Version
2.0

Plan Integration for Resilience Scorecard GUIDEBOOK

Spatially evaluating networks of plans to reduce hazard vulnerability

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EXECUTIVE SUMMARY

As losses from "natural disasters" continue to increase, despite sophisticated knowledge about the causes and effects of such events – it is becoming increasingly evident that the term "natural" under-represents the responsibility of human decisions. Research on disasters clearly indicates that loss is largely due to poorly planned and haphazard development in hazardous locations . The trend of increased losses will likely be exacerbated in the future, as climate change is expected to increase the risks of climate sensitive hazards.

The hurricane season of 2017 (which included Harvey, Irma, Jose, and Maria, among others) was particularly tragic, resulting in over 3000 deaths and more than $280 billion in damage. Many communities are still in the process of rebuilding after the storms—and preparing for the next one. As they do so, they have an opportunity to plan in a more coordinated and risk-aware manner, placing hazard mitigation and vulnerability reduction at the fore – and integrating them throughout their networks of plans – using the *Plan Integration for Resilience Scorecard*.

Communities are often overwhelmed by their many and varied plan documents, which are often inconsistent—lacking the integration needed to effectively advance the cause of hazard resilience. For instance, a community's hazard mitigation plan may call for land acquisition and buy-outs in a high-hazard area, while its comprehensive plan sets goals to increase investment in the same location. This sort of conflict is distressingly common across communities struggling with how to reduce hazard vulnerability.

Communities working toward resilience continue to face significant challenges, including:

1. A '**plethora of plans problem**' – cities are often swimming in plans. Even small communities can have four or more plans guiding their development and management at any given time. These plans are typically developed by multiple stakeholder groups (both within and outside government) and pursue a variety of goals. Larger cities may have a dozen plans (or more!), and there is rarely a fully coordinated effort, particularly with respect to resilience.

2. The absence of a **collaborative process** by which to understand the various policies within different plans that are pulling in different directions, often resulting in increased vulnerability.

3. Little **spatial understanding** regarding the heterogeneous effects of policies across a community, let alone their effects on hazard mitigation and resilience.

The Plan Integration for Resilience Scorecard is a tool to help communities address these challenges, helping them understand and discuss inconsistencies across their networks of plans by *spatially evaluating* their plan documents and existing vulnerabilities. Creating a 'resilience scorecard' is a three-phase process.

- First, hazard zones and planning districts (such as neighborhoods) are defined and mapped, creating neighborhood-scale units for improved analysis.
- Second, documents in the community's network of plans are evaluated and scores are given to districts for each policy that (a) affects vulnerability, (b) influences land use, and (c) can be spatially assigned. Scores are then summed for each hazard zone in each district. Higher policy scores indicate greater focus on reducing vulnerability. Negative scores indicate that the sum of applicable policies may actually increase vulnerability.
- Finally, physical and social vulnerability are determined for each of the districts and compared to the policy scores. This additional analysis provides additional insight regarding how well policies target areas of the community that are most vulnerable.

Outcomes from the Plan Integration for Resilience Scorecard process include a deeper understanding of the network of plans by community staff and decision-makers, increased awareness of the connection between plans and vulnerability to natural hazards, and adjustments in plans and policy tools to improve integration—all of which can help advance community resilience. When the scorecard results are overlaid with assessments of physical and social vulnerability, communities are better able to set priorities, implement wise decisions, and focus on smart investments.

The method has been applied in a diverse sample of communities. From this, we have learned that conflicts exist within many community networks of plans, and that strong policy scores do not always align with areas of greatest need. Even communities with high overall plan scores exhibit some inconsistencies within their plan networks and mismatches between policies and vulnerabilities. It has also become evident that **the Plan Integration for Resilience Scorecard can provide the motivation and information that staff and decision-makers need to better integrate their network of plans and more effectively build resilience throughout their communities.**

CHAPTER 1

INTRODUCTION

Prior to Hurricane Sandy, the hazard mitigation plan in a coastal New Jersey city called for acquisitions and buy-outs in high-hazard areas, while the comprehensive plan set goals to increase investments in the same locations. These plans were not only incompatible, but actively increased vulnerabilities. Unfortunately, this is not uncommon in the United States. Local plans—whether comprehensive plans, hazard mitigation plans, small area plans, or functional plans—often lack the integration required to adequately address vulnerability to hazards. This guidebook provides a step-by-step approach to evaluating your community's network of plans to better understand contradictory policies and those that may increase risk. The *Plan Integration for Resilience Scorecard* facilitates discussion and prioritization of community investment with leadership, stakeholders, and the entire community.

Why are plans contradictory?

Even in small communities, but particularly in large communities, there exist a variety of local departments and agencies, often with competing interests and priorities. Changes in elected officials and staff turnover can further complicate the situation. Despite the best intentions, planners and policymakers often find themselves specializing in a particular area, and interactions between the complex web of city departments and agencies may be minimal. Whether for lack of resources or time, communities can easily find their constituent parts 'siloed'. For instance, a planning department may not adequately consider hazards during development

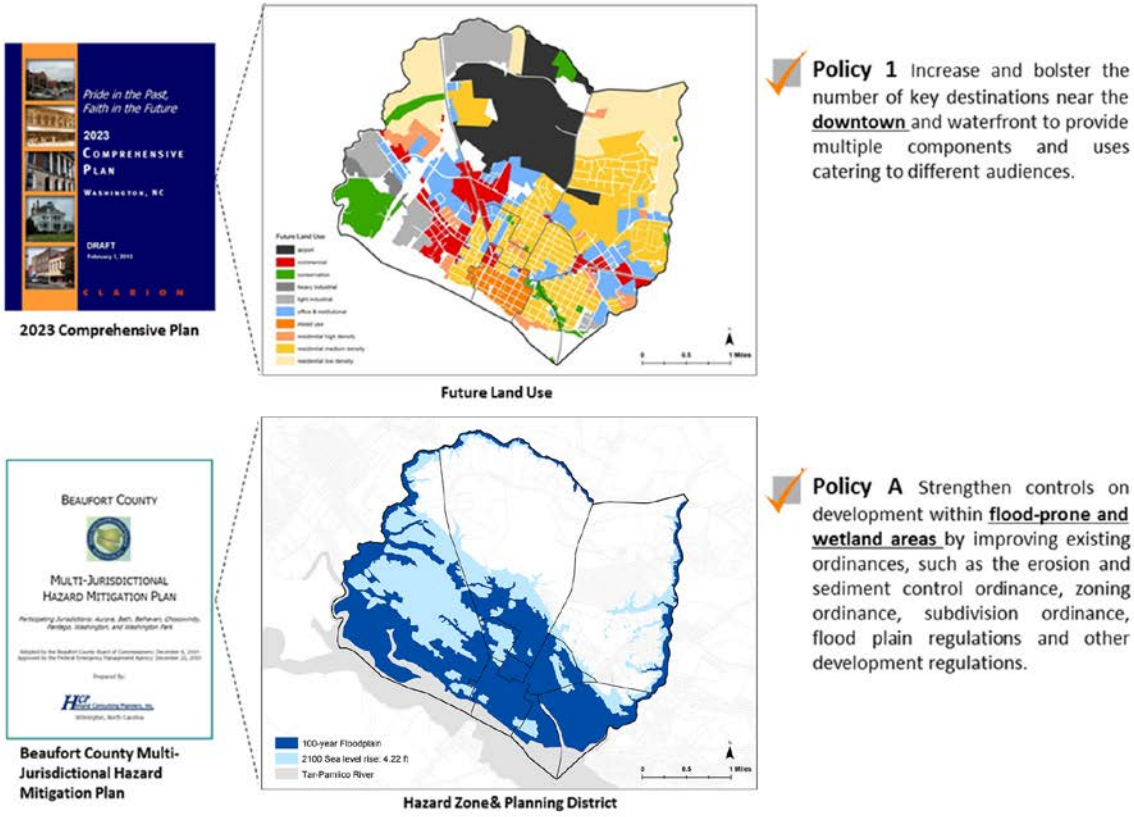


Figure 1.1: Spatial Incongruities in Planning Policies. Plans are often developed in isolation from one another; a comprehensive plan (top) might not reference hazards, while a hazard mitigation plan (bottom) may not reference land use or components of the built environment.

review, or the emergency management office may not account for planning and development management realities/needs. For a community to holistically plan for resilience, hazards must be considered in every part of the visioning, planning, and development process. Horizontal misalignment of planning initiatives – across community-level departments and agencies – pulls priorities and investments in different directions.

Ideally, all departments and their associated plans and projects would consider the long-term impacts of development, including with respect to hazards. As seen in *Figure 1.1*, some plans—such as land use plans, comprehensive plans, or general plans—include policies and strategies based on administrative boundaries or cultural districts (e.g., 'historic district' or 'downtown'). Others—such as hazard mitigation plans—contain policies and strategies based on physical geographies and hazard (e.g. '100-year floodplain' or 'flood-prone areas').

The Plan Integration for Resilience Scorecard helps reveal spatial incongruities in planning policies by mapping and overlaying:

- Planning districts and
- Hazard zones

Figure 1.2 conceptually illustrates spatial data layering and how policies within plans that refer to specific areas intersect to impact a community. Here, we layer planning districts, current and future hazard zones, and conservation areas, which yield scores that reveal increasing or decreasing vulnerabilities.

To gather data layers (as seen in Figure 1.2), we collect community-wide plans and evaluate the policies within them (Figure 1.3). As illustrated in Figure 1.3, we extract policies within community plans and test whether they increase or decrease vulnerability within hazard zones. As you will see, this simple exercise reveals plan conflicts or alignments.

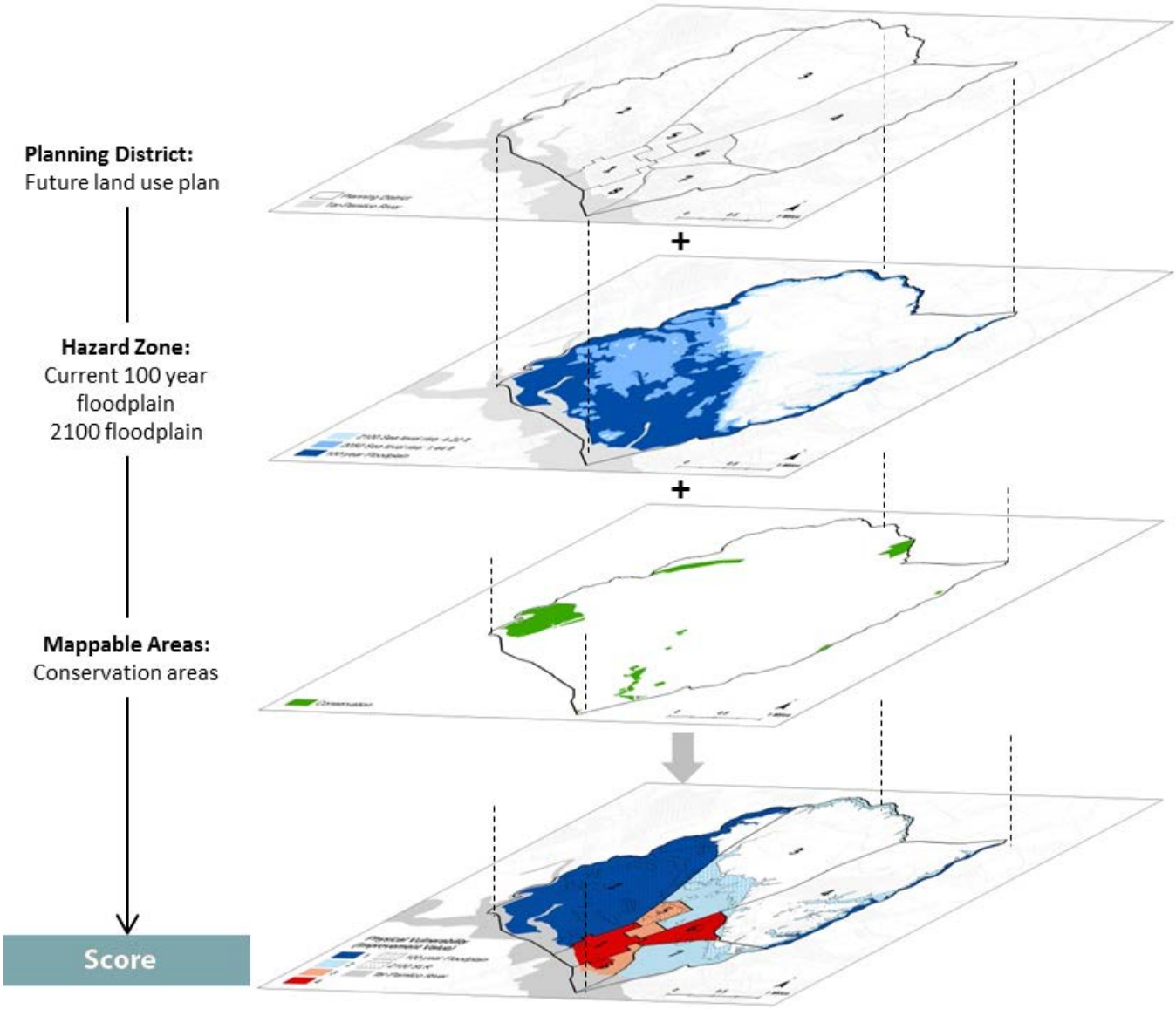


Figure 1.2: Overlaying Planning Districts with Hazards. Here we overlay planning districts with hazard zones and other 'mappable areas' to generate scores for each plan and for the community overall. The overlay can help the reveal hotspots and areas of conflict that the plans produce.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act of 2000 (DMA) requires all local governments to adopt hazard mitigation plans approved by FEMA to be eligible for federal pre- and post-disaster mitigation funds. For the first time, federal policy shifted to a more proactive approach—hazard mitigation.

NRC believes a resilience scorecard is "essential if communities want to track their progress toward resiliency" and "target efforts where they most need to improve."

Planning and Resilience

Resilience is "the ability to prepare and *plan for, absorb, recover from,* and more successfully *adapt* to adverse events."[1] A resilient community can 'bounce back' from a disaster, learn from past mistakes and adapt to new conditions. Planning- specifically, preventative *land use planning*- plays an important role in reducing vulnerability to hazards.[2] Land use approaches can guide new growth to locations outside of hazard zones. When plans include land use goals and policies that focus on reducing disaster losses, governments are more likely to adopt ordinances and invest in infrastructure[3], encourage households to reduce their risk[4], and reduce property damage from hazards[5].

As a result of the Disaster Mitigation Act of 2000, emergency managers are the primary developers of local hazard mitigation plans. When emergency managers and land use planners work together, mitigation plans are more likely to include land use policies and other preventative approaches[6], aligning with current guidance from the Federal Emergency Management Agency (FEMA) that recommends certain planning approaches and intergovernmental coordination. A strong interdisciplinary connection between local planners and policymakers with place-based knowledge can increase the incorporation of land use policies into plans[7]. In essence, communities that plan together are better equipped to handle a disaster when it strikes and are generally more resilient.

Goals of the Plan Integration for Resilience Scorecard

To address concerns about inconsistent plans, the National Research Council (NRC) has recommended the development of a resilience scorecard. The NRC believes such a scorecard is "essential if communities want to track their progress toward resiliency" and "target efforts where they most need to improve."[8] Many resilience indicators, tools, and scorecards are available to help assess community resilience (see full list in Appendix).[9] While some look at community capacities, others address economies, infrastructure,

1 National Academies 2012, p.1. Many relevant organizations adopted this definition of resilience in the "Industry Statement on Resilience" https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/Docs/StatementonResilience.pdf.
2 National Research Council (NRC) 2006, 2014
3 Berke et al., 2006; Burby & May, 1997
4 Horney, Simon, Grabich, & Berke, 2015
5 Burby 2006; Nelson & French, 2002
6 Lyles, 2015
7 Lyles, Berke & Smith, 2014
8 National Research Council, 2014
9 Cutter, Susan. (2015). The landscape of disaster resilience indicators in the USA. Natural Hazards 80:741-758.

and other components of the built environment. Still others focus on community plans and mitigation measures.[10] The Plan Integration for Resilience Scorecard is the first to evaluate the integration of plans.

A community's network of plans are cornerstones because they 1) represent the community's vision, 2) set goals, and 3) guide community development, actions, and policy decisions. The Plan Integration *for Resilience* Scorecard aims to:

1. Identify incongruities within networks of plans. The scorecard will reveal areas of compatibility and harmony between plans, but also uncover plan and policy conflicts that may exacerbate existing vulnerabilities or create new ones. By identifying such incongruities and overlaying them with hazards and measures of physical and social vulnerability, communities can focus on areas with the greatest risk, prioritize projects with multiple benefits, and adjust plans and policies for greater alignment and increased resilience.

2. Help "integrate and improve local plans in ways that reduce losses from hazard events." [11] The NRC recommends focusing on land use strategies and tools to mitigate hazards in the long-term.[12] Researchers have long discussed the positive impacts land use policies have on reducing vulnerabilities.[13] The Plan Integration for Resilience Scorecard evaluates not only land use plans, but the entire range of plans that spatially influence a community—encouraging comprehensive preparedness and mitigation.

3. Provide communities developing new plans or updating existing plans with a framework to reduce future hazard risk through smarter and more consistent policies. The methodical approach can be used to monitor and assess progress of the coordination of networks of plans for hazard vulnerabilities. A community can also evaluate the progress and performance of resilience investments and ensure continuity of decisions.

4. Provide a validated tool to address on-the-ground needs and build capacity.

Every community has a unique set of challenges and opportunities. Results from the scorecard evaluation can facilitate meaningful conversations with stakeholders and residents about new policies and investment priorities.

Aligning with Other Initiatives

The Plan Integration for Resilience Scorecard is not meant to be used in isolation, but as a tool to help reveal conflicts and prioritize wise decision-making and investments. It aligns with FEMA's 2013 *Local Mitigation Planning Handbook* and is the next generation of FEMA's 2015 *Plan Integration: Linking Local Planning Efforts*, as well as with the National Flood Insurance Program's Community Rating System (NFIP/CRS) Activity 510: floodplain management funding. The *Community Resilience Planning Guide* developed by the National Institute of Standards and Technology (NIST) also refers to the need for an assessment of plan integration prior to developing the resilience plan it describes. In addition, the scorecard complements many other community development activities, such as:

- **Plans:** There are several required and voluntary plans your community may develop. You can use the scorecard process as an initial fact basis to understand existing policies across your network of plans to inform new plan development.

10 Ibid.
11 Berke, Philip, G. Newman, J. Lee, T. Combs, C. Kolosna, D. Salvesen. (2015). Evaluation of networks of plans and vulnerability to hazards and climate change: a resilience scorecard. Journal of the American Planning Association, 81:4, 289.
12 National Research Council (NRC), 2014
13 Burby et al., 1999; Burby, French, Cigler, Kaiser & Moreau, 1985; Godschalk, Kaiser, & Berke, 1998; Berke et al., 2006; Burby & May, 1997.

Table 1.1 Examples of Plans, Funding, and Technical Assistance that align with the Plan Integration for Resilience Scorecard

	Agency	Plan	Funding	Technical assistance
Consolidated Housing Plan (CHP) and Annual Action Plans (AAP)	HUD	X		
Hazard Mitigation Plan [Preparedness Grants, Hazard Mitigation Grant Program, Pre-disaster Mitigation Grants, Flood Mitigation Assistance]	FEMA	X	X	
Community Rating System Activity 510	NFIP		X	
Habitat Management Plan (HMP) and Annual Habitat Work Plans (AHWP)	USFWS	X		
State Wildlife Action Plans (SWAP), aka Comprehensive Wildlife Conservation Strategies [Wildlife Conservation and Restoration Program (WCRP) funds; State and Tribal Wildlife Grants (SWG) program]	Congress by Conservation and Reinvestment Act of 2000	X	X	
Coastal Zone Management Program (CZMP) [Coastal Zone Enhancement Program; Coastal Nonpoint Pollution Control Program]	NOAA		X	
Forest Plan (Land Management Plan)	USFS	X		
Endangered Species Recovery Plan	NOAA	X		
Climate Action Plan (focusing on adaptation, mitigation, and/or resilience)	NA	X		
Historic Preservation Planning Program	NPS	X		
National Conservation Innovation Grants	NRCS		X	
NOAA Climate Program Office: Regional Integrated Sciences and Assessments (RISA) Program	NOAA		X	
Resilience AmeriCorps	CNCS			X
Resilience Dialogues	USGCRP			X
Regional Integrated Sciences and Assessments	NOAA			X
Landscape Conservation Cooperatives	DOI			X
Regional Climate Hubs	USDA			X
Climate Adaptation Community of Practice	USGCRP			X
Clean Water State Revolving Fund (CWSRF)	EPA		X	
Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE)	DOT		X	
Sustainable Communities Initiative	HUD		X	

- **Funding**: Opportunities exist to leverage available funding, using the scorecard as a foundational assessment to identify needs.
- **Technical assistance**: You can also leverage technical assistance and data to help complete the scorecard as a foundational step to understanding needs.

Table 1.1 provides examples of existing initiatives that may be pursued in conjunction with the Plan Integration for Resilience Scorecard to capitalize on and strengthen planning efforts. Detailed descriptions can be found in Appendix A.

Development of the Plan Integration for Resilience Scorecard

The research team at Texas A&M University evaluated a geographically dispersed, and variously sized set of coastal communities (Washington, NC; Fort Lauderdale, FL; League City, TX; Boston, MA; Tampa, FL; Asbury Park, NJ). They analyzed each city's network of plans, assigning scores to planning districts, and also evaluated physical and social vulnerability. Collectively, these efforts helped refine the tool and evaluation process. Then, over several months, the research team 'translated' the research methodology into a user-friendly guidebook for practitioners

To validate the tool and its translation to practice, the research team invited subject matter experts to participate on an advisory board. The advisory board is composed of hazard planning practitioners from the newly formed Hazard Mitigation and Disaster Recovery Planning Division (HMDR) within the American Planning Association (APA). HMDR promotes professional learning and communication about making communities safer from natural and man-made hazards, and planning for recovery from disasters. HMDR is a group of more than 300 volunteers within APA. It also features a contact list of more than 400 affiliate members (no dues, mostly non-planners) in related fields concerned with mitigation and recovery.

Advisory Board Members:

- Allison Hardin, CFM- City of Myrtle Beach, Planner and Coastal Hazards Education Specialist
- Barry Hokanson, AICP- PLN Associates, President of the American Planning Association Hazard Mitigation and Disaster Recovery Division (APA-HMDR)
- Chad Berginnis, CFM- Association of State Floodplain Managers, Executive Director
- Darrin Punchard, AICP, CFM- Punchard Consulting
- Gavin Smith, PhD- University of North Carolina, Professor; US Department of Homeland Security's Coastal Resilience Center of Excellence, Director
- Jennifer Ellison- City of Urbandale, Community Development Director
- Matt Campbell- FEMA, National Coordinator for Community Recovery Planning and Capacity Building Recovery Support Function
- Michele Steinberg, National Fire Protection Association, Wildfire Division Manager
- Rich Roths- URS Corporation, Principal Planner

After the scorecard guidebook was vetted by experts and practitioners, the team began recruiting flood-vulnerable cities as potential pilot communities to test the scorecard and guidebook process. The selection criteria included:

- Population of less than 250,000
- Coastal community
- Approval from local legislative body
- Communities positioned to leverage partnerships with other agencies (i.e., HUD, FEMA, EDA, EPA, RPC/EDD, USACE, NIST, USDA, etc.) and NGO's, VOAD's, etc. to achieve mutual aims.

With guidance from the research team, pilot communities committed to:

- Assemble a team of stakeholders and key informants familiar with local planning documents
- Receive training on how to apply the scorecard to the local network of plans
- Score their own network of plans (with technical assistance from the Texas A&M research team)

BOX 1.1: Pilot Communities

Norfolk, Virginia

The City of Norfolk, VA, exposed to coastal flooding and sea-level rise, has a population of 250,000. Norfolk's planning staff and emergency management office decided to use the resilience scorecard because the City seeks to be a "model community on resilience",and recently completed the Vision 2100 Plan (which incorporates sea-level rise at 2100).

Core Team:

- George Homewood, FIACP, CFM- Director of City Planning
- Paula Shea, AICP- Principal Planner
- Jeremy Sharp, AICP- Principal Planner
- Steven Pyle- Assistant Emergency Manager
- Matt Staley- GIS Coordinator
- Katerina Oskarsson, Deputy to the Chief Resilience Officer of 100RC

League City, Texas

League City, TX, exposed to inland and coastal flooding along with sea leel rise, has a population of 88,000. League City, a politically conservative community, sought approval to complete the resilience scorecard from city staff, city council members, the planning and zoning commission and the emergency management office. A comprehensive plan update and assessment of all development regulations was the original impetus for the project in 2016.

Core Team:

- Mark Linenschmidt, AICP- Senior Planner
- Korrie Becht- Long Range Senior Planner
- Kris Carpenter- Planning ManagerRyan Edghill- Emergency Management Coordinator
- Chanel Jones- Assistant Emergency Management Coordinator

Nashua, New Hampshire

Nashua, NH, exposed to inland flooding among other hazards, has a population of 88,000. The City launched the Resilient Nashua Initiative in 2017 to holistically understand hazard vulnerbailities. By focusing on the hazard mitigation plan update, the City gathered together a more than 50 member steering committee from across departments, agencies, non-profits, and other community stakeholders. The City applied for a number of grants for the larger effort including a National League of Cities grant to complete the resilience scorecard in conjuction with the Community Resilience Planning Guide from the National Institute of Science and Technology.

