fargo-Moorhead.[253] The Corps selected a plan that would create an earthen diversion channel 100 to 300 feet in width with a maximum depth of twenty-nine feet and a construction footprint of 6560 acres. The cost for the project would be approximately $1.4 billion.[254] "At 36 miles long, three stories deep and two football fields across from bank to bank, the project would be one of the nation's most ambitious flood control efforts in history."[255]

Downstream interest and environmental groups were very unhappy with this plan and they demonstrated that the Corps had underestimated the likely downstream flooding impacts and scope.[256] The proposed diversion canal would not only cause significant flooding, it would cross the border into Canada. In response to comments and further assessment of the downstream impacts, the

252. *See generally* Flesher & Burdeau, *supra* note 30.

253. U.S. ARMY CORPS OF ENG'RS, DRAFT FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT: FARGO-MOORHEAD METROPOLITAN AREA FLOOD RISK MANAGEMENT PROGRAM 276 (2010), *available at* http://fmdam.org/wp-content/uploads/2012/01/2010-05-28-Draft-Feasibility-Report-Public-FINAL.pdf.

254. Paul Quinlan, *Flood Fears Downstream Hinder Plans to Divert Red River of the North*, N.Y. TIMES, Aug. 27, 2010, http://www.nytimes.com/gwire/2010/08/27/27greenwire-flood-fears-downstream-hinder-plans-to-divert-58522.html?pagewanted=1.

255. *Id.*

256. Jonathan P. Scoll, *Flood Control on the Red River as a Complex Environmental Decision System*, NAT. RESOURCES & ENV'T, Winter 2012, at 4.

Corps redesigned the project, incorporating a new and substantial flood staging/retention component immediately upstream of Fargo–Moorhead, consisting of a 50,000 acre-foot storage basin (4360 acres) behind a nearly twelve-mile embankment and an adjacent 150,000 acre-foot floodplain staging area.[257] In April 2011, the Corps published a Supplemental Environmental Impact Statement (SEIS) for this revised project.[258] The proposal, now consisting of the storage basin, the staging area, and the diversion channel, became more complex than the 2010 channel-only project.

Naturally, the changed plan shifted upstream the burden and community concern.[259] Thirty-three entities have come together under a joint powers authority to oppose the current plan and threaten suit.[260] They argue that the new plan will permanently displace Oxbow, Hickson, and Bakke Addition and subject more than 54,700 acres south of Fargo to more water.[261] These towns argue that under the North Dakota Constitution, the government will be taking their property by eminent domain for private economic gain in the form of opportunity for growth of Fargo.[262] In response to these concerns, ring

257. *Id.* at 3.

258. U.S. ARMY CORPS OF ENG'RS, SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT: FLOOD RISK MANAGEMENT PROJECT FOR FARGO-MOORHEAD (2011).

259. *Diversion Opposition Builds Momentum, Lays Out Plans for Legal Protest*, DIVERSION DISCUSSION (Aug. 13, 2012), http://diversiondiscussion.areavoices.com/?p=947.

260. *Id.*

261. *Id.*

262. *'We're Going to Smoke Them': Diversion Opponents Lay Out Plans for Legal Protest*, BAKKEN TODAY (Aug. 13, 2012), http://www.bakkentoday.com/event/article/id/370855/publisher_ID/1/. North Dakota and many other states changed their constitutions in the wake of the decision by the Supreme Court of the United States in *Kelo v. New London*, 545 U.S. 469 (2005), which affirmed the Connecticut Supreme Court's decision that New London's exercise of eminent domain to take properties to further its economic development plan was a valid public use. North Dakota's Constitution now reads,

> For purposes of this section, a public use or a public purpose does not include public benefits of economic development, including an increase in tax base, tax revenues, employment or general economic health. Private property shall not be taken for the use of, or ownership by, any private individual or entity, unless that property is necessary for conducting a common carrier or utility business.