Core Team:

- Justin Kates, Director of Emergency Management Anna McGinty, Chief Resilience Officer
- Angelo Marino, GIS Manager
- Pamela Andruskevich, GIS Analyst
- Jacqueline Cardoza, Planning Consultant

How to Use this Guidebook

The guidebook and scorecard should be used by practitioners to understand how existing local plans are coordinated, allowing them to address hazard-prone areas and serving as a guide to improve future plans. The scorecard should be used over time to improve and gauge progress in reducing vulnerabilities in current and future hazard zones. Such an analysis "will enable communities to reduce counterproductive efforts and more efficiently use resources to reduce their vulnerability to hazards." [15]

Throughout the guidebook we will use the city of Washington, North Carolina as an example community. Sidebars and maps will describe policies, plan inconsistencies and compatibilities, and other anecdotes related to things we uncovered while evaluating the network of plans:

- ***2023 Comprehensive Plan: Washington, NC (2013)*** – provides detailed land policy guidance (e.g., density and types of land uses and location, timing, and capacity of infrastructure) and a context for decision-making
- *City of Washington, North Carolina CAMA Core Land* ***Use Plan (2007)*** – land use plan adopted to fulfill the requirements of North Carolina's 1974 Coastal Area Management Act (CAMA) by establishing policies and guidelines related to the management of coastal areas, including economic development and the protection of natural resources
- ***Beaufort County Multi-Jurisdictional Hazard Mitigation Plan (2010)*** -- county-level hazard mitigation plan, developed to coordinate local disaster prevention and response and to fulfill the requirements of the federal Disaster Mitigation Act of 2000. While a more recent hazard mitigation plan has been approved since the scoring of these plans, we will still use the 2010 plan as an example for scoring throughout the guidebook.
- ***City of Washington Parks and Recreation Comprehensive Master Plan (2011)*** -- park plan developed to improve recreational opportunities and quality of life in Washington

Example Community : Washington, NC[14]

The colonial city of Washington is located in Beaufort County on the North Carolina coast. In 2010, the population was 9,074. Since the 1990s the economy has shifted toward tourism, and the population increased 1.7% between 2000 and 2010. The city's terrain averages about 10 feet above sea level, with slopes ranging from level to 4%; the city is exposed to several recurring natural hazards, including hurricanes, floods, and nor'easters. Flooding due to storm surge and sea-level rise are major threats because of the area's low-lying land and proximity to surface water.

14 Berke, et al. ,2015 , 289.

Define Your Community

In this guidebook, the term "community" refers to an administrative jurisdiction such as a town, city, or county. Depending on your state's enabling legislation, you may decide to choose various scales at which to conduct the scorecard evaluation. For instance, land use planning in some states is handled by the county, and smaller municipalities look to counties for their planning needs. In others, counties have very little authority to enforce ordinances, but may lead planning initiatives. When is comes to hazard mitigation planning, some states coordinate local planning efforts through guidance, review, and approval, and smaller municipalities develop the city-specific sub-plans. Additionally, regional planning agencies play a large role in hazard mitigation planning in parts of the U.S. Knowing about the various planning administrative dynamics in your state will help you decide on the appropriate community scale for your Plan Integration for Resilience Scorecard evaluation.

Leadership and Forming Your Team

Once you have defined your community scale, form a team. The evaluation of your network of plans cannot be conducted in silos, of course! We recommend establishing an interdisciplinary team (depending on your community size and resources) to oversee the scorecard evaluation. The primary goal of establishing the team is to communicate across departments or entities to better understand the plan content.

The core team should be composed of 2-4 people to coordinate the process, communicate across agencies, and present results to stakeholders. It should include persons overseeing planning initiatives or plans. **The core team would ideally include the person responsible for the**:

- Hazard mitigation plan (typically the emergency manager)
- Comprehensive land use plan (typically the planning director, city manager, county commissioner, or other)

Depending on the size and number of plans in the community, other participants may also be a good fit. We recommend including local planners, emergency managers, engineers, officials, staff from the community development, public works, and building departments, or any other group, person, or agency with land use or emergency planning responsibility. This team will play a central role in applying the scorecard and guiding the revision and improvement of the plans. One key to establishing an effective team is the capacity and ability of its members to advocate for policy change. We recommend utilizing existing committees. For example, metropolitan planning organizations (MPOs) or rural planning organizations (RPOs) are planning groups required for federal transportation funding and might be a good place to start. You may also consider existing mitigation plan teams, recovery teams, and similar groups when forming your scorecard team.

Larger Communities

If you are in a larger community – with many plans, departments, and agencies – the core team may choose to coordinate and delegate tasks to sub-teams. The sub-teams would complete the Policy Tasks and Mapping Tasks described, respectively, in Chapters 2, 3, and 4 of this guidebook. In total, we recommend that 6-12 participants work to complete the following tasks in larger communities.

Policy Tasks – Participants completing these tasks should have a general understanding of land use policies and should be comfortable identifying land use policies within different types of planning documents.

Mapping Tasks – Participants completing these tasks must be able to gather community maps and ideally have a general understanding of geographic information systems (GIS) software. Access to local maps is

needed, as well as the ability to collect maps from other sources.

Smaller communities
We understand that many communities have limited time, staff, and resources. If you are in a small city with little staff support (like our example community, Washington, NC), the core team can take on all the roles and responsibilities of the sub-teams. Small city teams may only include 2-3 people. Smaller communities should also prioritize Chapter 2, which include the Policy Tasks, Mapping Tasks, and Scoring Tasks.

Required Time and Effort

Before you start, set aside staff time to complete the tasks. Table 1.2 breaks down the anticipated time to accomplish the full Plan Integration *for Resilience* Scorecard. Consider building the Plan Integration *for Resilience* Scorecard into consulting service fees when developing new plans or plan updates.

Structure of the Guidebook

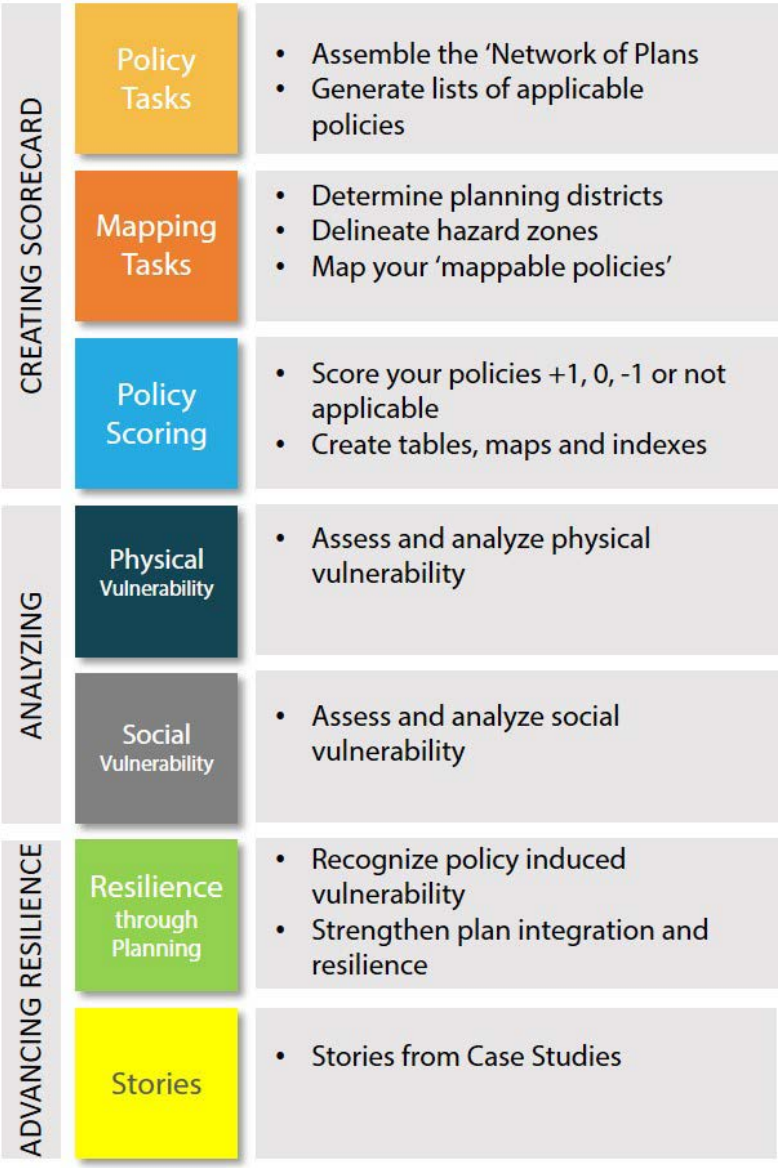
We recommend reading through the entire guidebook as you might read through a recipe, identifying ingredients, materials, and techniques needed to 'cook your meal'. Ask yourself: What plans and data are available? What people have authority to make land use or emergency planning decisions? What skillsets are needed?

BOX 1.2: Thinking about Your Team

To facilitate the Plan Integration for Resilience Scorecard, the City of Norfolk, VA (a city roughly 250,000 in population), developed a team of six members—the planning director, two planning staff within the department of city planning, an emergency manager, their chief resilience officer (funded as part of the Rockefeller Foundation's 100 Resilient Cities program), and a GIS analyst. While all members participated in collecting policies within the plan, the main points of contact included one senior planner and the GIS analyst.

Table 1.2 Time commitment

Team Tasks (per plan)	Staff Time
Policy Team	2-12* hr. per plan (A large comprehensive or general plan typically takes the longest time. Most plans range from 2-4 hrs.)
Score Policies	8 hr. per plan
Mapping Team	24 hr.
Physical Vulnerability	24 hr.
Social Vulnerability	24 hr.
Total	*120-160 hr. (1 FTE for 3-4 weeks)*



The guidebook is broken into the following:

Chapter 2: Creating Your Plan Integration for Resilience Scorecard
Gather all community plans and extract applicable policies. Use maps to overlay planning districts and hazard zones. Score policies based on whether they increase or decrease exposure in district hazard zones.

Chapter 3: Analysis
Evaluate your scorecard, physical vulnerability, and social vulnerability to better understand their patterns and relationships. Areas in need of prioritization will be revealed.

Chapter 4: Advancing Plan Integration, Knowledge, and Resilience
Guided by your scorecard and vulnerability analyses, adjust policies to improve plan integration, build knowledge, and strengthen resilience in the community.

Chapter 5: Stories
Learn from the experiences of other communities as you prepare your own story.

CHAPTER 2

CREATING YOUR PLAN INTEGRATION FOR RESILIENCE SCORECARD

A Plan Integration for Resilience Scorecard helps you spatially evaluate the policies in your community's network of plans, strengthening your understanding of how plans work together or conflict with respect to hazard vulnerability, and how your plans may affect different parts of the community in different ways. Your completed scorecard can then be mapped and analyzed in multiple ways, including via comparison to different kinds of vulnerability (see Chapter 3: ANALYSIS). The scorecard also acts as an organizational tool as you work to improve plan alignment and resilience in your community (Chapter 4: ADVANCING PLAN INTEGRATION, KNOWLEDGE, AND RESILIENCE).

This chapter breaks the multi-stage process down into a series of steps and guides you through the 'construction' of your community's unique scorecard. You will first prepare the policies to be scored by assembling the network of plans, generating lists of applicable policies for each plan, and validating those policy lists. Second, you will prepare maps to help spatially assign the policies; this includes determining your district-hazard zones and developing maps of place-specific terms. Once the policies and maps have been prepared, you will be able to assign scores to the appropriate district-hazard zone(s) and complete your scorecard! A conceptual diagram of this process is shown in *Figure 2.1*.

PREPARE POLICIES

The Policy Tasks described in this section are the first step to prepare the resilience scorecard be identifying and gathering policies within your network of plans. The first task is to determine which plans are relevant and useful for the analysis. Policy Task 2 provides guideance on the specific language and content to look for within the plans that will go into your scorecard. Finally, you will double check all components are within the policy lists, which will help prepare the policies for scoring.

Checklist:

- **Assemble the 'Network of Plans'**
- **Generate lists of applicable policies**
- **Validate and prepare policies**

OBJECTIVES:

- Gather all planning documents in the community
- Develop list of all policies (or policy-like language) within all planning documents
- Validate and prepare policies in the scorecard

MATERIALS REQUIRED:

- Community plan documents
- *Plan Integration for Resilience Scorecard*

STAFF REQUIREMENTS:

- Minimum 2 staff persons
- Ability to identify policies
- Ability to identify place-specific terms within policies
- Ability to link policies to the impacts of hazard vulnerabilities
- Ability to identify policy tools within policies

Policy Task 1: Assemble the 'Network of Plans'

A community's network of plans consists of all plan documents produced by any department, agency, or stakeholder group—as long as a plan has the potential to influence the development and management of the community. A network of plans typically includes a **comprehensive plan** (sometimes called a general plan or master plan) and a **hazard mitigation plan** , and may also include one or more **area plans** (e.g. downtown redevelopment plan, historic district plan, corridor plan) or **functional plans** (e.g. transportation plan, disaster recovery plan).

Figure 2.1 Assemble plans and list policies. These four plans were gathered from Washington, NC. Each plan was scanned for policies—how they increased or decreased vulnerability and integrated or in conflict. The scorecard will answer: How well are different plans in your community integrated? Are there policies within your plans that contradict and exacerbate disaster vulnerability

Your first task is to gather as many of these plans as possible. We suggest validating your list of plans with the leadership team and other departments to ensure all relevant documents are included. Focus your attention on city- and county-level plans. State-level plans are generally not detailed enough for this type of analysis and regional-level plans should be considered only if specific to your community.

1.1 Plan Document Types

The network of plans should include all plans that govern land use and development in hazard areas. Of all the plans that local governments prepare, the comprehensive plan often deals most directly with how and where development will take place. The hazard mitigation plan is also commonly adopted by local governments and are mandated by the Disaster Mitigation Act of 2000 as a requirement for communities to become eligible for federal pre- and post-disaster mitigation funds (Note: FEMA has recently placed increased emphasis on the integration of land use tools with mitigation planning).

Other standalone plans may also influence development in hazard zones, including plans that focus on a particular geographic area or specialized function. Transportation and infrastructure plans, parks and recreation plans, wildlife habitat management plans, economic development plans, housing consolidated plans, and many others may affect the way hazard-prone areas are developed and managed. Capital improvement plans also influence where development will occur and can actively steer development away from hazard zones with disinvestment. Examples of potentially applicable plans are included in *Table 2.1*.

1.2 Plan Criteria

As you gather plans, check to see that they contain policies or policy-like language and that they meet the following criteria:

- Plans should still be relevant; that is, they should still have some influence on policy decision-making. If a plan is too out-of-date, including it may not be worthwhile.
- Area plans (see *Table 2.1*) should intersect with at least one hazard zone. If the subject of an area plan is located entirely outside all hazard zones, it is at comparatively low risk and does not need to be included in the scorecard.
- Consider especially plans that affect the way the community grows or develops, and that refer to spatial aspects of the community.

Double Check:

Be sure to double check with local and regional departments to ensure plans are not left out. Even a thorough initial search may miss some plans. You may want to circle back and contact specific agencies.

15 FEMA, 2013, 2014.

Table 2.1 Examples of Types of Plans in a Community's 'Network of Plans'

Plan Type	Purpose	Contribution (+/-) to Vulnerability
Comprehensive/General Plan	Main community planning document	Policies can guide future development into or away from hazard zones.
Hazard Mitigation Plan	Reduce long-term risk to human life and infrastructure	Advocates vulnerability reduction and resiliency building, often via general policies or specific "action items"
Disaster Recovery Plan	Address disaster recovery related needs to be activated during recovery	Advocates vulnerability reduction and resiliency building post-disaster. Coordinates agencies to assist people post-disaster.
Area Plans:	Address planning issues pertaining to a portion of the community	Targeted policies may increase or decrease vulnerability, depending on purpose and location. Area plans may also contribute to policy district delineation.
Downtown (Redevelopment)		
Small Area/Neighborhood/ District		
Waterfront		
Corridor Plan		
Functional or Sector-specific Plans:	Focus on individual or related functions or sectors in need of specialized planning	Individual plan policies (or objectives, action items, etc.) may increase or decrease vulnerability, and are often distinct from those found in comp or hazard mitigation plans. Applicability to individual policy district may be aided by additional function/sector maps.
Transportation (or Transit)		
Parks / Open Space		
Economic Development		
Environmental Management		
Climate Adaptation/Mitigation		
Housing (Consolidated/Strategic)		
Wildlife Management		
Wildfire Protection		

Policy Task 2: Generate Lists of Policies

After assembling your network of plans, you can begin 'building' your scorecard. The first step is to generate lists of applicable policies (ideally performed independently by two people, who then compare and discuss their results). Thoroughly read each plan and add to the Policy List section of the scorecard (see Appendix C) any policy or policy-like statement that:

(1) Has potential to affect (reduce or increase) vulnerability to hazards;
(2) Includes at least one mappable, place-specific term; and
(3) Includes a recognizable policy tool (a form of government intervention to achieve specific objective or outcome). Descriptions of policy tools are provided in *Table 2.4*.

For many plans, policies will be plainly labeled as such; for others, they may be called objectives or action items (or may simply exist as policy-esque language in the document's narrative). For instance, hazard mitigation plans have a unique structure and typically contain action items rather than 'true' policies (discussed further in Section 2.3).

In many ways, determining a plan's applicable policies is as much an art as it is a science – remain flexible and responsive to the variation of your community's plans. Also, it is advisable to be somewhat 'generous' with the policies that you add to the list (to 'cast a wide net'). You will have a chance to remove policies that do not fully meet all three criteria in Policy Task 3: Validate Policy Lists. Policies that do not 'make the cut' for inclusion in the final scorecard may still present opportunities for adjustments that will improve resilience in the community (see Chapter 4), so having a record of them will be useful. As a helpful tip, start with shorter planning documents and save the larger, more extensive plans for the end to limit fatigue.

The policy criteria are described in greater detail (and examples are provided) in the following subsections.

2.1 Policies that Affect Vulnerability

The question of whether a policy will affect vulnerability is an important, though potentially subjective, one. The first thing to consider is whether the policy impacts an area of the community exposed to hazards (located within a hazard zone). Remember, the Plan Integration for Resilience Scorecard is a spatial evaluation tool based on vulnerabilities, so policies that are included should intersect the spatial extent of a hazard. If you are unsure of whether a policy

influences a part of the community in a hazard zone (hazard zones will be delineated in Map Task 2), include it anyway. The policy can be omitted later if you find there is no impact on hazard zones.

Second, as you read a policy, think about whether it might increase or decrease vulnerability to hazards. For instance, a policy from Washington, North Carolina, states:

"Encourage higher-density multifamily development in pedestrian-oriented urban areas with access to transit, a broad range of services and amenities and access to employment."

This policy encourages greater residential population density in "pedestrian-oriented urban areas" (*see Table 2.2*).

Although this is an effective New Urbanist policy to increase walkability and reduce carbon emissions, if areas are located in hazard zones it would increase the number of people and structures in harm's way. You may find that many policies in your plans have good intentions, but have the potential to exacerbate hazard risk. Also, keep in mind that the Plan Integration for Resilience Scorecard is not just assessing whether your community is in or out of a hazard zone. In other words, the evaluation is not two-dimensional.

If, for example, the above policy referred to higher density multifamily development in the same areas, but specified "vertical elevation of the residential floor above the base flood elevation" or "special building codes to withstand hazard impacts", this policy would decrease vulnerability. Be aware of these nuances, which can change the score a policy receives. [These are also examples of the kind of 'tweaks' you can make to policies as you update or renew planning documents (see Chapter 4)].

You will have an opportunity to double-check policies affect on vulnerability in Policy Task 3: Validate Policy Lists. *Table 2.2* presents examples of policies that would be included and excluded from the scorecard.

Types of place-specific terms:

Political or cultural areas

- Neighborhoods
- Commercial centers
- Cultural or recreational districts

Geographic features

- Natural areas
- Floodplains
- Conservation areas
- Rivers
- Streets

Individual buildings

- Frequently flooded structures
- Community facilities

2.2 Place-specific Policies

To be included in the scorecard, a policy should not only have the potential to affect vulnerability to hazards, but also should be 'place-specific', so that it can be spatially assigned to the appropriate parts of the community. Place-specific policies are those that contain at least one place-specific term that can be (or preferably that already has been) mapped within the community.

Table 2.2 Examples of Policies Likely and Unlikely to Affect Community Vulnerability

Policy likely to affect vulnerability	Justification for inclusion
Encourage higher-density multifamily development in pedestrian-oriented urban areas with access to transit, a broad range of services and amenities and access to employment to: ... (86)	This policy encourages greater residential population density in certain parts of the city; if some of these "pedestrian-oriented urban areas" are in hazard zones, this effectively increases the number of people and the amount of infrastructure in harm's way.
All proposed development adjacent to wetlands shall provide adequate buffers to protect wetlands and surface waters. (249)	In contrast, this policy encourages the establishment of adequate buffer zones which, while ostensibly for the purpose of protecting sensitive areas, also have the effect of limiting the amount of development in potentially hazardous areas.
Policy unlikely to affect vulnerability	**Justification for exclusion**
The City will capitalize on the Tar and Pamlico Rivers as community amenities for enjoyment by residents and visitors.	At first glance, this policy appears to encourage preservation of the rivers and their environs (which would have a positive effect on resilience), but it might also be interpreted as advocating increased use and investment in these "community amenities" (which may place more infrastructure and people in harm's way). Because of such ambiguity, this policy should be excluded.
Improve the infrastructure at City boat docks to increase visitation. Infrastructure improvement to include picnic tables, benches, boater bathrooms, a dock attendant's station, and other amenities near public ramps and waterfront destinations.	Although this policy advocates for greater investment in potentially hazardous coastal areas, the infrastructure improvements listed are generally water-oriented and therefore likely to be constructed in a resilient way, given the obvious potential for flooding.

Place-specific terms may include:

- Cultural or administrative areas, e.g. 'downtown' or 'the riverfront';
- Geographic features, e.g. 'wetlands' or 'Main Street'; and even
- Individual buildings, e.g. 'repetitive loss structures' or 'critical facilities'.

To illustrate this concept, several policies in the Washington, NC comprehensive plan refer to the same specific place: **conservation areas**. In this case, conservation areas are well-defined in the plan as 'park land or other preserved areas'. As a result, policies referring to conservation areas can be considered place-specific. The simplified map in *Figure 2.2* (derived from Washington's future land use map) illustrates how community policies are often 'spatial' due to their inclusion of place-specific terms that refer to mapped areas, features, or facilities.

You will also come across policies written in an aspatial way. Policies with no place-specific term may not reference specific areas, features, or facilities and cannot be included in this spatial evaluation. Examples of place-specific and non-place-specific policies are shown and described in *Table 2.3*. Later on, you may consider adding specificity to these aspatial policies as you update or renew planning documents (see Chapter 4).

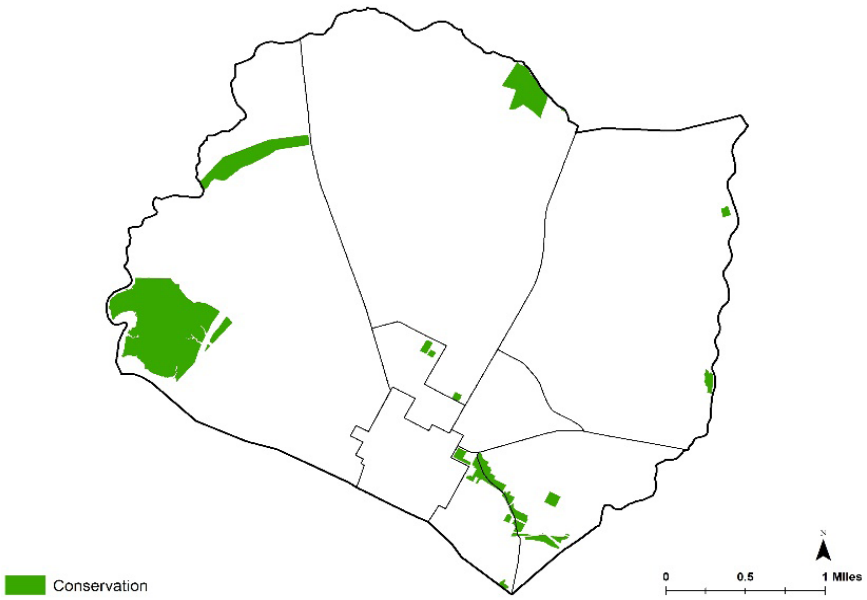


Figure 2.2 Map of conservation areas in Washington, NC (planning district boundaries also shown). Because the location of "conservation areas" is known – and is, in fact, mapped – we can spatially assign policies that reference such areas to the planning districts.

Table 2.3 Examples of Mappable and Non-Mappable Policies

Mappable policy	Justification for inclusion
Strengthen controls on development within flood-prone and wetland areas by improving existing ordinances, such as the erosion and sediment control ordinance, zoning ordinance, subdivision ordinance, flood plain regulations and other development regulations. (2023 Comprehensive Plan, p. 46)	The floodplain and wetland areas can be identified and have been mapped within the community.
Assure that as changes are planned for improvements to the downtown and especially the waterfront area that consideration is given to access issues and to environmentally-friendly building techniques. (2023 Comprehensive Plan, p. 42)	The downtown and waterfront areas can be identified within the community.
Revise local development ordinances to encourage shoreline vegetation protection to help mitigate flooding (Multi-Jurisdictional Hazard Mitigation Plan, p. 6-15)	The river shoreline can be identified within the community.
Non-mappable policy	**Justification**
Develop strategies that increase homeownership opportunities while also ensuring the City achieves an appropriate balance of other housing choices (rental housing, housing for the aged, etc.). (2023 Comprehensive Plan, P. 66)	While housing and residential land use can easily be mapped in a community, this policy is not mappable because it does not indicate the places in which homeownership should take place. If the policy would have specified the development of owner-occupied housing within a known hazard area, there would have been justification for including this policy within the scorecard.
Continue to pursue construction of greenways and walking trails throughout the community. (2023 Comprehensive Plan, P. 58)	While greenways and walking trails are mappable, this particular policy does not specify the location of future greenways and trails. If the policy had pointed to a specific plan or design of new trails, this policy would have been mappable. If the policy would have referred to the maintenance of existing greenways and trails this policy would have been mappable.

2.3 Policy Tools

Policy tools are techniques or interventions to achieve specific objectives or outcomes. Inclusion of a recognizable policy tool is an important element of policy-making because a statement without such language – even if labeled a policy – is unlikely to be actionable. The literature is clear that a plan without strong policies has limited ability to influence local legislation and decision-making. *Table 2.4* includes a list of policy tools related to land use and hazard vulnerability.

As you read through your network of plans, these are the kinds of tools you are likely to find in applicable policies. Keep in mind that you may encounter policies that appear to fit the scorecard criteria but do not obviously include tools on this list. If there is no obvious policy tool, but is actionable, you will have a chance to justify your reasoning in Policy Task 3.

There may be policies within your plans that do not contain policy tools. For instance, Washington's plan stated:

"The City of Washington will protect its waterfront/shoreline areas, historic district, and valuable scenic areas."

While a policy to protect such areas is laudable – and may result in greater community flood resilience – it offers no concrete tool or mechanism by which the city might go about protecting such assets. Examples of other policies with and without policy tools are shown in *Table 2.5*.

Table 2.4 Policy Tools: Land Use Policy categories and sub-categories

LAND USE APPROACH	APPLICATION TO HAZARD VULNERABILITY
Development Regulations	
Permitted Land Use	Provision regulating the types of land use (e.g. residential, commercial, industrial, open space, etc.) permitted in areas of community; may be tied to zoning code
Density of Land Use	Provision regulating density (e.g. units per acre); may be tied to zoning code
Subdivision Regulations	Provision controlling the subdivision of parcels into developable units and governing the design of new development (e.g. site storm water management)
Zoning Overlays	Provision to use zoning overlays that restrict permitted land use/density in hazardous areas; may be special hazard zones or sensitive open space protection zones
Setbacks or Buffer Zones	Provision requiring setbacks or buffers around hazardous areas (e.g. riparian buffers and ocean setbacks)
Cluster Development	Provision requiring clustering of development away from hazardous areas, such as through conservation subdivisions
Land Acquisition	
Acquire Land & Property	Purchase land/property in hazard area
Open Space or Easement Requirement/Purchase	Provision encouraging open space purchase by the community or open space easements as an element of development approval
Density Transfer Provisions	
Transfer/Purchase of Development Rights	Provision for transferring development rights to control density; may be transfer of development rights or purchase of development rights

LAND USE APPROACH	APPLICATION TO HAZARD VULNERABILITY
Financial Incentives and Penalties	
Density Bonuses	Density bonuses such as ability to develop with greater density in return for dedication or donation of land in areas subject to hazards
Tax Abatement	Tax breaks offered to property owners and developers who use mitigation methods for new development
Impact / Special Study / Protection Fees	Provision requiring impact fees, special study fees, or protection fees for development in hazardous areas; fees could cover costs of structural protection
Land Use Analysis and Permitting Process	
Land Suitability	Hazards are one of the criteria used in analyzing and determining the suitability of land for development
Site Review	Provision requiring addressing hazard mitigation in process of reviewing site proposals for development
Design/Construction Guidelines/Requirements	Guidelines or requirements that apply to the design or construction of developments in hazard areas
Public Facilities (including Public Housing)	
Siting	Provision to site public facilities, including municipal buildings and public housing, out of hazard areas
Sizing/Capacity	Provision limiting capacity of public facilities, including public housing, in hazard areas to cap amount of development
Post-Disaster Reconstruction Decisions	
Development Moratorium	Provision imposing a moratorium on development for a set period of time after a hazard event to allow for consideration of land use change
Post-Disaster Land Use Change	Provision related to changing land use regulations following a hazard event; may include redefining allowable land uses after a hazard event
Post-Disaster Capital Improvements	Provision related to adjusting capital improvements to public facilities following a hazard event
Capital Improvements	
Infrastructure "Hardening" or Weatherproofing	Provision encouraging or requiring development in hazard zones to increase structural resilience to hazards
Elevating	Provision pertaining to the physical elevation of structures in hazard zones
Drainage Improvements or Flood Control	Provision that pertains to drainage or flooding issues within the community
Ecosystem Enhancement	Provision that seeks to improve or preserve the functioning of the natural environment within the community
Slope/Dune Stabilization	Provision that pertains specifically to stabilization of slopes or dunes or seeks to control erosion

Table 2.5 Examples of Policies With and Without a Policy Tool

Policies with a Policy Tool	Justification for Inclusion
LU Policy 6.1.3: Support proposals to convert non-residential properties along mixed-use corridors, between major intersections, to residential or mixed-use residential uses and ensure the development is compatible with surrounding land uses and has adequate access to transit services and community services. (47)	The policy tool in this example is permitted land use; this land use policy encourages conversion of currently non-residential properties to residential use, effectively increasing the number of people in harm's way in cases where the "mixed-use corridors, between major intersections" happen to be in hazard zones.
ENV Policy 1.2.5: Use techniques, which may include clustering and transfer of development rights, to protect environmentally sensitive areas. (240)	This policy actually contains two policy tools: clustering and transfer of development rights (TOD). Both of these tools can be used to guide development away from certain undesirable areas (including flood hazard zones).

Policies without a Policy Tool	Justification for Exclusion
The City of Washington will monitor sea level rise and respond to threats to property and important natural areas as threats are identified.	Even though the policy directs the city to be cognizant of the land use implications of sea level rise, it fails to offer any policy tools that would lead directly to land use actions.
The City of Washington will protect its waterfront/shoreline areas, historic district, and valuable scenic areas.	A policy to protect such areas is laudable -- and likely to result in greater community flood resilience -- but this example offers no concrete tools by which the city might go about doing so.

BOX 2.1: "Policies" in Hazard Mitigation Plan

Whereas comprehensive and functional plans contain policies designed to guide and manage a community's growth, hazard mitigation plans are more narrowly focused on hazard assessment and mitigation. Studies show that hazard mitigation plans rarely utilize the full range of policy tools and tend to focus on structural mitigation measures, such as dams and levees.[16] Despite this very few 'true' policies are within hazar dmitgiation plan even though FEMA recommends certain planning approaches because preventive land use planning strongly influences a community's vulnerability.[17]

Hazard mitigation plans often contain policy-like statements which come in the form of mitigation action items. As long as an action item satisfies the requirements – i.e. affects vulnerability, includes a place-specific term, and includes a policy tool – it should be part of your Policy List. An example from the Hillsborough County, FL hazard mitigation plan:

> **"Construct new stormwater system to connect to the box culvert and eliminate flooding along Napoleon."**

This action item impacts vulnerability (eliminate flooding), has a place-specific term (box culvert along Napoleon Avenue), and the policy tool refers to a drainage-focused capital improvement project. Thus, it meets all three criteria and should be included in the Policy List.

Table 2.6 contains additional examples of action items from Washington's hazard mitigation plan, the Beaufort County Multi-Jurisdictional Hazard Mitigation Plan (which happen to be very similar to policies), as well as, from several other community hazard mitigation plans, thereby illustrating the range of action items one might find in a plan. Justifications for why such action items should be included or excluded from the analysis are also provided.

Table 2.6 Examples from Around the Country of Applicable "Action Items"

Action Item	Justification for Inclusion
Revise local development ordinances to encourage shoreline vegetation protection to help mitigate flooding (Beaufort County Multi-Jurisdictional Hazard Mitigation Plan, 2010, p. 6-15)	The river shoreline can be identified within the community. Development regulations are to be used to protect shoreline vegetation. Flood vulnerability will likely be reduced as a result.
Continue to maintain all property acquired with public mitigation funds within the Special Flood Hazard Area (SFHA) as undisturbed open space in perpetuity. Continue to pro-actively establish open space within the floodplain and floodway as grant funds become available to carry out this initiative. (Beaufort County Multi-Jurisdictional Hazard Mitigation Plan, 2010, p. 6-21)	The extent of the SFHA and the floodplain and floodway can be identified within the community. Land use planning tools used include development regulations, zoning overlays, and land acquisition. Flood vulnerability will likely be reduced as a result.
Coastal Erosion – Columbia Point *• UMass and the state should stabilize the bank or establish a new bank. (Metro-Boston Multi-Hazard Mitigation Plan, 2008, p. 70)*	The extent of the Columbia Point district in Boston, MA, is known. The capital improvements policy tool of bank stabilization/improvement is used. This will likely reduce flood vulnerability.

16 Masterson et al. 2014.
17 FEMA 2013; NRC 2006, 2014

Table 2.7 Example Spreadsheet for Validating Policies.

PLANNORFOLK		Potential Areas for Consideration			[Notes]:	[Ex: SLR only]						
	Planning District	Place-specific	Vulnerability	Policy Tool	1	2	[Ex: CBD]	4	5	6	7	... n
Development Regulations												
Permitted Land Use												
[EXAMPLE ... underline the mappable, place-specific term and italicize land use policy (if more than one)] POLICY 1.7.3: The City shall create redevelopment strategies to promote redevelopment and "in-fill" activities in the NWPFH through the implementation of land development regulations for the Northwest Regional Activity Center (Northwest-RAC). (2-9)	Current Hazard Zone	✓	✓	✓			-1					
	Future Hazard Zone						-1		1			
Density of Land Use												
Action LU1.1.4. Support mixed use development in appropriate locations in Residential Mixed, Multifamily Corridor, Multifamily, Commercial, and Office designated areas provided that it includes a combination of two or more land uses, at least one of which is residential and the other is non-residential, it includes the use depicted on the Future Land Use Map as part of the mixed use	Current Hazard Zone	✓	✓	✓								
	Future Hazard Zone											
Action LU1.1.5. Support the development of uses in Transit Supportive Areas (areas surrounding selected rail stations) that create opportunities for a mix of employment and residential activity that promotes transit, bicycle, and pedestrian	Current Hazard Zone		✓	✓	★							
	Future Hazard Zone											
Subdivision Regulations												
	Current Hazard Zone											
	Future Hazard Zone											
Zoning Overlays												
	Current Hazard Zone											
	Future Hazard Zone											
Setbacks or Buffer Zones												
Action LU1.1.2. Implement residential land use categories that reflect existing successful neighborhood patterns with regard to lot width, structure type, setback,	Current Hazard Zone		✓		★							
	Future Hazard Zone											
Cluster Development												
	Current Hazard Zone											
	Future Hazard Zone											
CATEGORY TOTAL	Current Hazard Zone				0	0	-1	0	0	0	0	0
CATEGORY TOTAL	Future Hazard Zone				0	0	-1	0	1	0	0	0
Land Acquisition												

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★ If any criteria are unknown, set policy aside to revisit (see Chapter 4)

Policy Task 3: Validate and Prepare Policies

After generating policy lists for your community's network of plans, review each policy to validate its place in the scorecard. By recording the ways it meets (or fails to meet) each of the three criteria described above (2.1 vulnerability, 2.2 place-specific, and 2.3 policy tool), you will prepare the policy list for scoring. Do not be discouraged if you find that many of your policies fail to meet one or more of the criteria upon closer inspection. It is typical for 20% (or more) of policies to drop out during this step if you 'cast a wide net' as adviced in Policy Task 2.

Validating and preparing your policies has several benefits. First, it provides valuable documentation of each policy's key components and your logical reasoning. Second, it reduces confusion and facilitates a smoother policy scoring process. Third, it generates a new list of policies excluded from the scorecard, but are potentially 'low-hanging fruit' (Chapter 4). Despite their exclusion from the final scorecard, these policies are currently part of an adopted plan and, therefore, guiding community development and management. Excluded policies represent opportunities for later adjustments that will strengthen plan integration and resilience in your community.

3.1 Confirm and Assign Directionality

When reviewing a policy, first consider whether and how it meets the 'vulnerability' criterion. If you confirm that it is likely to positively or negatively affect vulnerability, jot down a few notes in the 'Vulnerablity' column regarding your reasoning. Once you have confirmed the directionality, you may find it helpful to color-code your policies – in, say, green (if it is likely to have a positive effect) or red (negative effect).

If you think a policy in your list is unlikely to affect vulnerability – or that its effect could just as easily be positive as negative, given the way it is phrased – you may choose to:

- move it to the 'low-hanging fruit' list and set it aside for later consideration during a future plan revision, OR
- leave the policy in the scorecard, but note its 'neutrality' (e.g. color-code it beige or yellow). In this case, you will still spatially assign the policy during the scoring step, but will not give it an actual score—marking it, instead, with a '0' as a place holder. As long as you are spatially assigning policies, doing so for these 'neutral' policies will not constitute much additional work, but may prove even more valuable during a plan revision process than if you simply move them to the 'low-hanging fruit' list.

Whatever you decide, policies that will likely have negative or neutral effects on vulnerability will be prime candidates for adjustment (or deletion!) as you work to improve integration and build resilience to hazards through wise plan and policy guidance.

3.2 Confirm and Record Place-specific Term

For each policy, also confirm that it contains a place-specific term that will allow you to spatially assign it during the scoring step. As before, writing a few notes in the appropriate column – this time the 'Place-specific Term' column – will help clarify your thinking. Be sure that these notes contain the actual place-specific term from the policy and, if appropriate, a brief explanation about how it ought to be spatially defined in your community.

Keep in mind that you may find policies that you believe are applicable throughout the entire hazard zone (or zones). An example might be a development requirement that new buildings are built with a certain design flood elevation.

If, upon reflection, you decide that you are unsure of

the place-specific term or that it cannot be mapped, move the policy to the 'low-hanging fruit' list. Making such policies more explicitly place-specific by adding a place-specific term(s) during your plan revision process may strengthen them and improve your plan's ability to foster greater resilience.

As an added bonus, when you finish this step (Policy Task 3.2) for all of your policy lists, your notes from the 'Place-specific Term' column can be given to your GIS team to help them with 'Map Task 4'. If they can develop a comprehensive set of maps/shapefiles/layers of place-specific terms, this will dramatically improve your ability to spatially assign policies during the scoring step.

3.3 Confirm and Record Policy Tool

Finally, confirm that each policy contains an actionable policy tool(s) and record it (them) in the 'Policy Tool' column, along with a brief explanation, if needed. Use *Section 2.3* and *Tables 2.4* and *2.5* to help you decide what, if any, tool is suggested by the policy.
If you are unsure whether a policy includes a policy tool – or if you decide that it does not, in fact, include one – move it to the 'low-hanging fruit' list. Adding one or more actionable policy tools during your plan revision process can strengthen an otherwise unactionable policy, improving its (and the plan's) effectiveness.

PREPARE MAPS

The Plan Integration for Resilience Scorecard is unique because it allows you to *spatially* evaluate plans and policies and their effects on vulnerability to hazards. The Map Tasks described in this section facilitate the spatial assignment and scoring of the policies in your network of plans. The first task is to determine and map the **planning districts** in your community. You will then identify and map relevant **hazard zones** and combine them with the planning districts to generate **'district-hazard zones'**, the unit of analysis for the scorecard. Finally, using the **policy lists** generated in Policy Task 2 and validated and prepared in Policy Task 3, you will develop maps (or use those that already exist) to help you spatially assign those place-specific poicies.

Geographic information systems (GIS) software is not required to complete the tasks or to create your scorecard, given the many online mapping tools currently available, though it can make the spatial assignment of policies somewhat easier. GIS may also allow a finer-grained analysis (e.g. U.S. Census block group, as opposed to the larger-scale Census tract more readily available when using online tools) and will enhance the evaluation if there are spatial elements in the community that are not available with online tools.

OBJECTIVES:

- Create or gather Planning Districts Map (or GIS layer)
- Create or gather Hazard Zones Map (or GIS layer)
- Create or overlay Hazard Zones in Planning Districts Map (or GIS layer)
- Create or gather maps of place-specific terms in the mappable policies

MATERIALS REQUIRED:

- Plan Integration for Resilience Scorecard
- Maps of:
  - *Planning Districts*
  - *Hazard Zones*
  - *Place-specific terms in Mappable policies*

Checklist:

- Delineate Planning Districts
- Delineate Hazard Zones
- Map your 'Mappable Policies'

Download data to build maps:

- FEMA's 100-year floodplain (Zones A, AE….) (https://msc.fema.gov/portal/), or(http://www.data.gov/).
- United States Army Corps of Engineers (USACE) sea level rise estimations-- http://www.corpsclimate.us/ccaceslcurves.cfm)
- Elevations from USDA's Geospatial Data Gateway-- https://gdg.sc.egov.usda.gov/
- Block groups and specific planning districts in your community (i.e., Central Business District)-- (https://www.census.gov/geo/maps-data/data/tiger-line.html)

Choosing Planning Districts:

Washington, NC: the city is so small, a fine-grained analysis of U.S. Census block groups was most appropriate.

Norfolk, VA: the city decided to use U.S. Census tracts (roughly 80) which was a more manageable size, despite losing a more fine-grained analysis.

Boston, MA: the city's official neighborhoods are used as planning districts, given their significance to current and historical planning.

Houston, TX: the city is divided into 'super neighborhoods,' which may be a relevant planning district or may be too large; depends on the desired level of detail.

STAFF REQUIREMENTS:

- At least 1 staff person
- Ability to gather maps that are within plans
- Ideally, ability to bring shapefiles and data into GIS software to generate new information (manual overlay of maps can work as well).

Map Task 1: Determine and Map Planning Districts

Spatially evaluating your network of plans and policies using the Plan Integration for Resilience Scorecard[18] requires the division of the community into areas known as *planning districts*. The purpose of dividing the community into sub-geographies is to better understand the policy integration (or lack thereof) across different parts of the community. Analyzing the community by planning districts, rather than as a whole, also helps reveal spatial differences in vulnerability. The smaller the planning district, the more fine-grained the analysis.

1.1 Choose Planning Districts

Planning districts are important to identify because planning efforts often attempt to coordinate policies within such areas. That being said, communities should determine their planning districts according to their specific goals and circumstances. Generally, there are three mains strategies for selecting planning districts:

1. Readily available data: U.S. Census block groups (or tracts, depending on the size of your community) are a convenient and widely utilized sub-jurisdictional spatial unit.
2. Neighborhoods: Some communities have well-defined neighborhoods that are widely used for planning and policymaking. If this sounds like your community, you're in luck!
3. Community-specific or 'specialized' districts: Often the focus of specific planning initiatives or policies, these may include historic or cultural districts, overlay districts, development focus areas, or other designated places refered to in local plans and policies.

18 Each applicable policy affects the vulnerability of the population (or of the infrastructure, ecology, etc.) in each LPD differently, depending on the land use characteristics in that district. Many of the community's land uses or classifications are mapped, which allows for spatial differentiation. Thus, the LPD acts as the basic unit of analysis for this research.

Some communities choose to use planning districts referenced in their plans because there are often specific policies associated with these planning districts. Others may choose Census block groups or tracts because they are inherently apolitical. You can also define your planning districts as a 'hybrid', with a few specialized districts and the remainder of the city divided according to Census designations. In Washington, NC, planning districts were determined by this hybrid method, using a combination of areas designated in the land use maps and U.S. Census block groups.

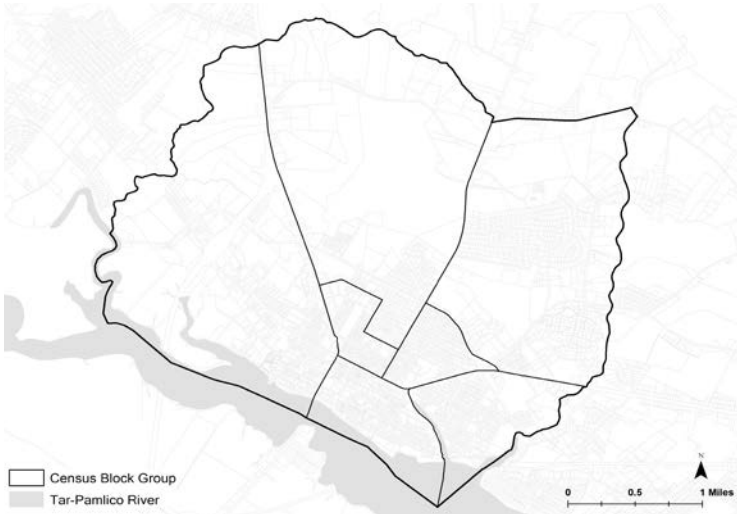
1.2 Map Planning Districts

After determining the planning districts you wish to use for your analysis, map them as a single GIS shapefile (layer), numbered or labeled in a logical manner (to help with future analysis and organization). For those with limited GIS capability, overlay image files with a slight transparency in Microsoft

Online mapping resources:

These online mapping tools can help communities that lack data and maps.

- NOAA Coastal Flood Exposure Mapper: https://coast.noaa.gov/floodexposure/#/map
- FEMA's National Flood Hazard Layer on ArcGIS Online: http://www.arcgis.com/home/webmap/viewer.



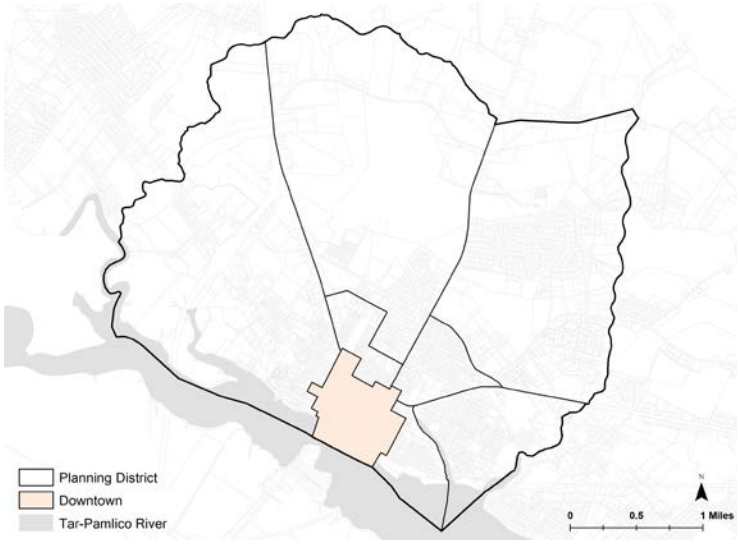


Figure 2.3 Customizing Planning Districts. The map (right) displays Census block groups for Washington, NC. Because there was a strong focus on the central business district (CBD) in the plans, we created a customized planning district map. Using GIS software, the CBD is clipped out of the Census block groups to create a new geography.

Census Block Group (top) and Planning Policy District (bottom)

Other Online Hazard Zone Mapping Resources:

Since not all cities build hazard-related GIS data to delineate hazard zones and analyze the impacts, HAZUS-MH is a good alternative for mapping hazard zones. HAZUS-MH is a nationally applicable standardized risk-based disaster management tool to assess damages, estimated economic losses for buildings and infrastructures, and mitigation benefits from earthquakes, coastal floods and hurricanes. You can visually display the hazards and identify vulnerabilities. With the information, it enables users to prioritize mitigation measures to determine how those can be implemented in order to reduce future losses. There are other online mapping tools for communities that lack data and maps.

NOAA Coastal Flood Exposure Mapper: https://coast.noaa.gov/floodexposure/#/map

continued on next page....

PowerPoint or other software. Images can also be printed and physically overlaid, but using digital platforms will make it easier to overlay the various maps. District numbers/labels will correspond to the columns in your scorecard spreadsheet (see Appendix C).

Map Task 2: Determine and Map Hazard Zones

After determining the planning districts that you will use, the second step is to delineate your community's hazard zones, those areas likely to be affected by a given hazard.

2.1 Choose Hazard Zones

Many types of hazards can be mapped, but for our purposes in Washington, NC, we evaluated coastal flood-hazard zones—the 100-year floodplain [FEMA's Special Flood Hazard Area (SFHA)] as the 'current hazard zone' and a projection of the future 100-year floodplain that incorporates sea-level rise as the 'future hazard zone' (*Figure 2.4*; also see *Box 2.4*).

Your community may be more interested in other hazard zones, such as surge zones, wave action locations, or dam inundation areas.

It is also common for communities to buffer flood hazard areas, acknowledging changes in flood patterns, as opposed to only using the 100-year floodplain. Increasingly, communities are rethinking the usefulness of the 100-year floodplain as a planning standard; Houston is considering replacing it with the current 500-year floodplain for planning and regulatory purposes (CITE), given that city's history of devastating storms.

If your community is exposed to more than coastal flooding hazards, we encourage you to explore their spatial relationships and modify the Plan Integration for Resilience Scorecard to fit your needs. Non-coastal flooding hazard zones include fire risk areas, liquefaction zones, earthquake risk zones, high wind zones, and many others. Consider your context when delineating hazard areas.

2.2 Map Hazard Zones

When you have decided on the hazard zones that you wish to focus on in your scorecard, obtain relevant maps or GIS shapefiles that delineate those areas in your community. The hazard zones will correspond to the sub-divided rows/columns in your scorecard spreadsheet (see Appendix C).

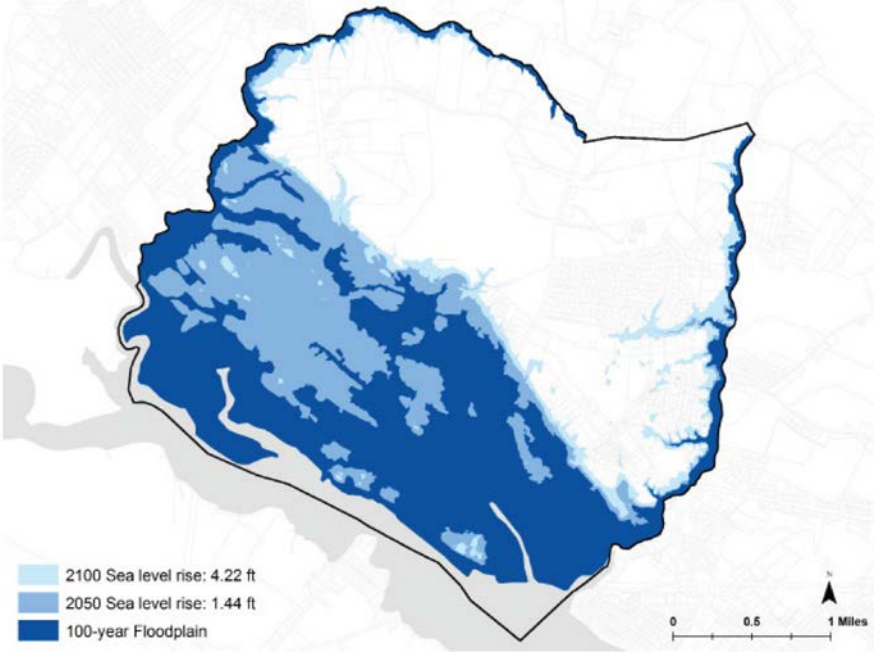


Figure 2.4 100-year Floodplain. The current 100-yr floodplain is mapped, along with the new floodplain due to sea level rise in year 2050 and 2100.