N.D. CONST. ART. I, § 16 (2012). For further background, see Richard A. Posner, *Foreword: A Political Court*, 119 Harv. L. Rev. 31, 42 (2005) ("Congress and the states can deprive the interpretation of its significance by placing limits on the use of the eminent domain power; the fact that a statutory power is upheld against constitutional challenge does not prevent the legislature from voluntarily curtailing the power.").

dikes will be built around at least some of these at-risk towns.[263] The Corps continues to revisit its plan[264] and the state environmental agencies are still examining the project under the respective state environmental protection acts.[265]

Similarly, the Corps's flood management plan for Cedar Rapids has created no tangible results to date. It provides flood reduction management to the east side of the Cedar River in downtown Cedar Rapids, which includes a majority of the commercial and industrial structures in the downtown area.[266] The plan is comprised of a system of 3.15 miles of earthen levees, floodwalls, and closure structures.[267] Concrete floodwalls comprise approximately two thirds of the total alignment length.[268] The Corps's preferred plan would be constructed to a stage of 32.4 feet, approximately 1.3 feet higher than the June 2008 flood crest, which the Corps characterized as providing a "substantial degree of risk reduction to the area."[269] It would substantially reduce flood risk to the east bank of the river in Cedar Rapids, which includes approximately 600 residents and 9340 employees.[270]

Cedar Rapids was not satisfied with the Corps's decision to eliminate the plan that would provide flood protection to both sides of the river and raised environmental justice concerns in its comments to the Corps's proposed flood management project.[271] In particular,

263. *Diversion Authority and Oxbow Reach Agreement for Levee Construction*, F-M AREA DIVERSION (June 13, 2013), http://www.fmdiversion.com /newsdetails.asp?ID=102. The towns of Hickson and Bakke will also receive a ring levee under the Army Corps's new plan. *See Oxbow/Hickson/Bakke Ring Levee Option: Frequently Asked Questions*, F-M AREA DIVERSION, http://www.fmdiversion.com/faqsringleveeoption.asp (last visited Oct. 14, 2013).

264. *See* U.S. ARMY CORPS OF ENGINEERS, DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT: DESIGN MODIFICATIONS TO THE FARGO-MOORHEAD METROPOLITAN AREA FLOOD RISK MANAGEMENT, *available at* www.fmdiversion.com/PDF/CorpsEA/FMM_Supplemental_Draft%20Environmental_Assessment_12June2013.pdf.

265. *See, e.g.*, *MnDNR Concludes Public Review of EIS*, F-M AREA DIVERSION (June 18, 2013), http://www.fmdiversion.com/newsdetails.asp?ID=105.

266. U.S. ARMY CORPS OF ENG'RS, *supra* note 166, at 283.

267. *Id.*

268. *Id.* at ES-IV.

269. *Id.* Amazingly, 1.3 feet higher is considered safe and effective in responding to the 500-year flood, yet climate change and increased rainfall projections make quite unpredictable the crest of the next big storm.

270. *Id.* at 195.

271. *Id.* Flood mitigation is a subset of the problem of pre- and post-disaster mitigation, and there is an important environmental justice component. Flood damage prevention strategies often raise serious environmental justice problems

many of the residents in the flood-affected homes were located on the west side of the Cedar River in working class neighborhoods with a high percentage of the elderly, poor and disabled, as well as female heads of households.[272] The City of Cedar Rapids argued that the Corps's benefit cost analysis fails to account for the impact that a subsequent flood would have on Cedar Rapids considering that it suffered such major consequences in 2008 and has been left vulnerable.[273]

The City of Cedar Rapids was not alone in suggesting that the City's preferred alternative should be considered in more depth, evaluating its level of flood damage reduction compared to the other alternatives. The Corps sent out the Feasibility Study for an independent peer review and the resulting report, issued in 2010, recommends that the Corps give greater consideration to the economic evaluation in light of the sustained damage from the 2008 flood; the report suggests that the environmental justice issues require a deeper analysis.[274] Still, the Corps moved forward. Lacking was the Corps's stated justification for its decision to override the environmental justice consideration in this situation. As of 2013, Cedar Rapids has been left trying to find funding to protect the west side of the Cedar River.[275]

In the Sacramento region, the CVFPP promises "stronger levees, enhanced flood capacity, a healthier ecosystem, improved preparations for and responses to flood emergencies, greater resiliency, and leaner, more efficient operations."[276] California also increased the required level of protection in urban areas, reflecting its acknowledgement of a likely increase in flood conditions.[277] The CVFPP aims to improve urban flood protection so that it can withstand the 200-year flood.[278] It provides guidelines, and references

because vulnerable social groups are often forced to live in at-risk areas. *See* DANIEL A. FARBER AND JIM CHEN, DISASTERS AND THE LAW: KATRINA AND BEYOND, ch. 4 (2006).