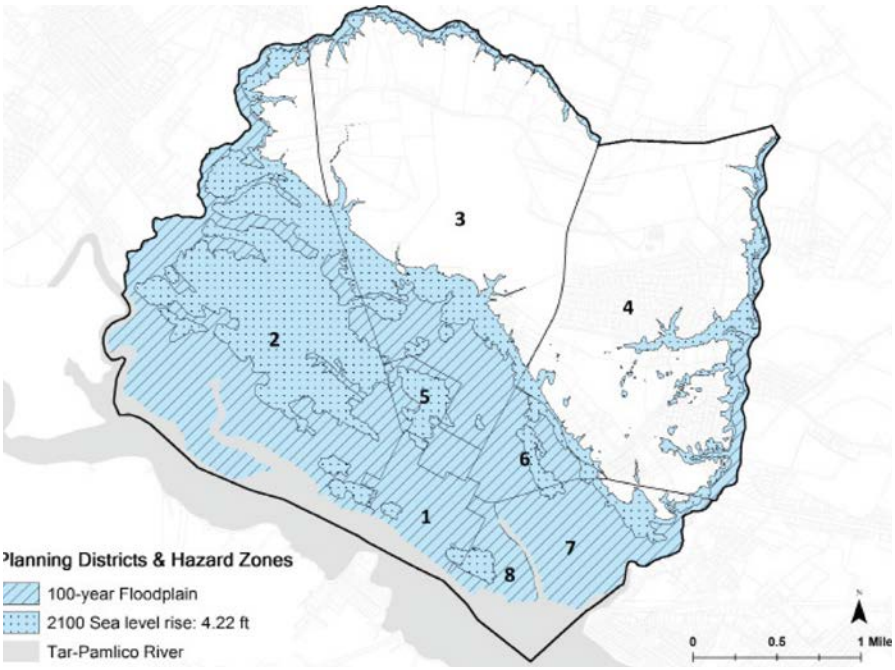


Figure 2.5 District-Hazard Zones. The map represents the newly joined "district-hazard zones," created from the planning districts and hazardzones layers. The "district-hazard zone" represents the true unit of analysis.

Other Online Hazard Zone Mapping Resources:

..continued

NOAA Sea Level Rise and Coastal Flooding Impacts: https://coast.noaa.gov/slr/

NOAA Sea Level Rise Viewer: https://coast.noaa.gov/digitalcoast/tools/slr.html

Climate Explorer: https://toolkit.climate.gov/tools/climate-explorer

FEMA's National Flood Hazard Layer on ArcGIS Online: http://www.arcgis.com/home/webmap/

National Seismic Hazard Maps-USGS Earthquake Hazard Program: https://earthquake.usgs.gov/hazards/hazmaps/

U.S. Drought Monitor: http://droughtmonitor.unl.edu/

WFAS-Severe Fire Weather Potential Mapping System: http://www.wfas.net/

Online resources for sea level rise:

SLR Tools Comparison Matrix is a helpful tool for future SLR inundation mapping. http://sealevel.climatecentral.org/matrix/

NOAA has developed an interactive map that models sea-level rise against a number of factors. The web tool displays socio-economic vulnerability. (http://www.csc.noaa.gov/slr/viewer/)

NOAA has also developed a tool for lake level rise for the Great Lakes https://coast.noaa.gov/llv/

NOAA Sea Level Rise and Coastal Flooding Impacts: https://coast.noaa.gov/slr/

Rhode Island Coastal Resource Management Council (CRMC) also developed Sea Level Affecting Marches Model (SLAMM) to project three different sea level rise scenarios of 1, 3, and 5 feet in the future for all 21 coastal communities of Rhode Island. http://www.crmc.ri.gov/climatechange.html

Map Task 3: Combine Planing Districts and Hazard Zones to Form 'District-Hazard Zones'

When you have decided on and mapped your relevant planning districts and hazard zones, these should be spatially combined, resulting in a new district-hazard zone shapefile (layer). The district-hazard zone is the intersection of the planning district and the hazard zone *(Figure 2.6)* and represents the true unit of analysis for the scorecard; policies that only impact areas outside hazard zones are not considered. You will have a district-hazard zone layer for each hazard you are analyzing. For example, in Washington, we assessed the current 100-year floodplain

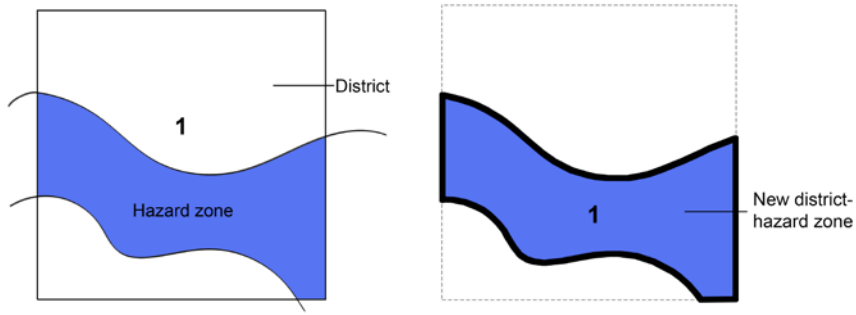


Figure 2.6 Creating District-Hazard Zones. Spatially join the planning district and hazard zone to form the true unit of analysis, the "district-hazard zone."

BOX 2.4: Thinking About Future Hazards

To better plan for the future, we consider potential risks that could happen over the course of time. The United States Army Corps of Engineers (USACE) provides alternative sea-level change projections in 10-year increments, up to 2100. Consider using the **2100 sea-level rise** projections because it shows a larger extent of future hazard exposures; the year 2100 is a useful long-term planning horizon of land use commitments and urban infrastructure.

In Washington, NC, we combined the 2100 sea level rise estimates with elevation data to get a quick picture of what the new 100-year floodplain might be in 2100—we labeled this the "future hazard zone." This overly simplistic model, while not perfect, allowed us to have a conversation about future risk in the community. To do this we collected the USACE sea level rise estimations based on NOAA coastal gauge measurements (http://www.corpsclimate.us/ccaceslcurves.cfm). We used the "intermediate high" scenario for the year 2100 (chosen from a range of possible sea level rise scenarios). Then, we added the base elevation of the 100 year floodplain to the USACE sea level rise estimates for the year 2100. Elevation data for every county in the US can be obtained from the USDA's Geospatial Data Gateway website (https://gdg.sc.egov.usda.gov/). Generally, the most detailed LiDAR elevation dataset provided is a 1-meter elevation dataset. Alternatively, we noticed the **500 year floodplain** oftentimes reflected a similar 2100 floodplain scenario.

and the future 100-year floodplain, incorporating a projection of sea-level rise. This resulted in two separate district-hazard zone layers, wherein the scorecard spreadsheet we referred to them as the "current hazard zone" and "future hazard zone" respectively. If you are assessing more hazards, you will have additional layers, which is important when scoring the policies in Chapter 3.

Map Task 4: Develop Maps for Place-specific Terms

In Policy Task 2, you generated lists of 'place-specific policies' within your network of plans. In Policy Task 3, you validated and prepared these policies for spatial assignment and scoring—in part by listing and defining the place-specific term included in each policy. To better understand the relationships between individual policies, natural hazards, and the various parts of your community, it may be useful to collect or create maps that reflect the place-specific terms found within the policies *(Figure 2.7)*. Doing so will help you spatially assign policy scores to different parts of the community, resulting in a Plan Integration for Resilience Scorecard that can help inform changes to improve resilience.

If you remember, in Washington, NC, several policies included place-specific terms such as "conservation areas" and "natural areas", which can be overlaid (or compared) with hazard zones. Such "conservation areas" are likely to reduce vulnerability by absorbing flood waters. If we overlay Washington's waterfront commercial area with the hazard zones, we see a different story—commercial investments (and plans for even greater intensity) in areas exposed to flood hazards and thereby increasing vulnerability. Take some time to collect maps of your place-specific terms so that you can better understand their exposure to hazards, and how this may affect vulnerability in your district-hazard zones.

Keep in mind, you do not need map layers for every place-specific term. For example, in Norfolk, Virginia, an often-referenced place-specific term within policies was "shoreline". The city did not create a separate shapefile or special map for this geography, because it was intuitive and easily recognizable. Place-specific terms that might require mapping include repetitive loss structures, critical facilities, public housing, natural areas, historic districts, etc. If you are able, set up layers or maps in GIS software so that you can easily turn layers on and off as needed, allowing you to see where they overlap with your district hazard zones.

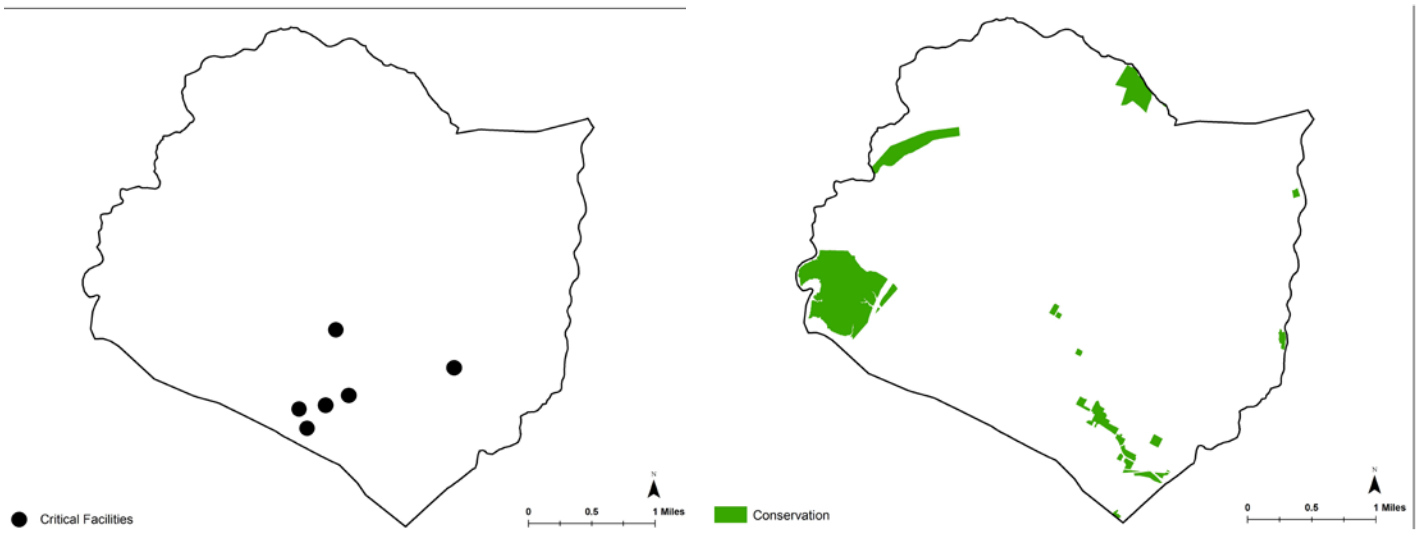


Figure 2.7 Place- specific Terms. Here are two place-specific terms that can be mapped, making the policy 'mappable'.

Checklist:

- Create the Plan Integration for Resilience Scorecard
- Create Tables, Maps and Indexes

ASSIGN POLICY SCORES

Now that you have prepared your policies and maps, it's time for the fun part! Using your policy descriptions and set of maps, you will spatially assign the policies to the district-hazard zones where they are likely to increase or decrease (or have no effect on) vulnerability. If possible, we recommend that your team assign the policy scores as a group. Or, you might try scoring independently and coming together to discuss the scores and develop a consensus.

When you are finished, you will have produced a Plan Integration for Resilience Scorecard that is unique to your community, your network of plans, and the hazards with which you must contend. The scorecard (spreadsheet) generates numeric scores for your community's policies and plans that can provide a deeper undersanding of their integration, spatial focus, and policy implications within hazard zones. In Chapter 3: ANALYSIS, you will learn ways to evaluate the results of your scorecard to better understand your network of plans, including areas of alignment and conflict and how it interacts with the different types of vulnerability that exist in your community.

OBJECTIVE:

- Score your Network of Plans

MATERIALS REQUIRED:

- District-Hazard Zone Map (or GIS layer)
- Maps showing place-specific terms (or GIS layers0
- Plan Integration for Resilience Scorecard

STAFF REQUIREMENT:

- Ability to determine whether a policy might increase or decrease exposure in hazard zones

Using the Plan Integration for Resilience Scorecard spreadsheet (see *Appendix C*), assign each policy in your final policy lists to the appropriate district-hazard zone. The sum of all scores assigned to each district-hazard zone will result in an index **policy score** for that area of the community, which can be compared and mapped (see Chapter 3: ANALYSIS). Furthermore, the compilation of all district-hazard zone scores results in a total score for each planning document. An example scorecard is shown in *Table 2.8*.

First, observe the way each policy was determined to affect hazard vulnerability. Every district-hazard zone (cell on the spreadsheet) will receive a score of '**+1', '-1', '0', or 'not applicable**' for every policy, depending on how the policy is likely to affect vulnerability in that part of the community.

- A **score of '+1'** indicates that a policy positively affects (that is, it reduces) vulnerability for a specific district-hazard zone. In other words, it reduces (directly or indirectly) the exposure of people or structures to the hazard or mitigates the negative effects of the hazard.
- A **score of '-1'** indicates that a policy negatively affects (that is, it increases) vulnerability for a specific district-hazard zone. In other words, it increases (directly or indirectly) the exposure of people or structures to the hazard or perpetuates the negative effects of the hazard.
- A **score of '0'** indicates the policy is neutral and has no effect on vulnerability, whether positively or negatively, in the district-hazard zone.
- **'Not applicable'** indicates that the policy does not refer to the district-hazard zone (or the policy's place-specific term is not located in the district-hazard zone). 'Scores' for not applicable ('NA') may be added to the spreadsheet to avoid confusion and enhance recognition of the spatial impact of policies on district-hazard zones. The NAs will not affect the summed index scores, and cells left empty may be confused as not yet scored. Consider blacking-out district-hazard zone cells that are NA. However, if your team is comfortable with leaving these cells blank to indicate NA, you may do so.

To help you quickly and accurately score policies, display the district-hazard zone map with the place-specific term layer of the policy you are spatially assigning. If set up in a GIS, you can easily toggle map layers on and off for each place-specific term. For instance, a policy may refer to the place-specific term 'wetlands'. The next policy may refer to the place-specific term 'public housing'. If you have these as layers within your map, you can easily see where they are located—and within which district-hazard zone(s).

Below are several examples of policies and explanations of their policy scores and locations. Additional examples may be found in *Table 2.8*.

Example 1:

A policy in the infrastructure element of the City of Washington Comprehensive Plan states,

"Assure the provision of public and private parking in support of increased development and activity" (City of Washington, 2013, p. 30).

The City of Washington aims to expand infrastructure capacity to foster downtown development, which is entirely in the 100-year floodplain and future hazard zone due to sea level rise. There is no discussion of vertical elevation, but instead seems to disregard the hazard completely. Thus, for District 1, this policy received a score of -1 for the current hazard zone and a -1 for the future hazard zone.

Example 2:

A policy in the City of Washington hazard mitigation plan, which is part of a county multi-jurisdiction mitigation plan, states the need for

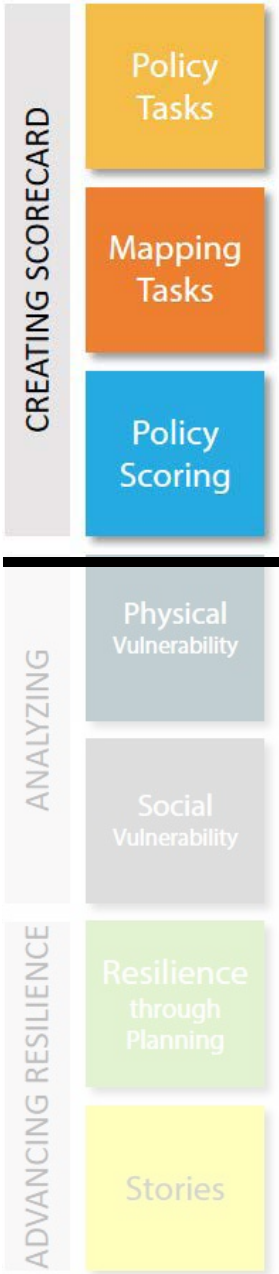
"acquisition of properties located in the city's repetitive loss areas… including areas adjacent to Jack's Creek…passing through areas that are largely utilities for public housing" (Beaufort County 2010, p. 4-14).

These areas cover parts of three districts (5, 6, and 8). Districts 1, 2, 3, 4, and 7 would be excluded from scoring for this policy because they are not part of its geographic scope and thus not directly affected. The future hazard zones in districts 5, 6, and 8 are similarly unaffected and are thus also excluded. The policy of "acquisition" receives a score of +1 for each of the current hazard zones in districts 5, 6, and 8, given their "adjacen[cy] to Jack's Creek."

Keep in mind, there is a level of professional judgment in the process of assigning policy scores. Policies can be complex and nuanced. It is rarely appropriate to limit your thinking to two dimensions—whether the policy is inside or outside of the hazard zone. Carefully consider each policy and ask yourself how the policy guides the community to avoid or resist the hazard, or how it contributes to maintaining or increasing existing vulnerabilities.

Table 2.8 Example of Portion of Scorecard for Washington, NC.

Development Regulations	Planning District	Place Specific	Vulner-ability	Policy Tool	01	02	03	04	05	06	07	08	**TOTAL (ALL PDs)**
Permitted Land Use													
[GOAL] Public facilities and publicly owned lands will be used at their highest and best use, except for those public lands that are in environmentally sensitive locations, where conservation should be the objective. (p. 47)	Current Hazard Zone	Yes	Yes	Yes		1				1			**2**
	Future Hazard Zone					1				1			**2**
Subdivision Regulation													
Strengthen controls on development within flood-prone and wetland areas by improving existing ordinances, such as the erosion and sediment control ordinance, zoning ordinance, subdivision ordinance, flood plain regulations and other development regulations. (p. 46)	Current Hazard Zone	Yes	Yes	Yes	1	1			1	1	1	1	**6**
	Future Hazard Zone				1	1	1		1	1	1	1	**7**
Zoning Overlays													
Consider creation of a Conservation Overlay Zoning District to help protect sensitive areas. (p. 42)	Current Hazard Zone	Yes	Yes	Yes		1				1			**2**
	Future Hazard Zone					1				1			**2**
Increase and bolster the number of key destinations near the downtown and waterfront to provide multiple components and uses catering to different audiences. (p. 38)	Current Hazard Zone	Yes	Yes	Yes	-1	-1					-1	-1	**-4**
	Future Hazard Zone				-1	-1					-1	-1	**-4**
Seek out opportunities to enhance downtown as a center of arts and cultural resources. Promote efforts to enhance the visibility and use of the historic Turnage Theater. (p44)	Current Hazard Zone	Yes	Yes	Yes	-1								**-1**
	Future Hazard Zone				-1								**-1**
Policy Category Total	Current Hazard Zone				**-1**	**2**	**0**	**0**	**1**	**3**	**0**	**0**	**5**
	Future Hazard Zone				**-1**	**2**	**1**	**0**	**1**	**3**	**0**	**0**	**6**



KEY CONCEPTS- CHAPTER 2

Policy Lists for your network of plans should include policies that meet the following criteria:

1. Has potential to affect (reduce or increase) vulnerability to hazards;

2. Includes at least one mappable, place-specific term (or has the ability to be mapped in the community. Examples include, but are not limited to, cultural or administrative areas ('downtown' or 'the riverfront'), geographic features ('wetlands' or 'Main Street'), and individual or groups of buildings ('repetitive loss structures' or 'critical facilities')

3. Includes a recognizable policy tool (a form of government intervention to achieve specific objective or outcome). Descriptions of policy tools are provided in Table 2.4.

District-hazard zone is the intersection of a planning district and a hazard zone and represents the true unit of analysis for this evaluation because we are only considering policies that impact areas within hazard zones. You will have a district-hazard zone layer for each hazard you are analyzing.

Scoring your Network of Plans

'+1' score indicates that a policy positively affects (that is, it reduces) vulnerability for a specific district-hazard zone.

'-1' score indicates that a policy negatively affects (that is, it increases) vulnerability for a specific district-hazard zone.

'0' score indicates the policy is neutral and has no effect on vulnerability, whether positively or negatively, in the district-hazard zone.

CHAPTER 3

ANALYSIS

Now that you have produced a Plan Integration for Resilience Scorecard, you can use it to analyze your community's network of plans and policies. You can analyze your scorecard:

1. In terms of internal consistency and integration—that is, how well (and where) the plans and policies align toward reducing vulnerability and
2. With respect to how they relate to different kinds of vulnerabilities that are present to greater or lesser degrees throughout your community.

This chapter begins by focusing on methods for **EVALUATING POLICY SCORES**—analyzing your community's completed scorecard, itself. Tables and maps can be useful ways of displaying your scorecard findings and facilitating further analysis, offering opportunities for comparison and pattern recognition. Procedures for developing tables and maps of your scorecard results are described, followed by a discussion of several ways to evaluate them, using Washington, NC, as an example.

Techniques for **ASSESSING VULNERABILITY** are then presented. Knowledge about the geographic distribution of physical vulnerability (including the location of critical facilities) and social vulnerability can be helpful in setting priorities and identifying areas for greater policy focus. Explanations are provided for the different vulnerabilities, including examples of how they can be be spatially assessed and what the results can reveal with respect to the spatial alignment of policies, plans, and vulnerability in your community. Chapter 4: ADVANCING PLAN INTEGRATION, KNOWLEDGE, AND RESILIENCE will focus on how this analysis can be put to use enhancing integration in your community's network of plans and strengthening resilience to natural hazards.

OBJECTIVES:

- Assess physical and social vulnerability

MATERIALS REQUIRED:

- District-Hazard Zone Map (or GIS layer)
- Policy Score Map
- Data on social vulnerability

STAFF REQUIREMENT:

- GIS knowledge and experience creating maps

Checklist:

- *Assess Physical Vulnerability*
- *Assess Social Vulnerability*

EVALUATING POLICY SCORES

Your completed Plan Integration for Resilience Scorecard contains a wealth of information about your community's network of plans and policies, including their alignment and spatial focus and the level of integration of hazard mitigation. By producing a PIRS, you have not only spatially evaluated your network of plans and improved your understanding of how policies are likely to affect vulnerability, but also organized your data to facilitate effective comparison and visualization.

Tables

Tables are a simple and powerful way to display complex results, such as those from your resilience scorecard, and to inform further analysis. Your finished scorecard enables the production of tables that contain the summed values (index policy scores) for each district-hazard zone. A useful summary table might contain lines with these summed values for each separate plan in your network, along with a line for the composite values (total scores across all plans). Other tables can be created according to your analytical needs—for example, it might be useful to create a table that indexes only the negative-scoring policies, so that you can determine the district-hazard zones in need of the most attention.

Table 3.1 provides an example of a summary table for the four plans scored in Washington, NC. You can see 'at a glance' that some plans – and some district-hazard zones – score far better than others. The table also reveals differences in the ways plans affect vulnerability in the current hazard zone versus the future hazard zone.

Remember that these index scores are derived from and connected to the individual policies and scores in your scorecard. This connection will prove convenient as you look for opportunities to adjust your plans and policies to strengthen resilience (see Chapter 4).

Table 3.1 Scores by district-hazard zone for Washington, NC for comprehensive plan.

	Core Land Use (CAMA)		2023 Comprehensive		Hazard Mitigation		Parks & Recreation		*All Four Plans (Combined)*	
District (total score for all policies in district)	Current Hazard Zone	Future Hazard Zone	Current Hazard Zone	Future Hazard Zone	Current Hazard Zone	Future Hazard Zone	Current Hazard Zone	Future Hazard Zone	Current Hazard Zone	Future Hazard Zone
District 1 *(Downtown)*	-2	-6	-5	-5	10	2	0	0	**3**	**-9**
District 2	6	2	0	0	9	2	1	1	**16**	**5**
District 3	0	-2	-1	0	1	2	1	1	**1**	**1**
District 4	0	-1	0	0	3	2	1	1	**4**	**2**
District 5	0	-4	0	0	6	2	1	1	**7**	**-1**
District 6	6	0	2	2	11	2	0	0	**19**	**4**
District 7	5	-1	-2	-2	12	2	1	1	**16**	**0**
District 8	4	-2	-1	-1	10	0	1	1	**14**	**-2**
TOTAL	**19**	**-14**	**-7**	**-6**	**62**	**14**	**6**	**6**	**80**	**0**

*In Washington, NC we used the 100 yr. floodplain as the 'current hazard zone' and the sea level rise (SLR) projections as the 'future hazard zone'.

BOX 3.1: Formatting the Scorecard for ArcGIS

Once finishing the plan evaluation, separate the sheets by different hazard zones (i.e. 100-year floodplain, 2100 sea level rise, etc.) and delete districts which are not included in each hazard zone (see *Figure 3.1a*). Since the number of districts in those two different hazard zones might be different, it would be useful to see the patterns of each hazard zone separately. Then, check the District ID name and format so both ArcGIS and the spreadsheet match, and join the table and District Boundary using ArcGIS *(Figure 3.2)*.

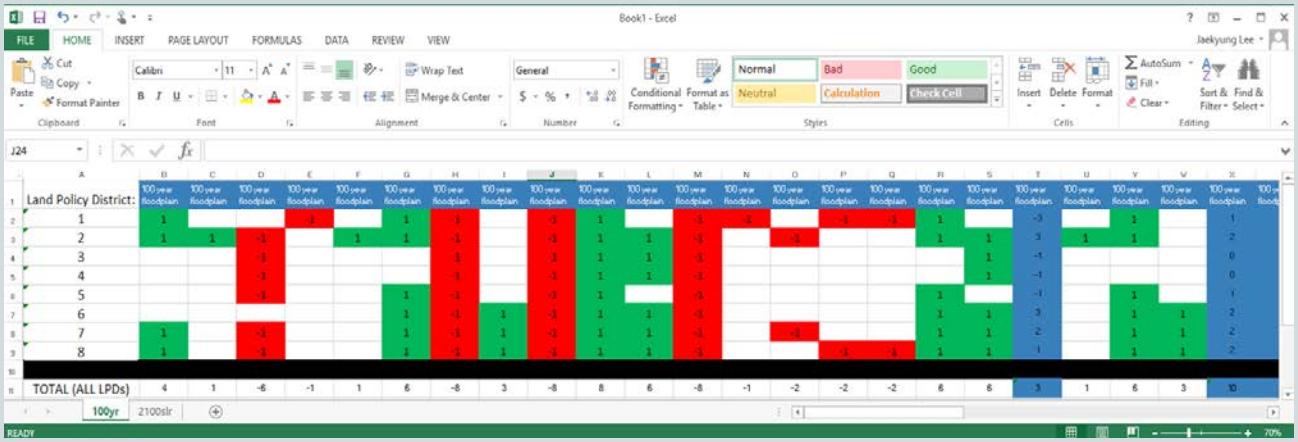


Figure 3.1a. A Plan Evaluation Sheet of 100-year floodplain

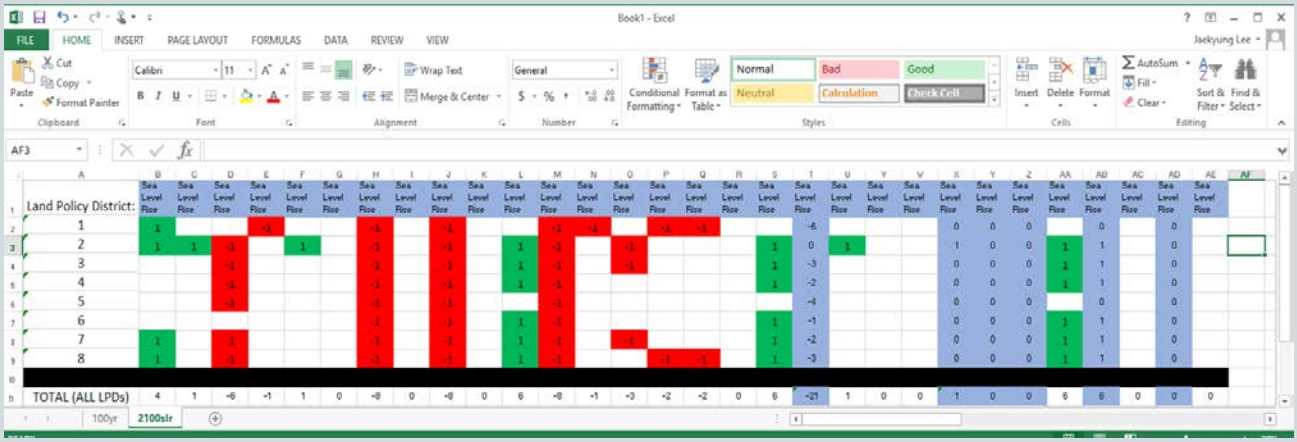


Figure 3.1b. A Plan Evaluation Sheet of 2100 sea level rise

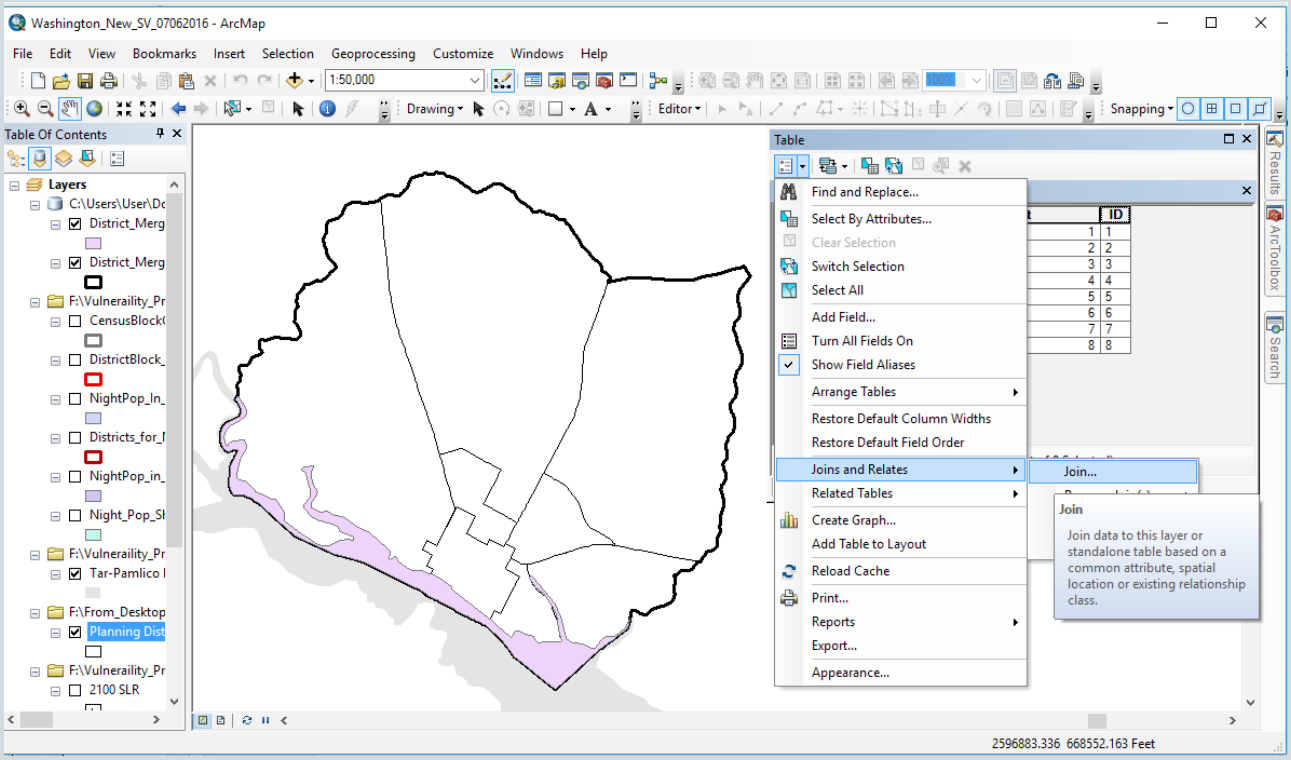


Figure 3.1c Join the Table and District Boundary using ArcGIS

Maps

To go a step further, you can create choropleth maps (which use shading or coloring to display differences in value) from the totals and sub-totals in your scorecard. If you are working in GIS, this may be accomplished by joining your summary table(s) to your district-hazard zone layer(s) (see *Box 3.1*). Maps are an informative way to visualize your resilience scorecard results—which are, after all, intentionally spatial!

Figure 3.2 shows choropleth maps for the four individual plans in Washington, NC, while a composite map is shown in *Figure 3.3*. Each district-hazard zone score on the map corresponds to a summed value (index policy score) in the scorecard. Notice that areas outside the hazard zones are not given scores, because they are not included in the resilience scorecard analysis, which is confined to parts of the community at higher hazard risk.

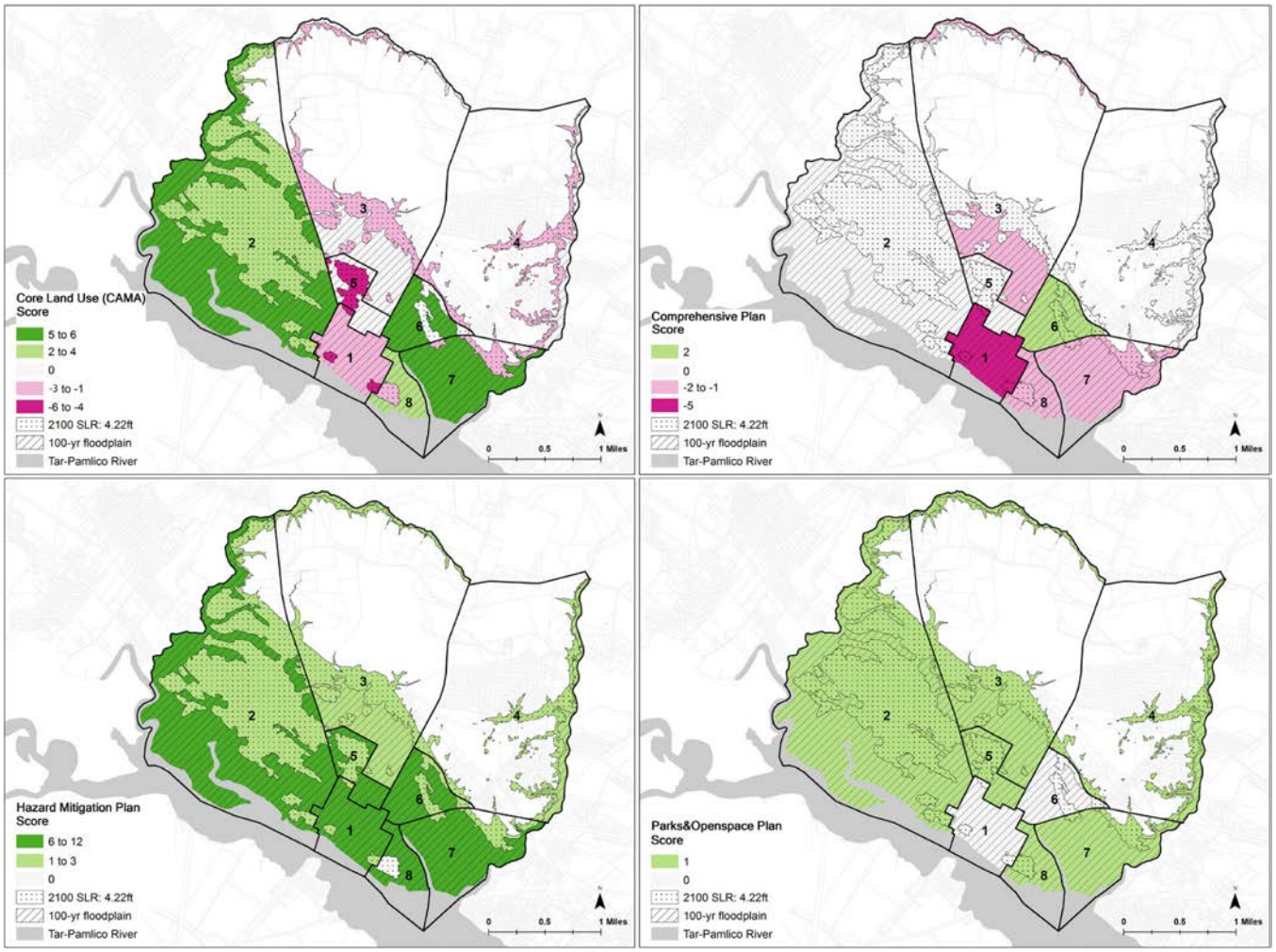


Figure 3.2 Comparing Scores of Different Planning Documents in Washington, NC.

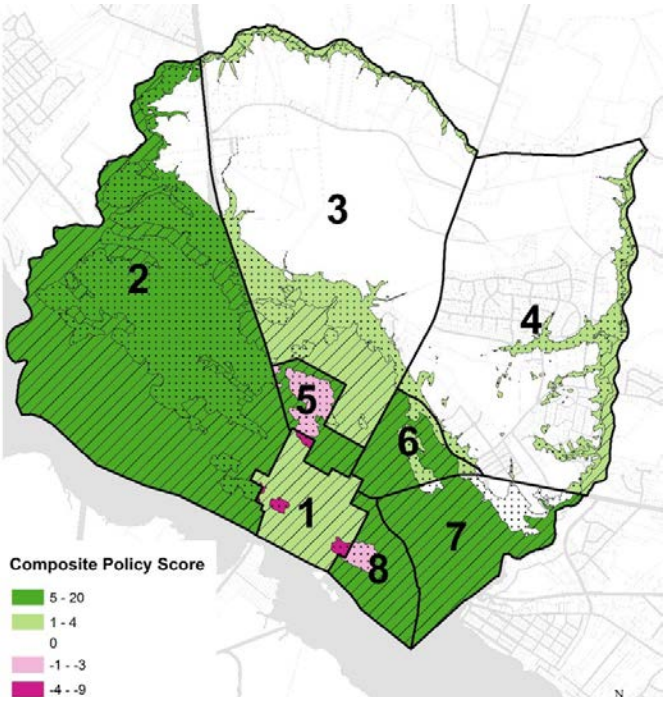


Figure 3.3 Composite score among all plans.

Analysis

Your PIRS tables and maps enable many different kinds of evaluation. Although analysis may be undertaken using tables alone, maps help make the results more intuitive and compelling, and help with pattern identification. Three useful methods of analysis are explained below, but you are encouraged to explore others.

1. First, we might compare differences between hazard zones. For instance, in the *'CAMA' Core Land Use Plan* (*Figure 3.2*, top left map), the western-most district (District 2) is shown to have more policies focused on reducing vulnerability in the current hazard zone (100-year floodplain; hatched) than in the future hazard zone (2100 sea-level rise; dotted). In the same way, we can observe that in Districts 7 and 8, the *'CAMA' Core Land Use Plan* contains a policy mix that is likely to reduce vulnerability in the current hazard zones, while the policies focused on the future hazard zone are likely to increase vulnerabity. These findings may indicate the need for adjustments to the policies that affect specific district-hazard zones—a process facilitated by the organization of the scorecard. This step is explained in greater detail in Chapter 4.

2. We might also use the tables and maps to compare policy scores across plans. In Washington, NC, the *Comprehensive Plan* (*Figure 3.2*, top right map) and the '*CAMA' Core Land Use Plan* (top left) contain policies that increase vulnerability in certain district-hazard zones—particularly in Districts 1, 3, and 5. In contrast, the *Hazard Mitigation Plan* (bottom left) and Parks and *Open Space Plan* (bottom right) actively decrease vulnerability throughout the city, including in Districts 1, 3, and 5. This apparent inter-plan conflict may require further investigation and reconciliation (the subject of Chapter 4).
3. Finally, the maps can be used to identify 'policy hot spots' and 'policy cool spots' in the city—areas receiving much or relatively little policiy attention, respectively, from the plans. These can be identified for individual plans as well as for the network of plans, as a whole. For examples of 'hot spots', we can observe the Composite Policy Score

BOX 3.2: Scoring the Network of Plans in Washington, NC

Most of the city of Washington, NC is located in either the 100-year floodplain or the projected sea-level rise hazard zone. However, the relationships between ability and plan scores are not consistent. For example, the network of local plans proposes to raise physical vulnerability in at least part of every planning district in the city—including all of downtown (District 1), which is already highly physically vulnerable). In contrast, policies in the network of plans are likely to reduce existing physical vulnerability in the 100-year floodplain in Districts 2, 5, 6, 7, and 8.

The resilience scorecards also reveal discrepancies in the way Washington's network of plan documents individually affect vulnerability in the city. Most notably, *Figure 3.3* shows that the current comprehensive plan receives negative scores in several planning districts, particularly the Central Business District, indicating that the plan is likely to increase vulnerability in parts of the city, whereas the hazard mitigation plan receives uniformly positive scores. These results point to differences in emphasis; the comprehensive plan is largely concerned with economic development, while the mitigation plan's explicit focus is vulnerability reduction.

The resilience scorecards for Washington, NC indicate that the city's plans are having an overall effect of increasing vulnerability to coastal flooding in many areas, a troubling finding for an already vulnerable community. They also reveal conflicts between the documents in the community's network of plans; some appear to be exacerbating vulnerability, even as others work to reduce it. These and other insights revealed through the resilience scorecard analytical method will be valuable for local planners and decision-makers as they work to improve planning for coastal flooding hazards in Washington.

Map for all plans in Washington (*Figure 3.3*). It is clear that several district-hazard zones contain an overall policy mix that is likely to increase vulnerability (areas in pink), while others contain many policies that are likely to reduce it. These results suggest the need to prioritize policy changes and investments in resilience measures in parts of District 1, 5 and 8, where the greatest incongruities exist among the plans and where vulnerability is likely to be increased. The city might look for inspiration to District 2, where the policy mix appears well-aligned toward reducing vulnerability.

Washington's *Comprehensive Plan* (*Figure 3.2*, top right map) provides an examples of a 'cool spot'. Both district-hazard zones in Districts 2, 4, and 5 display policy scores of zero. In Districts 2 and 5, this is due to intraplan policy conflict—an equal number of policies likely to reduce vulnerability as likely to increase it in these areas. In District 4, however, it signifies the absence of policies. Washington's *Comprehensive Plan* focuses more policy attention on the central, developed portion of the community (much of it actually increasing vulnerability) than in the outlying areas. This lack of policy attention for some hazard-prone areas could prove problematic, and may merit further discussion (see Chapter 4).

Some of the results of your policy score analysis may seem discouraging—but don't lose sight of what the evaluation really is: a diagnosis that reveals how various policies are pulling in different directions. The path forward, toward greater community resilience, is to adjust and adapt policies and priorities based on this new knowledge, as will be detailed in Chapter 4. To help prioritize these adjustments and interventions, we recommend that you also conduct vulnerability assessments and compare the results with those from your scorecared.

ASSESSING VULNERABILITY

On its own, your Plan Integration for Resilience Scorecard can reveal a lot about your community's network of plans, including the existence and geographic focus of policies that may exacerbate vulnerability. It is important to remember, however, that not everything or everyone responds to a hazard event in the same way. Understanding what parts of your community are likely to face greater challenges in rebounding from a disaster will help focus and prioritize your policy changes and investments. Therefore, in addition to evaluating policy scores in your network of plans, we encourage you to explore different measures of physical and social vulnerability.

This section describes several techniques for spatially evaluating vulnerabilities and using the results, together with your scorecard, to better recognize 'vulnerability hot spots' and areas of 'policy-vulnerability mismatch' (see *Figure 3.4*).

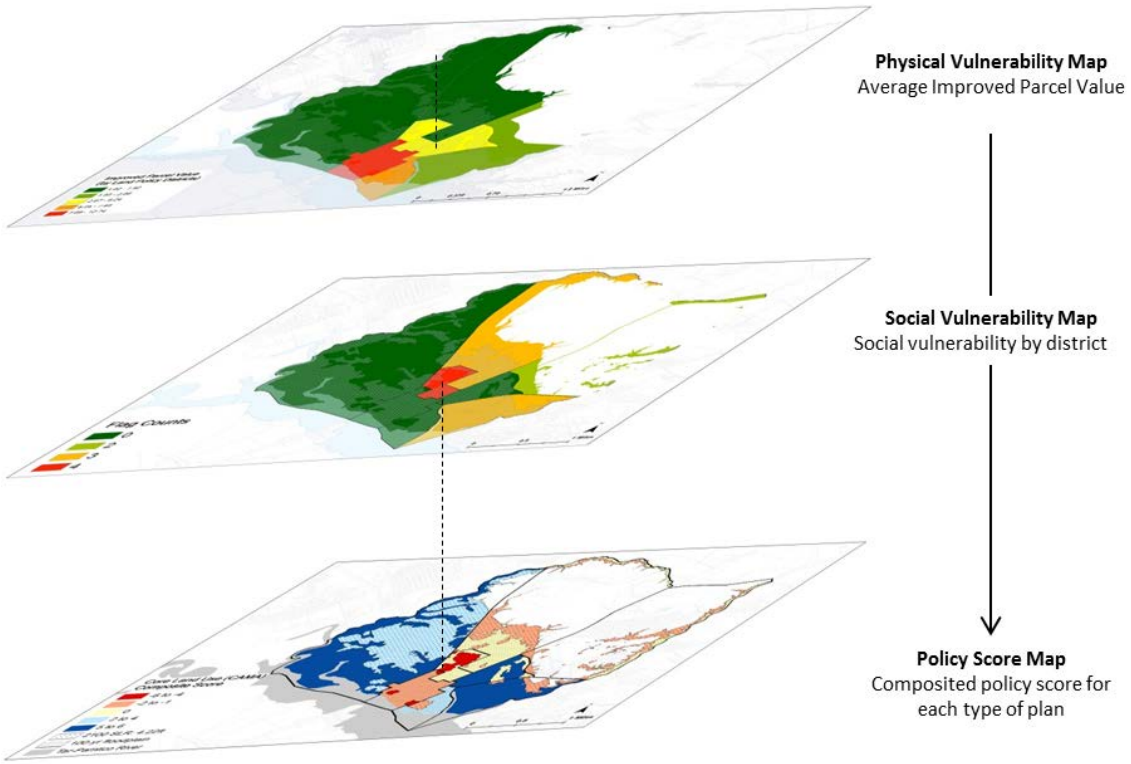


Figure 3.4 Overlay and compare Physical Vulnerability, Social Vulnerability, and Policy Score Map to find 'hotspots' and priority areas

BOX 3.3: Why assess physical vulnerability and plan integration together?

A recent analysis of six coastal cities[19] found an inverse relationship between plan integration scores and physical vulnerability—higher plan scores were correlated with lower levels of physical vulnerability across district-hazard zones. The analysis also led to suggestions regarding the value of targeting districts that are most physically vulnerable, and how various land use policy tools might work together in support of physical vulnerability reduction.

Physical vulnerability refers to the built environment, including buildings and infrastructure, exposed to hazards. The location and vulnerability of critical facilities is of special concern.

Social vulnerability refers to the people, households, or even neighborhoods and communities exposed to hazards.

Physical Vulnerability

The simplest way to understand physical vulnerability is to think about the investments that will be impacted if a disaster strikes. What structures – homes, businesses, public facilities – will need to be repaired or rebuilt? What infrastructure – roads; public transportation services; stormwater drains; flood control structures; electrical, water, and wastewater lines and facilities – will be damaged or affected? And which of the most critical facilities in the community – schools, fire and police stations, hospitals, pharmacies, grocery stores – are exposed to hazards?

Improved Parcel Value

There are many ways to evaluate physical vulnerability (and many resources available to help communities do so—see *Box 3.3*). One straightforward strategy is to calculate physical vulnerability using improved parcel value data to illustrate the differences across your community's district-hazard zones. While not a comprehensive indicator of physical vulnerability (and with the notable drawback that some appraisals may be out-of-date), improved parcel value data are useful for several reasons:

1. All communities are required to maintain publicly available property appraisal records, making for easy access to relevant data; and
2. Improved parcel value is an accepted proxy of investments in the community.

To perform this physical vulnerability assessment, first gather the latest improved parcel value data from the appraisal records database (usually provided by the county assessor). Also, obtain the latest parcel boundary shapefile with the parcel codes—which should also be publicly available. Create a GIS layer by joining the improved parcel value data to the parcel boundary shapefile, using the parcel code that is shared by both datasets. Then, find the average improved parcel value for each district.

Location of Critical Facilities

Another important aspect of physical vulnerability in a community is the location of critical facilities. Critical facilities are structures and infrastructure that are essential to the proper functioning of a community, especially during and immediately

19 Berke, P.R., Malecha, M.L., Yu, S., Lee, J., & Masterson, J.H. (2018). Plan Integration for Resilience Scorecard: Ealuating networks of plans in six US coastal cities. Journal of Environmental Planning and Management. DOI: 10.1080/09640568.2018.1453354

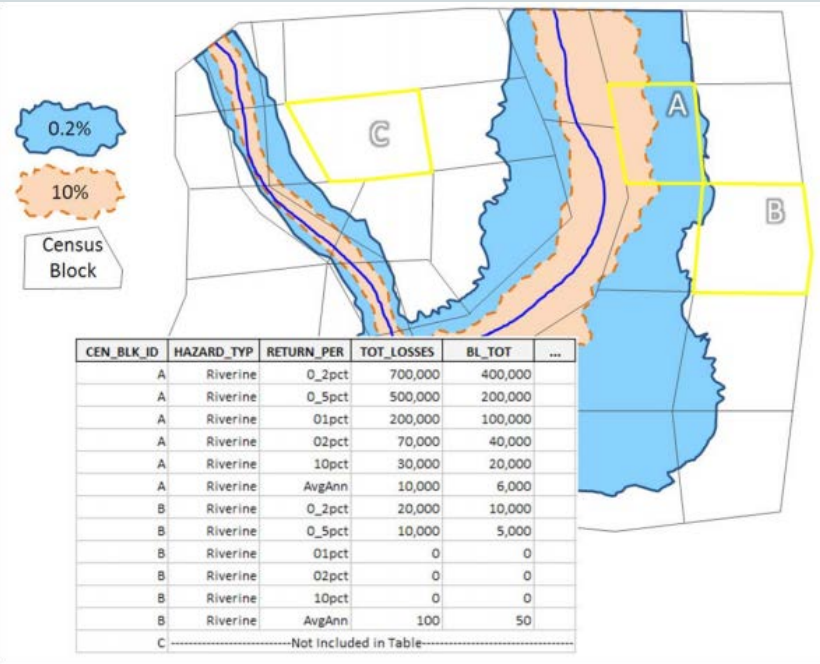
following a disaster. They typically include hospitals, police and fire departments, schools, water/wastewater treatment facilities, electrical facilities, public transportation facilities, and even so-called 'commercial critical facilities' like pharmacies and grocery stores. The true value of a critical facility is often greater than its appraised value; when a community's electricity is out for several days, or when a hospital or shelter is unreachable due to flooding, quality of life is significantly affected.