272. U.S. ARMY CORPS OF ENG'RS, *supra* note 166, at 261.

273. *Id.* at 202–03.

274. BATTELLE MEM'L INST., *supra* note 167, at 17, A-4 cmt. 4.

275. Steve Gravelle & Patrick Hogan, *Another Loss for LOST*, THE GAZETTE (Mar. 6, 2012, 11:10 PM), http://thegazette.com/2012/03/06/another-loss-for-lost/ (describing the second failure of Cedar Rapids' requested tax hike to cover the plan to protect the west side of the Cedar River).

276. COWIN ET AL., *supra* note 176, at iii.

277. *Id.* at 1-16.

278. *Id.*

anticipated DWR levee design requirements, for local governments regarding levee construction and maintenance. These guidelines aim to improve original levee construction so that (1) they are resilient even when overtopping occurs, (2) setbacks are provided when possible to reduce damage from overtopping, and (3) mitigating measures are in place such as secondary levees, berms, and raised roads.[279] These developments are encouraging because they reflect an acceptance that levees will fail and that steps can be taken to prepare for that failure.

The Corps has been involved in improving existing federal reservoir projects impacting the Central Valley, such as the Folsom Dam. The Corps and the Department of Interior's Bureau of Reclamation collaborated to develop the Folsom Dam Auxiliary Spillway project, a $962-million effort to help Sacramento achieve 200-year level flood protection.[280] The Bureau of Reclamation is charged with operating and maintaining the Folsom Dam and the Corps is responsible for reducing the flood damage.[281] The auxiliary spillway, designed to complement the Folsom Dam function, will improve the speed and effectiveness of releasing water from Folsom Lake in high water events. Water will be transported through a 3000-foot spillway chute from a control structure to the American River; it will include a stilling basin to slow water to a pace that the river can handle.[282] These efforts are under way.[283]

Neither the Cedar Rapids nor Fargo-Moorhead federal plans have been built to date. Both have been approved by the Corps and presented for inclusion in the President's Budget. But, President Obama's proposed 2014 budget reduces the Army Corps's budget and does not include any of these projects or any other river flood projects for that matter.[284] The WRDA 2013, which could benefit the

279. *Id.* at 3-7.

280. *See generally* U.S. ARMY CORPS OF ENG'RS, RECORD OF DECISION: FOLSOM DAM SAFETY AND FLOOD DAMAGE REDUCTION JOINT FEDERAL PROJECT (2007), *available at* http://www.spk.usace.army.mil/Portals/12/documents/civil_works/JFP/Folsom%20JFP%20ROD%2003May07.pdf.

281. *Id.*

282. *Id.* at 2.

283. *See* U.S. Army Corps of Eng'rs, *Construction Continues on the Control Structure of Folsom Dam's New Auxiliary Spillway*, FLICKR.COM (June 19, 2013), http://www.flickr.com/photos/sacramentodistrict/9094757441/ (providing photographs of the Corps's progress).

284. *See, e.g.*, Michelle Corless, *Eastern Iowa Projects Not Included in President Obama's Fiscal Year 2014 Budget*, KWWL.COM (Apr. 10, 2013), http://www.kwwl.com/story/21936829/2013/04/10/eastern-iow.

Cedar Rapids and Fargo-Moorhead projects, passed the United States Senate, but still awaits a vote by the House and then appropriations.[285] As discussed in Part II above, the funding of Corps's projects through the budget process leads to extended delays, causing the state and local governments to take stop-gap measures to reduce flood risks. It also creates situations where, by the time these projects are built, they may no longer represent the most up-to-date solution.