Information on critical facilities is typically collected and updated by emergency managers as part of the hazard mitigation planning process. If facility locations can be obtained, overlay them with the scorecard and other vulnerability maps. This will enable the identification of district-hazard zones that contain critical facilities, adding another important element to your analysis.

For a more comprehensive evaluation of community critical facilities, we suggest referring to the *Community Resilience Planning Guide*, produced by the National Institute of Standards and Technology (NIST), an agency of the U.S. Department of Commerce. You are also encouraged to explore other metrics and indicators for evaluating physical vulnerability to decide what best suits your needs (see *Box 3.3*).

BOX 3.4 Physical Vulnerability within the HAZUS-MH Flood Loss Tool

Hazus-MH Software from FEMA provides a national database of demographic (age, income, race etc.) and infrastructure data, critical facilities, transportation and utility networks, and building inventory ('GBS', or general building stock).



CEN_BLK_ID	HAZARD_TYP	RETURN_PER	TOT_LOSSES	BL_TOT	...
A	Riverine	0_2pct	700,000	400,000	
A	Riverine	0_5pct	500,000	200,000	
A	Riverine	01pct	200,000	100,000	
A	Riverine	02pct	70,000	40,000	
A	Riverine	10pct	30,000	20,000	
A	Riverine	AvgAnn	10,000	6,000	
B	Riverine	0_2pct	20,000	10,000	
B	Riverine	0_5pct	10,000	5,000	
B	Riverine	01pct	0	0	
B	Riverine	02pct	0	0	
B	Riverine	10pct	0	0	
B	Riverine	AvgAnn	100	50	
C	----------Not Included in Table----------				

Figure 3.5. Example showing economic impacts based on HAZUS results (source: Guidance for Flood Risk Analysis and Mapping from FEMA, 2014: p7)

Figure 3.5 shows how HAZUS-MH is applied to calculate annualized loss values by different hazard zones. HAZUS provides a table that represents census block, hazard type, and flood frequency for the risk assessment performed. In this example, a census block contains flood loss estimates for the 0.2% (500-year) and 10% (10-year) annual chance events.

Online Physical Vulnerability Tools

USGS Structures Inventory Database provides critical facilities data (http://nationalmap.gov/structures.html) reproduced by NOAA within the coastal geographies including coastal shoreline counties, coastal watershed counties, coastal states, the coastal zone and FEMA flood zones. There are 40 different types of facilities grouped into 4 categories; Fire/EMS, Hospital/Medical, Law Enforcement, and Schools.

The data includes point locations and can be downloaded in ESRI geodatabase format for U.S coastal areas. Data can be downloaded from the web at: ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Struct/GDB/

Definitions, methodologies and the geographic descriptions can be found here: https://coast.noaa.gov/dataregistry/search/collection/info/criticalfacilities

ADD Explanation and links to NIST Guide (https://www.nist.gov/topics/community-resilience/planning-guide)

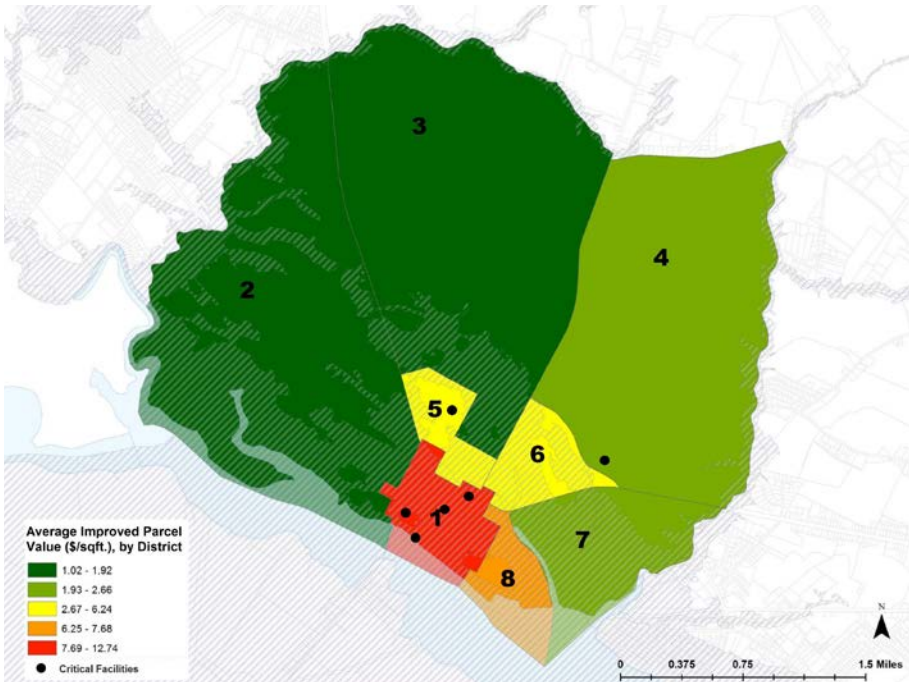


Figure 3.6 Physical Vulnerability and Location of Critical Facilities in Washington, NC

Analysis

Figure 3.6 shows the spatial distribution of two types of physical vulnerability in Washington, NC—average improved parcel value ($/sqft.), by district, and the location of critical facilities. Average improved parcel values range from $1.02 to $12.74 per square foot. Based on this measure, the most physically vulnerable area of the city is the Central Business District (District 1), followed by District 8. Several critical facilities can also be found in these districts. The intersection of these different measures indicates a 'physical vulnerability hot spot'; these districts should be prioritized for greater policy attention and investment aimed at strengthening resilience.

Social Vulnerability

Social vulnerability is a term that emerged in the field of disaster research in the 1990s and is defined as a person's or group's "capacity to anticipate, cope with, resist and recover from the impacts of a natural hazard."[20] Disasters affect different people or groups in different ways, based on their relative vulnerability, resulting in some populations being more strongly affected than others.

20 Blaikie, P.M., T. Cannon, I. Davis, and B. Wisner. At Risk: Natural Hazards, People's Vulnerability and Disasters. London: Routledge, 1994. P.

Social Vulnerability Index

There are a number of ways to assess social vulnerability, including many detailed research methodologies and online applications (see Box 3.6). One well-regarded method – the Social Vulnerability Index (SVI) – from the U.S. Department of Health and Human Services (HHS) Centers for Disease Control and Prevention (CDC) – will be described here. The SVI method has two key benefits:

1. Data are easy to obtain, coming from the U.S. Census Bureau's American Community Survey (ACS); and
2. Demographic information is intuitively combined to define areas of potential 'need'.

The CDC maps social vulnerability at multiple scales by focusing on a series of 15 demographic indicators, grouped into four categories:

Socioeconomic characteristics

- Below poverty
- Unemployed
- Income
- No high school diploma

Household composition and disability characteristics

- Aged 65 or older
- Aged 17 or younger
- Civilian with a disability
- Single-parent households

Minority status and language barriers

- Minority
- Speaks English "less than well"

Housing and transportation characteristics

- Multi-unit structures
- Mobile homes
- Crowding
- No vehicle
- Group quarters

The CDC's Social Vulnerability Index (SVI) database (svi.cdc.gov) allows communities large and small to access maps of vulnerability in their local area. Data are also available for download. Because the CDC data come from the U.S. Census Bureau, communities that want to take a closer look can download datasets at as fine a scale as the census block group.

We suggest that you visit the website and download SVI data for your community. The open and comprehensive nature of the download allows you to customize your analysis—you can use all 15 indicators or focus on a few that may be more applicable to the context. Of course, if your community already has data on socially vulnerable populations (gathered, for instance, as part of other planning initiatives) feel free to use that, instead!

BOX 3.5: Why assess social vulnerability and plan integration together?

In an assessment of six coastal cities[21], results indicate very little attention paid to social vulnerability within plans. Communities were developing plans and policies without the most socially vulnerable in mind, likely impacting response and recovery times and missing opportunities to build resilience. Understanding the spatial distribution of socially vulnerable populations can lead to more effective prioritization of policy changes and investments within the community.

21 Berke, P.R.,Yu, S., Malecha, M.L., Masterson, J.H., & Cooper, J. (under review). Equity impacts of plans in six cities vulnerable to floods and sea level rise: A resilience scorecard. Journal of Planning Education and Research.

Online Social Vulnerability Tools:

The Center for Disease Control has mapped social vulnerability by county and specifically looks at socioeconomic characteristics, household composition and disability characteristics, minority status and language barriers, and housing and transportation characteristics. (http://svi.cdc.gov/map.aspx)

Digital Coast, NOAA Coastal Services displays hundreds of maps on hazard vulnerability, natural vulnerability, and social vulnerability. (http://csc.noaa.gov/digitalcoast/dataregistry/#/)

NOAA, Office of Science and Technology- Mapping Social Vulnerability maps coastal cities and their social vulnerability which includes, labor force characteristics, housing characteristics, poverty, population composition, and personal disruption. (http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map)

NOAA's State of the Coast displays population data for coastal counties in the U.S. It also provides important information on coastal communities, economies, ecosystems, climate, and more. (http://stateofthecoast.noaa.gov/population/welcome.html)

The Texas Planning Atlas, as discuss in Masterson et al., 2014, provides social vulnerability indicators described above. Currently, the Atlas only covers Texas, but we anticipate 'lighting up' other states in the near future. (http://coastalatlas.arch.tamu.edu/)

Esri SoVI Mapping Tool summarizes risk for states and counties. At scales greater than 1:3 million, vulnerability is calculated on the state level. At scales less than 1:3 million, scores are calculated for each county. Although this web service provides a simplistic view of social vulnerability, it shows which areas have a greater potential for damage caused by disaster events. (http://www.arcgis.com/home/webmap/r.185d6cde6760a20c5&useExisting=1)

The U.S. Census Bureau, Center for Economic Studies has developed a web mapping tool for communities to better understand their economies. On The Map (http://onthemap.ces.census.gov/) lets you evaluate the primary industries, and the inflow and outflow of your community, among other things.

Social Explorer is an interactive website that pulls Census data in an easy to read format, through maps, tables, graphs. (http://www.socialexplorer.com/explore/tables)

American FactFinder has downloadable data from the U.S. Census Bureau and communities can pull Census Block Group boundary information and shapefiles (https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml; https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2010&layergroup=Block+Groups)

Analysis

Figure 3.7 depicts social vulnerability at the district scale in Washington, NC, based on SVI data. According to this set of indicators, the most socially vulnerable area in the city is District 5, just north of the Central Business District (District 1). District 5 is also located in both flood hazard zones, and receives mixed direction from the network of plans (Figures 3.2 and 3.3); some policies work to reduce vulnerability, while others are likely to increase it. This suggests something of a 'policy-vulnerability mismatch' with respect to social vulnerability in District 5, and a need for higher prioritization. Opportunities exist to increase resilience in this highly socially vulnerable area by adjusting existing policies and incorporating hazard mitigation and social equity more effectively in plans and policy initiatives (see Chapter 4).

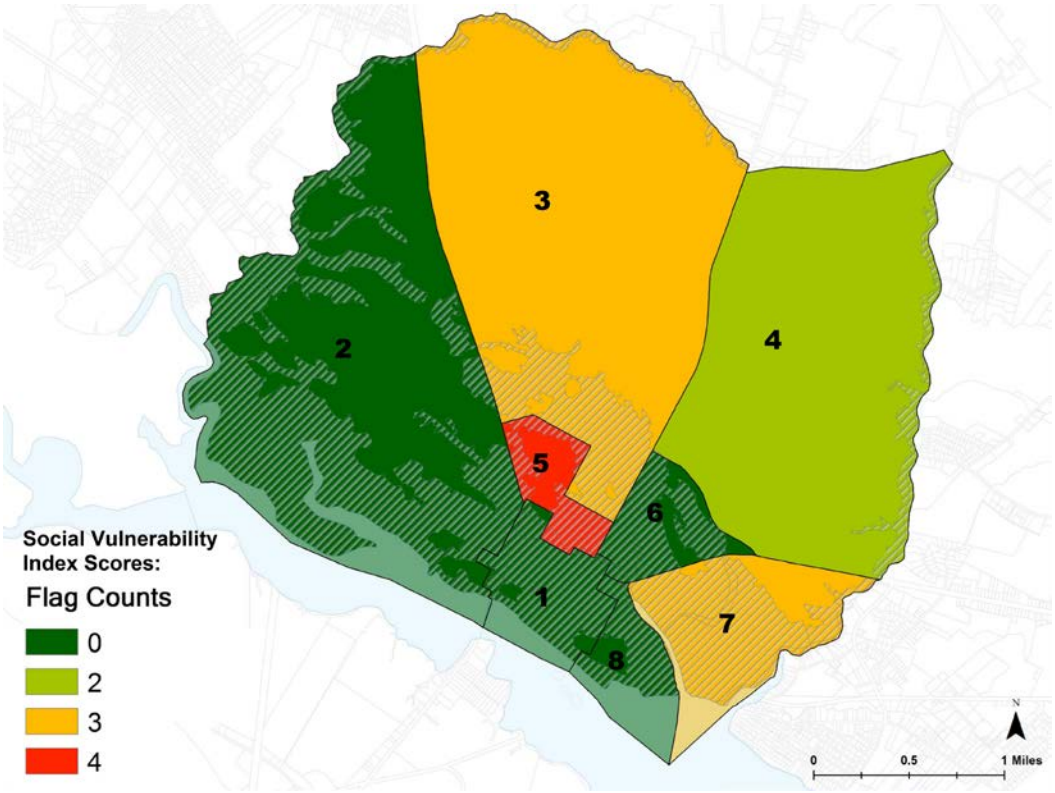


Figure 3.7 Social Vulnerability by Planning Districts. Higher 'flag counts' represent areas with higher levels of social vulnerability and a social vulnerability 'hotspot'

Key Concepts:

Assess physical vulnerability and social vulnerability as a way to understand vulnerability hotspots for more informed decision making.

Physical vulnerability can include:

- Infrastructure—whether roads, public transportation services, stormwater drains, electrical, water and wastewater lines and facilities or even levees and dams;
- Other critical community facilities—such as schools, fire stations, police stations, hospitals, post offices, etc.
- Structures—whether homes or businesses;

Social vulnerability can include:

- Socioeconomic characteristics—below poverty, unemployed, income, no high school diploma
- Household composition and disability characteristics—aged 65 or older, aged 17 or younger, civilian with a disability, single-parent households
- Minority status and language barriers—minority, speak English "less than well"
- Housing and transportation characteristics—multi-unit structures, mobile homes, crowding, no vehicle, group quarters

CHAPTER 4

ADVANCING PLAN INTEGRATION, KNOWLEDGE, AND RESILIENCE

Creating a Plan Integration for Resilience Scorecard, evaluating policy scores, and assessing community vulnerability provides a valuable new perspective and additional knowledge to help you strengthen integration and resilience by making better-informed decisions about prioritization and adjustment of policies across your network of plans. The scorecard process, it is hoped, will result in advances in *plan integration,* in *knowledge*, and, ultimately, in *resilience* across your community. Each of these outcomes is described in this concluding chapter, and illustrated with examples from planning practice and research.

Advancing plan integration: adjusting and adding policies
Strengthen integration across your network of plans – from the comprehensive plan and hazard mitigation plan to sector- and area-specific plans – by using your scorecard and vulnerability analysis results. Adjust, expand, add, or even remove policies to improve plan alignment and reduce vulnerability. Prioritize *policy hot/cool spots*, *vulnerability hot spots*, and areas of *policy-vulnerability mismatch*.

Advancing knowledge
Increase the understanding of local planners and staff, elected and appointed officials, key stakeholders, and the broader community about the relationships between different plans and their effects on hazard vulnerability—including how they might be better integrated and focused toward building resilience.

Advancing resilience
Apply your well-integrated and resilience-focused network of plans to more effectively guide the development and management of your community. Influence regulations and development tools, direct resources efficiently and effectively, and track your progress toward building resilience across the community—especially in the most vulnerable areas. strategies, and design and location of capital improvement projects (transportation, water, sewer).

Checklist:

- Change plans and development policy tools
- Change knowledge of planners and stakeholders

OBJECTIVE:

- Engage the community in setting priorities for policy change

MATERIALS REQUIRED:

- Previously created maps and tables
- Scorecard

STAFF REQUIREMENTS:

- Ability to recruit diverse stakeholders
- Ability to design an inclusive public involvement process
- Ability to facilitate group conversations

Advancing Plan Integration: Adjusting and Adding Policies

Your Plan Integration for Resilience Scorecard and vulnerability analysis results provide you with the information needed to make informed policy adjustments that strengthen the integration of your network of plans toward greater resilience and enhance its focus on areas of particularly high vulnerability. The process of amending plans and policies should ideally also be informed a comprehensive community engagement effort (see Advancing Knowledge section, below). By prioritizing *policy hot/cool spots, vulnerability hot spots*, and areas of *policy-vulnerability mismatch* – but also remembering to look comprehensively across your community and network of plans – you can adjust, add, expand, or even remove policies to improve plan alignment and reduce vulnerability.

Using the information gathered, scrutinize your scorecard, focusing on areas of concern, but also thinking about policies that might have a broad impact. Take the time to consider policy alternatives, including those that might be added or amended with minimal effort, cost, or opposition. Work with internal staff and elected and appointed officials to develop and prioritize policy changes, informed by feedback from stakeholder groups (again, see below). Develop a phased action plan with timelines to address priorities, which can help guide legislative changes and facilitate greater plan integration when updating existing plans or drafting new ones. Actions may include:

- Adjusting policies within existing plans (see *Examples of Policy Adjustment*, below)
- Amending development regulations and other ordinances (e.g. subdivision or zoning ordinances)
- Undertaking a new resilience planning process, such as that described in the NIST *Community Resilience Planning Guide*

For controversial or harder-to-implement changes, discuss alternative strategies with officials. There is no easy answer for communities that desire economic investment in hazardous areas. Return-on-investment and other mechanisms may be used to facilitate decision-making. Policies do not change the environment overnight, however; governments have an opportunity to guide development toward safer areas or in safer ways to avoid the negative fall-out feared by those concerned.

As described in Chapter 1, the City of Norfolk, VA, applied the Plan Integration for Resilience Scorecard to great effect. The scorecard process gave them a chance to comprehensively and methodically reevaluate their network of plans

and policies, highlighting inconsistencies and revealing areas in need of adjustments to increase specificity and integration. Following the creation and analysis of their scorecard, the Norfolk city planning commission conducted a public hearing to specify amendments across various plan and policy documents, including a variety of "text amendments to better incorporate the actions aimed at mitigation and resilience as outlined" in the hazard mitigation plan across other planning documents. Official actions resulting from their scorecard process, including broad policy adjustments, are summarized in *Box 4.1*. More specific exampes of potential policy adjustments to advance plan integration are provided below.

Examples of Policy Adjustments

Your scorecard and vulnerability analyses are likely to reveal a multitude of potential issues in your network of plans (this is true of even the best networks of plans we have encountered). These may include district-hazard zones that might be classified as *policy hot/cool spots* or *vulnerability hot spots*, or that display *policy-vulnerability mismatch* (see Chapter 3: ANALYSIS for further detail). You may also discover instances of inter-plan policy conflict, such as one plan calling for buyouts and strategic retreat, while another suggests densification in the same area.

BOX 4.1 Norfolk, VA changing plans and policy tools

The City of Norfolk planning commission public hearing demonstrates how Norfolk is amending policies to incorporate elements within the network of plans:

- Incorporate the Vision 2100, their resiliency strategy for sea level rise, into *plaNorfolk*—the comprehensive plan—to address land use, transportation issues, and facility siting.
- Incorporate the hazard mitigation actions into *plaNorfolk* as well.
- Amend *plaNorfolk* to include location criteria of public facilities to address resiliency.
- Amend zoning regulations to better incorporate *Vision 2100* and resiliency principles described.
- Include *Vision 2100*—specifically, the areas in the community they will protect and areas they will strategically abandon—into *plaNorfolk*, the housing plan, and the waterfront plan.
- Incorporate *Vision 2100* into their housing plan to analyze acquisitions that would further resilience.
- Incorporate *Vison 2100* into their capital improvement projects to determine major roadway improvements, rail, ferries, etc.
- Will also evaluate the development proposals and budgets based on the *Vision 2100* and sea level rise.
- Use the hazard mitigation plan and *Vision 2100* as a guide to decide mitigation options.
- Incorporate *Vision 2100* into their capital improvement projects when deciding the location of new schools and facilities.
- Assess and re-write ordinances, regulations, and development review criteria to increase integration of resiliency principles and plan policies.
- Include flood insurance rate reductions for residents based on more credits under the NFIP's Community Rating System.
- Specify appropriate strategies in the hazard mitigation plan to mitigate the impact of flooding on existing flood-prone structures.
- Incorporate location (safety) criteria for community facilities in *plaNorfolk*, adding it to accessibility and other influential factors.

Resolving such issues and conflicts is the ultimate goal of the Plan Integration for Resilience Scorecard method. Adjusting (or adding) policies to improve the integration and focus of policies in your network of plans will help advance your community's resilience to hazards.

Different approaches can be used to address different types of issues, but the underlying objective is to raise policy index scores in your district-hazard zones – and across your community – by *increasing* the number and geographic reach of policies likely to *reduce* vulnerability (and vice versa). This may be accomplished in four primary ways:

1. Policies receiving negative scores can be adjusted so that they are less likely to increase vulnerability – or even likely to reduce it. Of course, such an adjustment may be too challenging for a given poicy; in these cases, it may be best to consider simply dropping the problematic policy, altogether. (see *Table 4.1*)
2. Policies receiving neutral scores – or that were left out of your final scorecard for failing to meet one or more of the criteria for inclusion (see Chapter 2) – can be adjusted so that they are more likely to reduce vulnerability. (see *Table 4.1*)
3. The geographic focus of strong, vulnerability-reducing policies can be focused or expanded. (see *Table 4.2*)
4. 'Best practice'-type policies – adjusted to fit your community's context, of course – can be added to your plan(s). (see *Table 4.3*)

Examples of different kinds of adjustments are provided below, based on policies drawn from existing plans. This list is far from exhaustive, however. We encourage you to think creatively about how best to accomplish your goals of advancing plan integration and strengthening resilience in your community by adjusting policies.

Table 4.1 Examples of Adjusting Negative- or Neutral-Scoring Policies. The most frequent (and *effective*) adjustments you are likely to make will be in an effort to change negative scores to positive ones—essentially turning vulnerability-*increasing* policies into vulnerability-*reducing* policies. The same is true for policies that receive neutral scores or which were left off your scorecard, entirely. Some examples of how this might be accomplished are shown below.

Problematic Policy	Potential Adjustment
The city will capitalize on the rivers as a community amenity for enjoyment by residents and visitors.	The city will capitalize on the rivers as a community amenity**, preserving riparian areas and/or returning them to their natural state** for enjoyment by residents and visitors.
The City will monitor sea level rise and respond to threats to property and important natural areas as threats are identified.	The City will monitor sea level rise and respond to threats to property **(elevating, retrofitting, or retreating, as appropriate)** and important natural areas **(e.g. preserving, expanding, buffering)** as threats are identified.
The City will protect its waterfront/shoreline areas, historic district, and valuable scenic areas.	The City will **use buffering and other 'green infrastructure' strategies to** protect its waterfront/shoreline areas, historic district, and valuable scenic areas.
The City supports directing more intensive land uses to areas of its planning jurisdiction which have existing infrastructure.	The City supports directing more intensive land uses to areas of its planning jurisdiction which have existing infrastructure**, unless such areas are located in flood hazard zones**.
The City encourages the location of new economic development in and around the existing urban area where public infrastructure exists or can be easily extended.	The City encourages the location of new economic development **on appropriate sites (that is, not including flood hazard zones)** in and around the existing urban area where public infrastructure exists or can be easily extended.
Encourage higher-density multifamily development in pedestrian-oriented urban areas with access to transit.	Encourage higher-density multifamily development in pedestrian-oriented urban areas with access to transit, **except in known and likely future flood-hazard areas.**
The City supports implementation of the Downtown Revitalization Strategy	The City supports implementation of the Downtown Revitalization Strategy**, though redevelopment in hazard-prone areas should incorporate elevation, flood-proofing, and other building-scale resilience measures**.

Problematic Policy	Potential Adjustment
Redevelop several commercial parcels in area X with mixed use structures whose designs complement the architecture of homes in the vicinity.	Redevelop several commercial parcels in area X with mixed use **and flood-resilient** structures whose designs complement the architecture of homes in the vicinity.
Several parcels along Main Street consist of surface parking lots fronting the street and occupying the majority of the area of these parcels. Parcels W, X, Y and Z are recommended for redevelopment into mixed-use structures with ground floor retail permitting upper-story residential units or offices.	Several parcels along Main Street consist of surface parking lots fronting the street and occupying the majority of the area of these parcels. Parcels ~~**W, X**~~, Y and Z are recommended for redevelopment into mixed-use structures with ground floor retail permitting upper-story residential units or offices**; parcels W and X, located in the floodplain, are recommended for conversion to neighborhood-oriented parks**.
In order to create attractive and affordable rental living opportunities and to provide greater flexibility for homeowners, permit accessory dwelling units in single-family areas.	In order to create attractive and affordable rental living opportunities and to provide greater flexibility for homeowners, permit accessory dwelling units in single-family areas**, but only if such areas are not located in current or future flood-hazard zones**.

Table 4.2 Examples of Focusing or expanding the geographic focus of strong policies.
Adjusting otherwise strong policies to give them more specific – or wider – geographic focus is another way to increase policy index scores and advance resilience in your community.