The lack of standards and maintenance of existing levees and the failure to improve levees not only increase the risk to citizens in harm's way, but also may raise liability concerns for the local and state governments. In 2006, the Sacramento Area Flood Control Agency (SAFCA) issued a white paper, noting a number of the factors compelling action to evaluate and improve flood protection including the rapid urban growth.[286] SAFCA encouraged the California legislature to develop a comprehensive plan to provide statewide standards for levees, and clarify issues regarding liability of the state and local governments for flooding.[287] SAFCA's call to address liability concerns stems from *Paterno v. State of California*,[288] where the State was ordered to pay more than $400 million dollars for damages associated with the failure of the Linda levee, which had been built long ago by local governments and later adopted into the State's system of levees. In the court's words, "[t]he State must be charged with knowledge of how the levee was built. It operated the levee for decades and had ample opportunity to examine it. If it chose not to do so for fiscal reasons, that would indicate the loss should be absorbed by the State."[289] In response to the *Paterno* case, the California legislature passed AB 70 in 2007; AB 70 states that if the local government "unreasonably" approved new development in

285. Jim Abrams, *Senate Votes to Extend Federal Water Projects Law*, THEBIGSTORY.AP.ORG (May 15, 2013), http://bigstory.ap.org/article/senate-votes-extend-federal-water-projects-law; *see* Rick Smith, *U.S. Senate Passes Flood-Protection Bill Vital to Cedar Rapids*, KCRG.COM (May 15, 2013, 6:25 PM), http://www.kcrg.com/news/local/US-Senate-Passes-Flood-protection-Bill-Vital-to-Cedar-Rapids-207627761.html (noting that the Iowa senators voted in favor of the WRDA 2013 and acknowledging the long wait that remains).

286. SACRAMENTO AREA FLOOD CONTROL AGENCY, LEGISLATIVE FRAMEWORK FOR FLOOD CONTROL AND FLOOD RISK MANAGEMENT IN THE SACRAMENTO VALLEY 1 (2006), *available at* http://www.safca.org/documents/Policy%20Framework%20-%20SACOGWhitePaper_1.pdf.

287. *Id.*

288. Paterno v. State, 113 Cal. App. 4th 998, 1021 (2003).

289. *Id.* at 1021.

a previously undeveloped area, it must contribute its fair and reasonable share for any liability associated with flooding.[290] The *Paterno* case should serve as a warning for other local and state governments charged with increased responsibility for flood management.

CONCLUSION

These three case studies illustrate the profound evolution in flood management theory that has occurred since the 1968 enactment of the federal flood insurance program. This change is beginning to appear in the flood plain. There is a growing recognition that the use of climate change data, or at least improved flood forecasting data, will improve flood preparation. The consideration of ecosystem restoration and expanded green space along riverfronts reflects a shift in thinking about the need to look beyond structural solutions. Unfortunately, the transition to integrated flood management remains more theory than practice. The legacy of reliance on structural protection exerts a powerful force on all levels of government and remains the preferred option. The incomplete transition to integrated flood management stems, in large part, from the lack of coherent guidance from the federal government compared to the EU Floods Directive. The federal government also has failed to provide adequate proactive funding for innovative approaches to flood management. Thus, local governments continue to underestimate risks, encourage moral hazard behavior, and engage in up or downstream risk shifting.

Local governments and regional entities have an opportunity to lead the way for the federal government by modeling integrated flood management. They must address directly the tension between urban growth and increased flood risks to achieve this goal. Local governments must accept and communicate to its residents the need for land use planning that reflects a more accurate assessment of flood risks, including making room for the river. If local governments pay attention as the innovative and bold plans, such as the Central Valley's effort, move forward, momentum may build for more sustainable approaches to flood management. The federal government also can build on these improvements by developing

290. CAL. WATER CODE § 8307(a) (West 2009); *see* Daniel Farber, *Tort Law in the Era of Climate Change, Katrina, and 9/11: Exploring Liability for Extraordinary Risks*, 43 VAL. U. L. REV. 1075, 1085–86 (2009) (using the concepts laid out in *Paterno* to consider potential federal liability for flood damages).

comprehensive guidelines and financial incentives that reinforce budding success stories.