Policy	Potential Adjustment to Focus/Expand
The City supports continuing preservation/protection of its flood hazard areas [defined, here, as the 100-year floodplain].	The City supports continuing preservation/protection of its **current and likely future** flood hazard areas.
Continue to pursue construction of greenways and walking trails throughout the community.	Continue to pursue construction of greenways and walking trails throughout the community**, prioritizing riparian and otherwise flood-vulnerable areas**.
Consider the use of site X for open space/recreational use.	Consider the use of site X **and other underutilized or vacant sites in flood-hazard zones** for open space/recreational use.
Keep Park X as parkland in perpetuity.	Keep Park X **and all parks located in current or likely future floodplains** as parkland in perpetuity.
Decrease permitted building heights from mid-rise to townhouse scale in the blocks between K and M Streets to match the scale of the adjacent existing residential area.	Decrease permitted building heights from mid-rise to townhouse scale in the blocks between K and ~~**M**~~ **O** Streets to match the scale of the adjacent existing residential area. **[…thereby also reducing allowed density in a larger portion of the flood-hazard area of the city]**
Dunes shall be established with plantings of Cape American beachgrass (Ammophila breviligulata).	Dunes shall be established **along all urban beaches** with plantings of Cape American beachgrass (Ammophila breviligulata).
Through the land use planning process, restrict incompatible development activities adjacent to publicly-owned or managed natural preserves.	Through the land use planning process, restrict incompatible development activities ~~**adjacent to**~~ **within a quarter-mile of** publicly-owned or managed natural preserves.

Table 4.3 Example List of Best Practice Policies. In addition to amending your existing policies, you may consider adding additional policies to your plan(s) to advance resilience. Examples of such 'best practices' policies, which can be tailored to your community's unique needs, are shown below.

'Best Practice' Policy
The City shall, through the land development review process, prevent the further destruction of desirable natural system buffers on the river and its major tributaries, unless found to be in the overriding public interest. The overriding public interest test, found in the Definitions section of this plan, provides criteria to guide City Council in the decision-making process.
Promote the acquisition, retention and management of natural areas to preserve environmental, recreation and other public benefits.
The City should discourage development in [low-lying] areas designated for light-density residential use with the exception of low-density residential/agriculture land uses.
The City supports larger lots, decreased impervious surface areas, and cluster development in conservation classified areas and areas with low land suitability through enforcement of the city's subdivision and zoning ordinances.
The City shall limit the specific and cumulative impacts of development or redevelopment upon wetlands, water quality, water quantity, wildlife habitat, living marine resources and the beach dune system through the development review process.
Eliminate unsafe conditions and inappropriate uses in the coastal high hazard area as a function of the post-disaster redevelopment plan as opportunities arise.
Give priority to acquiring land in the Coastal High Hazard Area to increase open space, recreation opportunities, public access, and to reduce the risk of property damage from potential disasters.
The City shall not utilize public funds for infrastructure expansion or improvements in the coastal high hazard area unless such funds are necessary to provide services to the existing development and to provide adequate evacuation in the event of an emergency.
Through the land planning and development review processes, restrict net encroachment into the 100-year floodplain of significant wetland and riverine systems in accordance with the provisions of the Environmental Resource Permit Rules, administered by the Southwest Florida Water Management District and the Florida Department of Environmental Protection.
The City shall give priority to acquiring vacant riverfront parcels through fee simple purchase or other alternatives including, but not limited to, conservation easements, transfer of developments rights, and post-acquisition disposition mechanisms.
Revise local development ordinances to encourage shoreline vegetation protection to help mitigate flooding.
Develop the space along the south side of Highway X between 12th and 13th Streets as a park space. Planning for such improvements should be carefully coordinated with other area plans.
Protect public investments in areas vulnerable to natural disasters by constructing improvements in accordance with DEP standards.

The City may require the maintenance of higher levels of service for public infrastructure (e.g., roadways) as a means of reducing densities and clustering development intensity away from environmentally sensitive areas.
Public expenditures should focus on projects which restore and enhance natural resources, such as beach nourishment and revegetation projects.
The County, in conjunction with its municipalities, independent districts and partner agencies, shall work to ensure that adaptation to climate change impacts, especially sea level rise, is incorporated into public infrastructure and is an integral component of all planning processes as stipulated in the Climate Change Element.
The City shall introduce new ordinances or modify existing regulations to include prescriptive standards for the preservation of natural open space, the private sector provision of passive open space (in addition to active parks) within residential areas, and the public sector acquisition of open space (in addition to or as part of community and regional parks). These open space areas should be able to be maintained in their natural state or require minimum maintenance by the public or private sectors.
The County shall evaluate opportunities to protect coastal investments and infrastructure, as necessary and feasible, from the impacts of climate change. Specifically, the County will maintain shoreline protection and erosion control by: a) Continuing the appropriate use of beach nourishment and sand bypassing; b) Facilitating the installation and maintenance of native beach dune vegetation along appropriate areas of beach; c) Revisiting redevelopment policies with the objective of providing additional coastal buffer area between developed areas and the shoreline; and d) Considering hard structures, such as seawalls, only when alternative options are unavailable.
The City shall ensure that any habitable, non-residential buildings in special flood hazard areas are designed and constructed to reduce the potential for flooding and wind damage. All structures within the defined flood zones (AE and VE) shall be constructed in accordance with the provisions specified in the Florida Building Code. Buildings and parking areas shall also be designed and constructed in accordance with the provisions of Rule 62-25, Florida Administrative Code.

Advancing Knowledge

The Plan Integration for Resilience Scorecard method is not only about generating and evaluating policy scores and vulnerability; the broader knowledge derived from going through the process is an important benefit. Staff and stakeholder knowledge begins to grow right from the start, as 'silos' are broken down through exposure to the community's entire network of plans. Application and analysis of the scorecard provides a deeper understanding of how the community's network of plans – including plans not explicitly intended to address hazard mitigation – are linked to mitigation and disaster loss. Planning staff in the the demonstration communities testify to the value of the scorecard process in advancing knowledge about their plans and policies in relation to hazard threats:

> *"We wanted to see the effect of all our policies on flood resilience because we had never taken such a comprehensive look our policies before. It was also an opportunity to see how different plans stacked up, particularly because we had not previously evaluated the hazard mitigation plan side-by-side with other community plans."* –City of Norfolk

> *"We were very intrigued by the 'spatiality' of our policies and hadn't thought about our policies spatially before. This was important to us because our Vision2100 document specifically designates areas of flood protection and retreat."* –City of Norfolk

> *"We utilized this to update our comprehensive plan and zoning ordinances"* –City of League City

> *"It is important for practice that you are tracing back to the policy."* –City of League City

Robust stakeholder and community engagement can expand this knowledge-building process, and may yield critical information about how specific policies influence public and private land use—at once fostering consistency across the network of plans and building support for plan implementation. A considered engagement process provides an opportunity to align community values with hazard mitigation policies.

Effective problem solving requires many decisions to be made with the input and consent of stakeholders and others with "relevant information about the problem and its causes, its solutions, and potential effects"[22]. To facilitate the collaborative process, identify and disseminate information gained from your scorecard analysis to groups of stakeholders with different interests, capacities, and roles within the community. Consider especially the roles/groups included in *Table 4.4*.

Table 4.4 Who to Engage

Role	Group
Those responsible for planning	Internal staff and or planning consultants
Those responsible for implementing the decision	Elected and appointed officials
Those affected directly by the decisions	Key stakeholders
Those affected indirectly or can influence whether or how the solution is implemented	Residents

Adapted from (Schwarz 2002, p. 27).

Figure 4.1 Discuss the resilience scorecard results with the following groups.

22 Schwarz, R. The Skilled Facilitator : A Comprehensive Resources for Consultants, Facilitators, Managers, Trainers, and Coaches. 2002. p27.

Work with Internal Staff

Meet with internal staff in the various community departments responsible for planning and management to communicate the results. Be sure to identify how plan integration impacts each department's core mission. The group should include a representative from each department or agency responsible for any of the plans in the network, as well as others that would benefit from awareness of the results. Consider discussing the following in the meeting:

- Project background and history
- Plans evaluated
- Composite policy score map
- Policy score maps by plan
- Physical and social vulnerability maps

After a broad discussion of the results, focus on specific policies in each plan that received negative scores. Start with districts identified as policy or vulnerability *hot spots* (see Chapter 3). Brainstorm possible amendments or additional policy tools to better align plans (see below). Consider the level of financial investment needed to decrease vulnerability. Communities may also want to discuss policy *cold spots*—district hazard zones with relatively few policies focused on reducing vulnerability. Brainstorm possible policies that might be added or expanded to increase resilience. Example worksheets to help with this process can be found in Appendix D.

Engage Elected and Appointed Officials

After gathering and incorporating internal staff feedback, you can better communicate to those responsible for changing and adopting policies, which may include:

- Local legislative bodies (e.g. city council, commissioner's court)
- Executive bodies (e.g. mayor)
- Regional planning commissions
- Other established boards and committees

You may choose to hold a special committee meeting or hearing to discuss the project background and results, including the final scorecard, policy score maps, and physical and social vulnerability maps. Discuss policies and suggested changes by reviewing the worksheet informed by conversations with internal staff. Speak to officials about economic resilience, economic loss, and return on investment whith respect to plan integration. Elected and appointed officials may also anticipate opposition to policy amendments and help develop a communication strategy to allay concerns of potential adversaries. Elected and appointed officials and staff should work with opposition groups early and often.

Engage Key Stakeholders

Next, identify stakeholders in the community that may be affected directly by policy changes and decisions. Stakeholders in the planning process may range from individuals and families, to regional, state and national actors, depending on the jurisdiction and resources involved. FEMA's *Local Hazard Mitigation Planning Handbook* offers guidance on whom to involve in the process (FEMA 2013). Consider the following stakeholder groups beyond individuals and households:

- Public and private developers
- Owners and operators of buildings and infrastructure systems
- Local business and industry representatives
- Representatives from community social institutions (e.g., community organizations, nongovernmental organizations, business/industry groups, health, education)
- Other interested community groups

Hosting meetings with stakeholder groups enables solicitation of feedback on possible consequences of policy changes, so officials can make informed

decisions for wise and balanced city investments. Discuss the Plan Integration for Resilience Scorecard with stakeholders, describing the findings—especially areas vulnerable to hazards and the policy score maps that show competing policies. Summarize the suggested policy changes for vulnerable district hazard zones with policy conflicts. Discuss the cascading impacts of plan incongruity and policy changes. For instance, a stakeholder group may not agree with policy tools that may increase densities in a particular district. Opinions about prioritization and the most appropriate strategies will vary by stakeholder group, of course. Avoid attempting to resolve such complexities; instead, simply document the feedback on balancing priorities, then report back to elected and appointed officials.

Engage Local Residents

FEMA's "Whole Community Approach to Emergency Management" recognizes that the federal role is only one small part of the overall emergency management process. Effective emergency management occurs when local, tribal, and state partners come together, along with non-governmental organizations such as faith-based groups and the private sector, as well as individuals and families. Thus, as part of the scorecard-related outreach, attempt to engage all who are affected by or could influence implementation. Residents are particularly important because of their local knowledge and potential to lead community-driven implementation efforts.

We recommend hosting workshops in neighborhoods with high physical and social vulnerability. Deliberate efforts to connect with groups in these most vulnerable areas will help reveal true priorities and potential solutions. To establish trust and effectively reach members of these communities, we suggest connecting with leaders who are, themselves, trusted—potentially including community-based non-profit groups, civic clubs, teachers, faith leaders, or social service workers. Working with existing groups already engaging with communities (e.g. Resilience AmeriCorps) is also advised.

Similar to the meetings with key stakeholders, provide residents with an overview and the purpose of the Plan Integration for Resilience Guidebook, describing areas vulnerable to hazards and the policy score maps that show competing policies. Summarize suggested policy changes for the neighborhood. Residents inherently think about how they and their loved ones will be affected and might think:

- Where is my home and how might it be affected by hazards?
- How might my elderly relative, differently abled neighbor, young child, or pregnant wife be impacted by these hazards?
- How will I get to my job or pick up my child from school?
- How will my basic routine be affected (e.g. access to basic necessities, healthcare, gas)?

Consider asking residents:

- What priority should the city/county/government place on reducing vulnerabilities?
- Which areas of the community are you most concerned about?
- What can the city/county/government do to reduce vulnerabilities?
- Do you think the suggested policy changes will help?
- What time, talent, or resources are you willing to invest in reducing your community's vulnerability?

Document feedback on balancing priorities and opinions regarding policies and report back to decisionmakers.

Document the feedback on balancing priorities and report back to elected and appointed officials.

Advancing Resilience

After you have adjusted and added policies – informed by your Plan Integration for Resilience Scorecard and vulnerability analysis results and community engagement efforts – your well-integrated and resilience-focused network of plans can be used to guide your community in a more resilient direction. Rectifying instances of inter-plan conflict will reduce confusion as you move forward in developing and managing a community that is less vulnerable to the effects of natural hazards. Prioritizing areas of high vulnerability (*vulnerability hot spots*), areas receiving little policy attention (*policy cool spots*) or that have a lot of policies likely to increase risk (*policy hot spots*), and areas of *policy-vulnerability mismatch* will help focus attention and resources on the places that are most in need. Better-informed staff, decisionmakers, stakeholders, and community members can work together to effectively advance the cause of resilience.

The scorecard can also be used to help your community monitor its progress in advancing resilience. By periodically reevaluating your network of plans and comparing your scorecard results to those achieved previously, you can confirm that you are on the right track—or discover that you are heading in the wrong direction and work to change course. In a similar way, you might evaluate your community's regulations and/or implementation in reference to your scorecard results.

The Plan Integration for Resilience Scorecard is a tool designed to help communities confront the pervasive threat of natural hazards. Offering a new perspective on the integration of networks of plans and the influence of policies on vulnerability, it can be used to more effectively guide efforts toward advancing resilience.

CHAPTER 5

STORIES

Here we tell the plan integration for resilience story of two communities' network of plans, League City, TX and Fort Lauderdale, FL. Both communities face development pressures and have successfully integrated promising strategies to reduce vulnerabilities. The first community (League City) has far better strategies for undeveloped areas, while the second community (Fort Lauderdale) has innovative strategies in already developed areas. Learn from their plan integration stories to better incorporate the lessons learned into your own community. Identifying strategies within other communities will prepare you to change your own community's plan integration for resilience story

Checklist:

- Identify promising strategies for undeveloped areas
- Identify promising strategies for developed and built-out areas

OBJECTIVES:

- Learn from other communities' network of plans
- Identify strategies for undeveloped and developed areas
- Consider ways to incorporate lessons into your own community

SKILLS RECOMMENDED:

- Familiarity with the Plan Integration for Resilience Scorecard
- Understanding of policies tools

Strategies for Undeveloped Areas: League City, Texas

To begin, let's start with low hanging fruit or policy changes that effect undeveloped areas. League City, Texas is a fairly young community with large amounts of undeveloped land slated to grow considerably in the coming decades. Communities like League City have the potential to change the course of history and guide development to less vulnerable areas or build in such a way to reduce vulnerabilities. Carefully read through the case study and identify strategies that may be applicable to areas in your community that are undeveloped or expected to grow.

Plans Evaluated:

- League City Comprehensive Plan 2035—June 2013
- City of League City Local Mitigation Plan, 2010
- 5-Year Strategic Plan for League City, Texas
- City of League City, Texas Parks & Open Space Master Plan – November 2006

League City, TX is a bedroom suburb of Houston located in low-lying coastal region facing significant flooding and hurricane hazards. The city has experienced four major flood events since 2000 that were designated as Presidential Disaster Declarations and thus eligible for federal recovery funds. Additionally, the city is rapidly growing with a population increase from 83,500 in 2010 to a projected 228,000 in 2040 (League City 2013). Current land use patterns are dominated by conventional development characterized by low-to-moderate density suburban residential neighborhoods, commercial strip corridors and retail centers. About 4,730 acres (15% of the city's total land area) is in the 100-year floodplain mostly due to the Clear Creek riparian area that runs east to west through League City. Of the floodplain lands, only 496 acres are designated as permanent open space (public parkland and conservation areas), while only 496 acres of floodplain lands designated as permanent open space (public parkland and conservation areas), and the remaining 4,234 acres of floodplain lands are privately owned. There is considerable potential for increased floodplain development as about 57% of the privately-owned floodplain land is undeveloped. Past floodplain development has fragmented aquatic systems and filled in wetlands along major coastal creeks and lake shorelines, which offer critical flood hazard mitigation functions.

"the Comprehensive Plan embraces the intentions and recommendations of other plans and serves as a bridge tying the solutions of other plans [to achieve]…the desired character and development patterns in the community"

(League City 2011, p. 4).

Table 5.1: Hazard Exposure in League City, Texas

	% Land Area in Hazard Zone		% Population in Hazard Zone		Mean Parcel Value	
	100-yr*	2100 SLR**	100-yr	2100 SLR	100-yr	2100 SLR
League City (TX)	8.1 sq.mi (15.4%)	19.5 sq.mi (37.0%)	8,488 (9.9%)	41,811 (49.0%)	$2.65/sqft (10.7%)	$4.75/sqft (43.1%)

*: 100-year floodplain

**: Estimated sea level rise change in 2100 (Excludes 100-year floodplain); League City: 6.29 ft

Overview of Network of Plans

League City's network of four plans (comprehensive, hazard mitigation, parks, and capital improvements) is highly integrated and supports a common policy framework aimed at hazard vulnerability reduction. The introduction of the comprehensive plan reflects the city's strong commitment to plan integration by indicating that, All plans include similar hazard goals involving protection of people and structures through sound development and/or environmental practices that support flood mitigation. The comprehensive plan, mitigation plan, and parks plan contain the city's future land use map to guide future new development and redevelopment.

The following sections dive deeper in two planning districts. The first district (Challenger Seven Memorial Park district or District 7), has innovative policies to reduce vulnerabilities, but they are within a low vulnerability area. The second district (W Main St. district or District 10), reveals far less innovation of policies in areas that are most vulnerable to hazards.

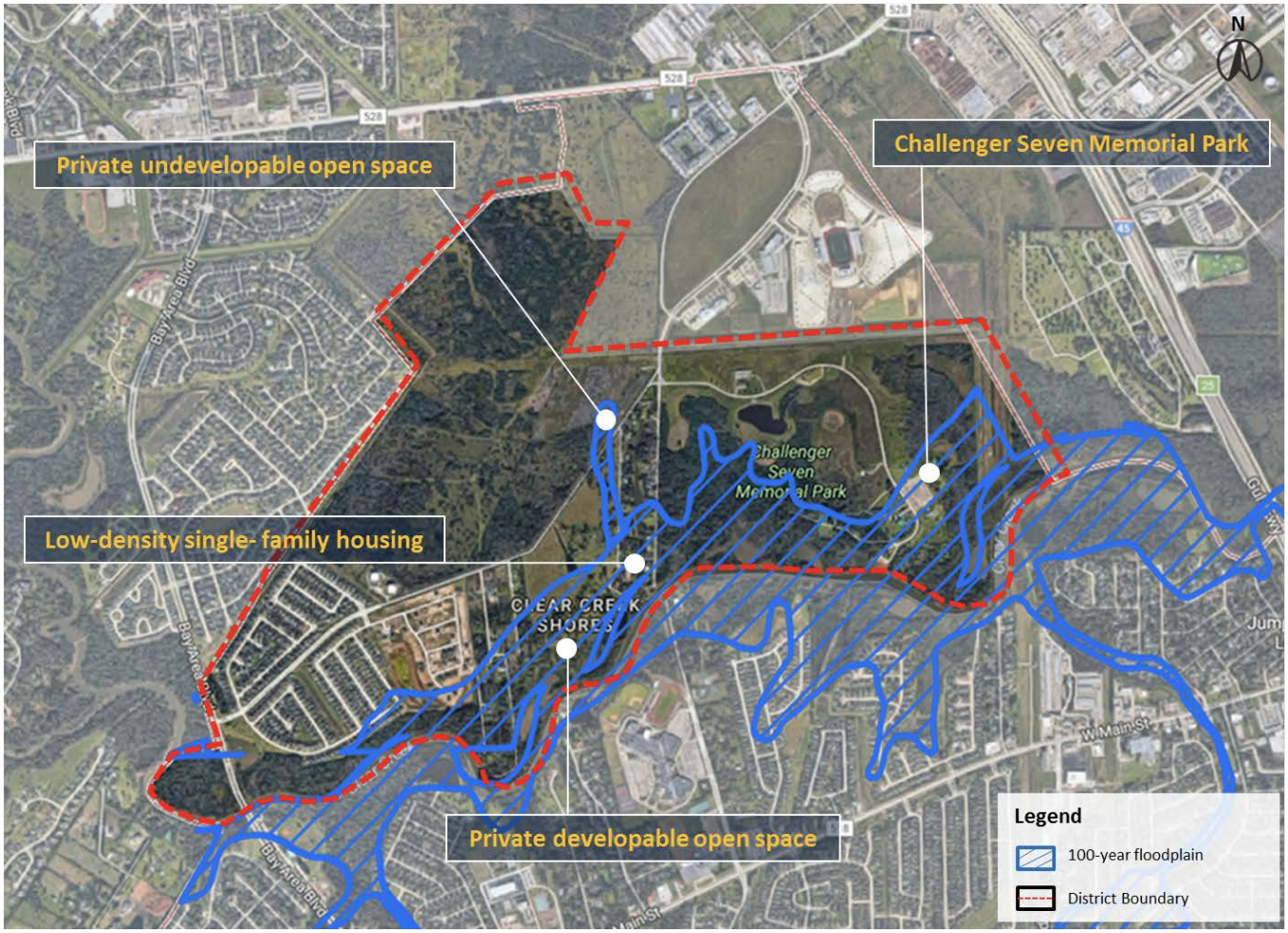


Figure 5.1: District 7, League City, Texas

Innovative Policies in Low-vulnerability Areas

The Challenger Seven Memorial Park District (or District 7; see Figure 5.1) exemplifies how the city's network of plans prioritizes vulnerability reduction in districts that are less developed. The plan integration score has the fifth highest score in reducing physical vulnerability (+37), but the third lowest in physical vulnerability among the city's 21 districts. About 22% (197 acres) of the district is located in the 100-year floodplain. Of the current floodplain land uses,

- 55% (110 acres) is designated as park,
- 31% (60 acres) as private developable open space, and
- 14% (27 acres) as low-density single-family housing (see Figure 5.1). [23]

Among the four plans, only the comprehensive plan includes policies that support more development in the floodplain in this district. These include zoning policies that allow "granny flats" in existing single-family homes and designate privately owned open spaces for low-density development. However, the plans place more attention on avoidance of future development in the floodplain, especially in the Clear Creek riparian area that runs along the southern boundary of the district (see Figure 5.1).

Several prominent themes of policies work together to reduce new floodplain development vulnerabilities:

Land use regulations aimed at reducing vulnerability in undeveloped floodplains:

- The comprehensive plan proposes new floodplain development with buffer regulations to enhance preservation of floodplain riparian lands.
- The comprehensive plan proposes subdivision regulations that require clustering and open space dedication standards for setting aside natural areas that include floodplains.
- The implementation elements of the hazard mitigation plan and parks plan explicitly indicate that the city revise ordinances to be consistent with the proposed changes in the comprehensive plan.

Public spending for land acquisition in proposed conservation areas in undeveloped floodplains:

- The comprehensive plan, parks plan, and hazard mitigation plan all specify that land acquisition funds be used to target riparian areas and wetlands that serve to mitigate flood impacts, provide recreation and water conservation benefits, as well as create trails that link open spaces.

Public facility investments aimed at reducing impacts of flooding:

- The comprehensive plan and parks plan support investment in stormwater management facilities (e.g., rain gardens and swales) in parks to provide flood mitigation and other environmental benefits to surrounding neighborhoods.
- The parks plan and hazard mitigation plan propose a string of flood detention lakes connected by trails for a regional drainage corridor.
- The mitigation plan prohibits construction of government buildings and special needs facilities (medical facilities, nursing homes) in floodplains.

Development limits are tied to evacuation times for new developments:

- The hazard mitigation plan and comprehensive plan support setting density limit standards due to the impacts of new development on evacuation times along emergency routes.

Little Attention to High-vulnerability Areas

The W. Main St. District (or District 10; see Figure 5.2) offers of an example of how the network of plans gives far less attention to reducing vulnerability in districts that are physically vulnerable. The district has the fourth lowest policy score (+12), but has the sixth highest of physical vulnerability among 21

23 GIS Datasets by Houston-Galveston Area Council http://www.h-gac.com/rds/gis-data/gis-datasets.aspx

districts in the city. About 46% (100 acres) of the district is located in the 100-year floodplain, with limited opportunity for new development. Roughly,

- 71% (71 acres) of the floodplain land is used as low-density single-family housing,
- 5% (5 acres) in commercial use
- 2% (2 acres) as park land (see Figure – annotated google map).
- The remaining floodplain land use includes private undevelopable open space (22%, 22 acres), but none of the private open space land is developable.

Policies in the comprehensive plan support increased development in the 100-year floodplain in this district, including zoning policies that support infill development by allowing a "granny flat" into any existing single family home, and de-

Figure 5.2: District 10, League City, Texas

sign guidelines that support infill on large lots currently occupied by a residential unit that can be subdivided. W. Main St. district (District 10) does not include a high priority conservation district like Clear Creek riparian areas. As a result, many of the conservation protection policies that are relevant to the Challenger Seven Memorial Park district (District 7) are not applicable in District 10. Despite this, **a few policies deal with reducing vulnerability to existing development:**

- Public facility investment policies aimed at reducing impacts from flooding appear in comprehensive plan, hazard mitigation plan, and parks plan. Examples include best practices for stormwater mitigation (e.g., pervious pavement for parking lots, detention ponds, rain gardens, and vegetative swales), and purchase of drainage easements in the floodplain.
- Affordable housing includes a stormwater drainage infrastructure policy aimed at an existing underserved, low-income neighborhood in floodplain areas, but this policy is not coordinated with other plans.
- The hazard mitigation plan includes a land acquisition program for repetitive flood loss properties in existing neighborhoods, but the targeting of properties is not coordinated with the future land use policies in the comprehensive plan or other local plans.

Strategies for Built-out Areas: Fort Lauderdale, Florida

Many communities already fully-developed or built-out and exposed to hazards may fear there are limited options to reduce vulnerability. Here, we focus on Fort Lauderdale, Florida, one of the most vulnerable cities in the United States. Carefully read through the case study and identify strategies that may be applicable to areas in your

Table 5.2: Hazard Exposure in Fort Lauderdale, Florida

	% Land Area in Hazard Zone		% Population in Hazard Zone		Mean Parcel Value	
	100-yr*	2100 SLR**	100-yr	2100 SLR	100-yr	2100 SLR
Fort Lauderdale (FL)	16.9 sq.mi (46.9%)	15.8 sq.mi (43.9%)	66,514 (40.0%)	84,981 (51.1%)	$22.0/sq.ft (44.9%)	$22.0/sq.ft (48.3%)

*: 100-year floodplain

**: Estimated sea level rise change in 2100 (Excludes 100-year floodplain); League City: 6.29 ft

community that are already developed.

Fort Lauderdale is the largest city in Broward County, Florida. Located along the state's southeastern coast and nicknamed the "Venice of America" due to its many canals, the city offers 337 miles of coastline. It is a principle city of the Miami metropolitan area, which is home to 5,564,635 people (2010 U.S. Census Bureau) and is considered one of the world's most vulnerable urban areas with respect to climate change and hazard events. Fort Lauderdale faces significant flooding, thunderstorm, tornado, and hurricane hazards (Broward County 2012). The city is almost entirely built out, with only four percent remains vacant (City of Fort Lauderdale 2008). As a high-amenity location, however, much potential exists for redevelopment—including in the 100-year floodplain, which encompasses approximately 44% of the city. Land use in Fort Lauderdale is a mix of:

- 55% residential (41%),
- utility (34%),
- commercial (12%),
- industrial (6%), and
- institutional (3%) uses.

Overview of Network of Plans

The city of Fort Lauderdale's network of eight plans (city comprehensive plan; local mitigation strategy; county comprehensive plan; city consolidated plan; downtown master plan; downtown new river master plan; Davie Boulevard corridor plan; South Andrews Avenue plan) is well-integrated and generally reduces vulnerability to hazards. The Coastal Management Element of the city's comprehensive plan essentially satisfies the requirements of Chapter 163, Florida Statutes that

"local coastal governments plan for [and] restrict development where development would damage or destroy coastal resources and protect human life and limit public expenditures in areas that are subject to destruction by natural disaster"(Fort Lauderdale 2008, p. 4-1).

The county's hazard mitigation plan places high priority on mitigating floodplain development in highly vulnerable areas. Throughout the city's network of plans, however, much attention is paid to development or redevelopment of areas that are of regional significance, known as Regional Activity Centers (RACs).

The following sections dive deeper into one best practice planning district. The district (Lauderdale Beach/Dolphin Isles or District 27), is almost entirely developed and highly vulnerable, yet the city has managed to fully integrate plans and pursue innovative policies to reduce vulnerabilities.

Plans Evaluated:

- 2008 Fort Lauderdale Comprehensive Plan
- 2012 Enhanced Local Mitigation Strategy for Broward County
- 2014 Broward County Comprehensive Plan
- The City of Fort Lauderdale 2010–2015 Consolidated Plan
- 2007 Downtown Master Plan
- 2008 Downtown New River Master Plan
- 2007 Davie Boulevard Corridor Master Plan
- 2004 South Andrews Avenue Master Plan

Lauderdale Beach/Dolphin Isles serves as a best practice example because Fort Lauderdale's network of plans gives much more attention to reducing vulnerability than to increasing development in this highly physically vulnerable district.

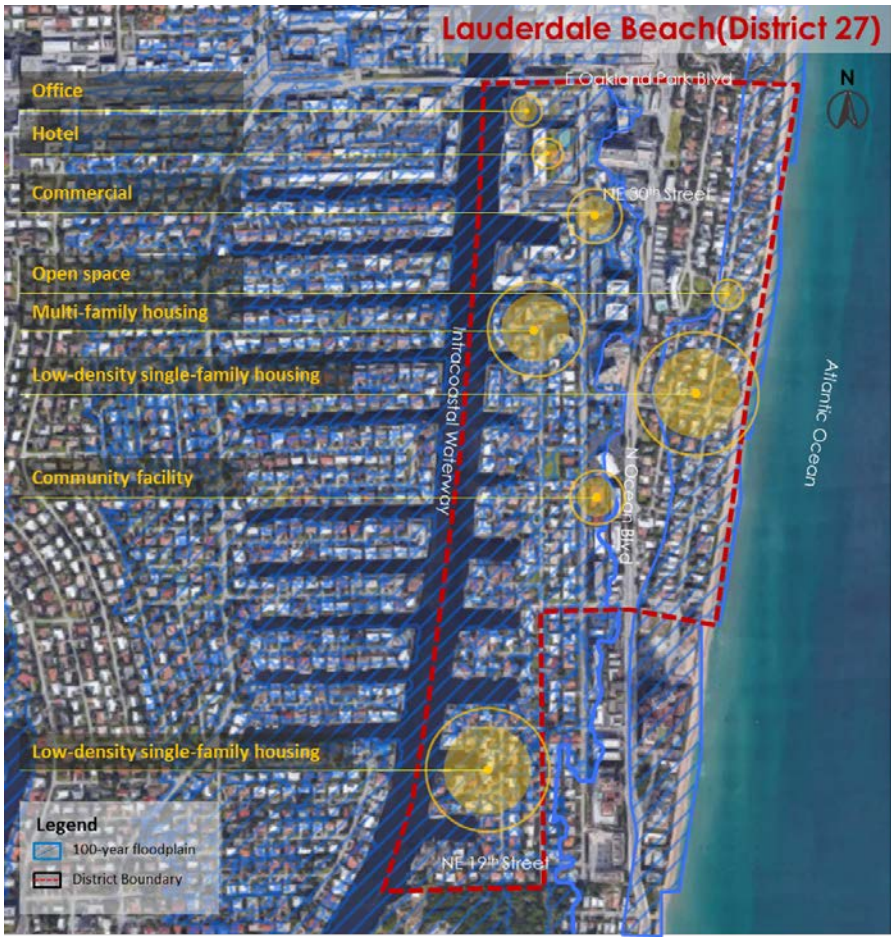


Figure 5.3: Satellite view of the Lauderdale Beach/Dolphin Isles neighborhood (District 27) in Fort Lauderdale, FL, with 100-year floodplain extent (blue hatch)

High Vulnerability and High Score

The Lauderdale Beach/Dolphin Isles district (or District 27; *Figure 5.3*) is a largely residential neighborhood located between the Intracoastal Waterway and the Atlantic Ocean in eastern Fort Lauderdale. It is entirely within the state-designated Coastal High Hazard Area (CHHA; City of Fort Lauderdale 2008), an overlay zone. It ranks in the top ten of Fort Lauderdale's districts in physical vulnerability and is among the highest overall in terms of policy score (+45), ranking 3rd out of 111 districts. As *Figure 5.3* shows, about 61.7 % (99 acres) of the district is located in the 100-year floodplain. Within this hazard zone, land uses are:

- low-density single-family housing (58%, 58 acres),
- multi-family housing (25%, 25 acres),
- community facility (5.4%, 5 acres),
- hotel (0.3%, 0.3 acres),
- commercial (4.9%, 5 acres),
- office (1%, 1 acre), and
- open space (0.3%, 0.3 acres).

Fifty-three polices across three plans (city comprehensive plan; county local mitigation strategy; county comprehensive plan) affect Lauderdale Beach/Dolphin Isles. Only four polices are likely to increase vulnerability by promoting redevelopment and reuse, all four of which are located in the city comprehensive plan. Three are linked to development regulations and one is tied to post-disaster reconstruction decisions.

All three of Fort Lauderdale's plans focus more on vulnerability reduction. **Several prominent themes of policies work together to reduce existing vulnerability and to prevent vulnerability due to future development or redevelopment in Lauderdale Beach/Dolphin Isles:**

Development regulations aimed at protecting coastal and hazard-prone areas:

- Policies throughout the city and county comprehensive plans encourage protection and conservation of existing natural beaches or berm areas, wetlands, and other types of open space in coastal and hazard-prone areas.
- Policies propose to regulate inappropriate development and limit land use densities and intensities within the CHHA overlay zone in sensitive areas such as floodplains (short-term focus on the 100-year floodplain and long-term focus on the 500-year floodplain).
- Enforcement and monitoring are also encouraged with respect to compliance with the regulations of the Florida Department of Environmental Protection's Coastal Construction Control Line (CCCL), a statewide program to protect the state's beaches and dunes.
- Several polices suggest an inventory of hazard-prone properties throughout the city, which may result in the implementation of development regulations, such as setback provisions and other site controls, to reduce future property damages and losses.

Land acquisition and land use guidelines aimed at reducing vulnerability for new development and redevelopment in coastal and hazard prone-areas:

- Fort Lauderdale's comprehensive plan contains policies suggesting that undeveloped land in the CHHA overlay zone should be considered for acquisition as recreation, open space, or restoration to its natural state.
- All new construction along the beachfront should be consistent with design guidelines and criteria established during the designation of the CCCL.
- The impacts of development or redevelopment are to be limited with respect to wetlands, water quality and quantity, wildlife habitat, living marine resources, and beach dune system. Similarly, drainage and stormwater management in new developments should follow designated standards to mitigate future impacts.

Directing capital funding related to coastal and hazard-prone areas:

- Policies in Broward County's comprehensive plan and the hazard mitigation plan direct public expenditures to improve public infrastructure in the CHHA overlay zone, including existing wellfields, surface or subsurface storage facilities, control structures, water and wastewater treatment plants, and transmission infrastructure.
- Several policies in the county's comprehensive plan propose that capital improvement funds focus on projects which restore the dune system and enhance natural resources, such as beach nourishment.
- Policies in the hazard mitigation plan require that hazard mitigation considerations link to the capital improvement funding process.

Strategies to Further Increase Plan Integration and Resilience

Like much of Fort Lauderdale, the Lauderdale Beach/Dolphin Isles neighborhood (or District 27) is almost fully built out and much of it is in the 100-year floodplain. Options are therefore limited with respect to reducing future physical vulnerability. Rather than directing new development to less hazardous areas, which is a good option for cities that have yet to reach build-out and/or have substantial lands outside the hazard zone, the Lauderdale Beach/Dolphin Isles district (and Fort Lauderdale as a whole) must build resilience and plan integration through measures that can be applied in situ. T**he themes described above may be complemented through several additions:**

- In addition to requiring new development in the CHHA overlay zone to meet certain criteria, Fort Lauderdale's network of plans could focus on elevation requirements for existing structures, directing grants and funding to preventative elevation of single-family and multi-family structures above current flood safety standards.
- To enhance the land acquisition strategy in Fort Lauderdale's comprehensive plan, density transfer or transfer-of-development programs could be encouraged that include hazard-prone coastal neighborhoods like Lauderdale Beach/Dolphin Isles.
- In addition to protecting the coastal ecology through conservation, overlay regulations, and beach nourishment, vulnerability could be reduced by directing capital funds to more holistic vegetation-based approaches, such as encouraging reforestation and vegetated dunes on the seaward side and mangrove areas in the canals.

GLOSSARY

Term	Definition	Source
100-year Floodplain	Land area predicted to flood during a 100-year storm event, which by definition has a 1 % chance of occurring in a given year.	http://www.fema.gov
2010 Sea Level Rise	The new 100-year floodplain in 2100 due to sea level rise	http://www.fema.gov
Acquire Land & Property	Purchase land/property in hazard area	North Carolina Division of Emergency Management, 1998
Built Environment	The built environment is a material, spatial and cultural product of human labor that combines physical elements and energy in forms for living, working and playing. It has been defined as "the humanitarian-made space in which people live, work, and recreate on a day-to-day basis.	Roof, K; Oleru N. (2008). "Public Health: Seattle and King County's Push for the Built Environment.". J Environ Health 71: 24–27.
Capital Improvement Programming (CIP)	Capital improvements programs are timetables that define when, where, and what level of municipal services a government will supply. Typically a part of the comprehensive plan, the CIP sets public spending on improvements for the ensuing five to ten years. Timetables can be effective at managing growth because it is rarely feasible for a developer to provide water, sewer and other services without a public subsidy.	North Carolina Division of Emergency Management, 1998
Central Business District	The commercial and business center of a city. In larger cities, it is often synonymous with the city's "financial district"	www. scalloway.org.uk
Cluster Development	Provision requiring clustering of development away from hazardous areas, such as through conservation subdivisions	North Carolina Division of Emergency Management, 1998
Coastal High-hazard Areas	An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. The coastal high hazard area is identified as Zone V on Flood Insurance Rate Maps (FIRMs). Special floodplain management requirements apply in V Zones including the requirement that all buildings be elevated on piles or columns.	http://www.fema.gov

Comprehensive Plan	Comprehensive plans identify how a community should be developed and where development should not occur. They govern the rate, intensity, form and quality of physical development. A thorough comprehensive plan will also address economic development, environmental, social and hazard mitigation concerns.	North Carolina Division of Emergency Management, 1998
Density Bonuses	Density bonuses such as ability to develop with greater density in return for dedication or donation of land in areas subject to hazards	North Carolina Division of Emergency Management, 1998
Density of Land Use	Provision regulating density (e.g. units per acre); may be tied to zoning code	North Carolina Division of Emergency Management, 1998
Design/ Construction Guidelines/ Requirements	Guidelines or requirements that apply to the design or construction of developments in hazard areas	North Carolina Division of Emergency Management, 1998
Development Moratorium	Provision imposing a moratorium on development for a set period of time after a hazard event to allow for consideration of land use change	North Carolina Division of Emergency Management, 1998
Disaster Mitigation Act of 2000 (DMA)	The Disaster Mitigation Act of 2000 (DMA) requires all local governments to adopt hazard mitigation plans approved by FEMA to be eligible for federal pre and post-disaster mitigation funds. For the first time, federal policy shifted to a more proactive approach- hazard mitigation planning.	North Carolina Division of Emergency Management, 1998
Drainage Improvements or Flood Control	Provision that pertains to drainage or flooding issues within the community	North Carolina Division of Emergency Management, 1998
Ecosystem Enhancement	Provision that seeks to improve or preserve the functioning of the natural environment within the community	North Carolina Division of Emergency Management, 1998
EDA	U.S. Economic Development Administration	https://www.eda.gov
Elevating	Provision pertaining to the physical elevation of structures in hazard zones	North Carolina Division of Emergency Management, 1998
Emergency Management	The creation of plans through which communities reduce vulnerability to hazards and cope with disasters.	"Maine Emergency Management Agency" (2007). "What is Emergency Management?" Drabek, Thomas (1991). Emergency Management: Principles and Practice for Local Government. Washington, D.C.: International City Management Association. pp. xvii.

EPA	U.S. Environmental Protection Agency	https://www3.epa.gov
FEMA	Federal Emergency Management Agency	http://www.fema.gov
Floodplain Management	Floodplain management addresses the hazard risk of communities partially or entirely located in a floodplain. The term also refers to the application of structural mitigation measures and codes to existing or proposed buildings in the floodplain.	North Carolina Division of Emergency Management, 1998
Functional Plan	The planning that is made to ensure smooth working of the organization taking into account of the needs of each and every department.	http://www.yourarticlelibrary.com/planning/planning-types-corporate-operational-functional-and-proactive-planning/25637/
Future Land Use Plan	Urban planning encompassing various disciplines which seek to order and regulate land use in an efficient and ethical way, thus preventing land-use conflicts. Governments use land-use planning to manage the development of land within their jurisdictions.	Young, A., 2003
Hazard Exposure	Hazard exposure is a state of being in which a person or a group of people remain in an imminent risk of danger. Such dangers are related to the workplace health safety and environment or day to day life.	https://www.safeopedia.com/definition/681/hazard-exposure-safety
Hazard Mitigation Plan	Hazard mitigation is the practice of reducing risks to people and property from natural disasters. A hazard mitigation plan specifies actions a community will take to reduce its vulnerability to natural hazards or to minimize the impact of a hazard event.	North Carolina Division of Emergency Management, 1998
Hazard Zones	In the guide book, hazard zones equal to flood zones. Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.	http://www.fema.gov
Historic District	A historic district is a group of buildings, properties, or sites that have been designated by one of several entities on different levels as historically or architecturally significant. Buildings, structures, objects and sites within a historic district are normally divided into two categories, contributing and non-contributing.	"History of Local Historic Districts". Establishing Local Historic Districts. Massachusetts Historical Commission.

HUD	U.S. Department of Housing and Urban Development	http://portal.hud.gov/hudportal/HUD
Impact / Special Study /Protection Fees	Provision requiring impact fees, special study fees, or protection fees for development in hazardous areas; fees could cover costs of structural protection	North Carolina Division of Emergency Management, 1998
Infrastructure	Infrastructure refers to structures, systems, and facilities serving a country, city, or area, including the services and facilities necessary for its economy to function. It typically characterizes technical structures such as roads, bridges, tunnels, water supply, sewers, electrical grids, telecommunications, and so forth, and can be defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions.	Sullivan, Arthur; Steven M. Sheffrin (2003). Economics: Principles in action. Upper Saddle River, New Jersey 07458: Pearson Prentice Hall. p. 474. ISBN 0-13-063085-3. Fulmer, Jeffrey (2009). "What in the world is infrastructure?". PEI Infrastructure Investor (July/August): 30–32.
Infrastructure "Hardening" or Weatherproofing	Provision encouraging or requiring development in hazard zones to increase structural resilience to hazards	North Carolina Division of Emergency Management, 1998
Land Suitability	Hazards are one of the criteria used in analyzing and determining the suitability of land for development	North Carolina Division of Emergency Management, 1998
Mappable Areas	An area in the community that can be mapped or is place-specific. Such areas can include, existing neighborhoods, existing commercial centers, natural areas, floodplain, native habitats, wetlands, primary conservation area, secondary conservation area, structures that frequently flood, and existing community facilities. Area/place: neighborhood, park; line: river, bike path, road; Point: critical infrastructure (school, fire department).	
National Research Council (NRC)	The National Research Council (NRC) is a private, nonprofit institution in the United States founded in 1916, which produces reports that shape policies, inform public opinion, and advance the pursuit of science, engineering, and medicine.	"ARTICLES OF ORGANIZATION OF THE NATIONAL RESEARCH COUNCIL Approved June 15, 2007". National Research Council. Retrieved 22 March 2014.
NIST	National Institute of Standards and Technology	http://www.nist.gov
Open Space or Easement Requirement/ Purchase	Provision encouraging open space purchase by the community or open space easements as an element of development approval	North Carolina Division of Emergency Management, 1998

Permitted Land Use	Provision regulating the types of land use (e.g. residential, commercial, industrial, open space, etc.) permitted in areas of community; may be tied to zoning code	North Carolina Division of Emergency Management, 1998
Physical Vulnerability	Physical Vulnerability is determined by aspects such as population density levels, remoteness of a settlement, the site, design and materials used for critical infrastructure and for housing (UNISDR).	http://www.odpm.gov.tt/node/162
Place-specific term	An area in the community that can be mapped or is place-specific. Such areas can include, existing neighborhoods, existing commercial centers, natural areas, floodplain, native habitats, wetlands, primary conservation area, secondary conservation area, structures that frequently flood, and existing community facilities. Area/place: neighborhood, park; line: river, bike path, road; Point: critical infrastructure (school, fire department).	
Post-Disaster Capital Improvements	Provision related to adjusting capital improvements to public facilities following a hazard event	North Carolina Division of Emergency Management, 1998
Post-Disaster Land Use Change	Provision related to changing land use regulations following a hazard event; may include redefining allowable land uses after a hazard event	North Carolina Division of Emergency Management, 1998
Public facility siting	Provision to site public facilities, including municipal buildings and public housing, out of hazard areas	North Carolina Division of Emergency Management, 1998
Public facility sizing/capacity	Provision limiting capacity of public facilities, including public housing, in hazard areas to cap amount of development	North Carolina Division of Emergency Management, 1998
Resilience	the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events)	National Academies, 2012, p.1
RPC/EDD	Employment Development Department	
Setbacks or Buffer Zones	Provision requiring setbacks or buffers around hazardous areas (e.g. riparian buffers and ocean setbacks)	North Carolina Division of Emergency Management, 1998
Site Review	Provision requiring addressing hazard mitigation in process of reviewing site proposals for development	North Carolina Division of Emergency Management, 1998

Slope/Dune Stabilization	Provision that pertains specifically to stabilization of slopes or dunes or seeks to control erosion	North Carolina Division of Emergency Management, 1998
Small Area Plans	Small-area plans apply to a range of situations and therefore come in a variety of forms. Some focus on redevelopment within built-up parts of the planning jurisdiction. Others apply to new urban and suburban development on the urban fringe. Still others address not development, but the protection of natural resources form development. Some are part of a whole constellation of similar small-area plans, more or less covering the planning jurisdiction in a systematic manner, following unified guidelines on content and process. Others are single shot attempts to address issues in special areas in a more or less opportunistic manner. The more common types of plans include the following: district or sector plan, transportation corridor plan, neighborhood plan, business center revitalization plan, redevelopment area plan, transit station area plan, historic or appearance district plan, facilities complex plan, natural resource area plan, specific development plan.	Berke et al (2006). Urban land use planning 5th ed, Urbana: University of Illinois Press, ISBN:0252030796.
Social Vulnerability	Social vulnerability has been defined in terms of people's "capacity to anticipate, cope with, resist and recover from the impacts of a natural hazard". Social Vulnerability refers to the inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well-being of individuals, communities and society. It includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organizational systems (UNISDR).	Wisner, Blakie, Canon & Davis, 2004, p. 11 http://www.odpm.gov.tt/node/162

Subdivision Ordinance	Local municipal ordinances specifying the conditions under which a tract of land can be subdivided. The ordinances may include layout and construction, street lighting and signs, sidewalks, sewage and storm water systems, water supply systems, and dedication of land for schools, parks, etc.	http://www.dictionaryofconstruction.com/definition/subdivision-regulations.html
Subdivision Regulations	Provision controlling the subdivision of parcels into developable units and governing the design of new development (e.g. site storm water management)	North Carolina Division of Emergency Management, 1998
Tax Abatement	Tax breaks offered to property owners and developers who use mitigation methods for new development	North Carolina Division of Emergency Management, 1998
Transfer/Purchase of Development Rights	Provision for transferring development rights to control density; may be transfer of development rights or purchase of development rights	North Carolina Division of Emergency Management, 1998
US Census Block Groups	Block Groups (BGs) are statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people, and are used to present data and control block numbering. A block group consists of clusters of blocks within the same census tract that have the same first digit of their four-digit census block number. Most BGs were delineated by local participants in the Census Bureau's Participant Statistical Areas Program. The Census Bureau delineated BGs only where a local or tribal government declined to participate, and a regional organization or State Data Center was not available to participate.	https://www.census.gov/geo/reference/gtc/gtc_bg.html
USACE	United States Army Corps of Engineers	http://www.usace.army.mil
USDA	U.S. Department of Agriculture	http://www.usda.gov/wps/portal/usda/usdahome
Vulnerability (disaster)	The degree to which a person, system or unit is likely to experience harm due to exposure to perturbations or stresses. Vulnerability describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors.	Kasperson, et al. (2002) http://www.odpm.gov.tt/node/162

Zoning Ordinance	Written regulations and laws that define how property in specific geographic zones can be used. Zoning ordinances specify whether zones can be used for residential or commercial purposes, and may also regulate lot size, placement, bulk (or density) and the height of structures. Zoning ordinances are lengthy documents describing not only the acceptable use for specified areas of land, but also the procedures for handling infractions (including any penalties), granting variances and hearing appeals.	http://www.investopedia.com/terms/z/zoning-ordinance.
Zoning Overlays	Provision to use zoning overlays that restrict permitted land use/density in hazardous areas; may be special hazard zones or sensitive open space protection zones	North Carolina Division of Emergency Management, 1998

APPENDIX

APPENDIX A

Other Resilience Indicators and Scorecards

Measure name	Type
ASPIRE (World Bank 2015)	Tool
BRIC (Cutter et al. 2010, 2014)	Index
CART (Pfefferbaum et al. 2011, 2013)	Tool
CCRAM (Cohen et al. 2013)	Tool
CDRI (Peacock et al. 2010)	Index
Coastal Resilience Index (Sempier et al. 2010)	Score-card
CoBRA (UNDP 2014)	Tool
Community Resilient System (CARRI 2013; White et al. 2015)	Tool
Community Resilience Index (Sherrieb et al. 2010)	Index
CREAT (USEPA 2015)	Tool
DFID Resilience (Twigg 2009)	Tool
FAO Livelihoods (Alinovi et al. 2010)	Index
Financial System Resilience (Berry et al. 2015)	Index
FM Global Resilience (Oxford Metrica 2015)	Index
NIST (NIST 2015)	Tool
Oxfam GB (Hughes and Bushell 2013)	Index
PEOPLES (Renschler et al. 2010)	Tool
RCI (Pendall et al. 2010)	Index
ResilUS (miles and Chang 2011)	Tool
RMI (Fisher et al. 2010; Petit et al. 2013)	Index/tool
Rockefeller 100 resilient cities (ARUP and Rockefeller 2014	Tool
RRI (Cox and Hamlen 2015)	Index
SPUR (San Francisco Planning 2009)	Score-card
Surging Seas (Climate Central 2015)	Tool
TNC Coastal Resilience (TNC 2015)	Tool
UNISDR Resilient Cities (UNISDR 2013, 2015a, b)	Tool
USAID Resilience (USAID 2013)	Tool

Adapted from Cutter 2016

Cutter, Susan. 2016. The landscape of disaster resilience indicators in the USA. Natural Hazards. 80: 741-758.

APPENDIX B

Aligning with Other Initiatives

Consolidated Housing Plan (CHP) and Annual Action Plans (AAP)- Data- and dialogue-driven assessment of community affordable housing and development needs; aligns and focuses funding from multiple federal block grant programs (e.g. CDBG); carried out through Annual Action Plans and monitored via annual performance reports

Align: Align resilience strategies with housing and poverty prevention strategies to expand housing stability; High-vulnerability areas are mapped, may overlap with hazard zones; policies and action steps sometimes contain place-specific terms (which allow us to map their influence); policies/actions might be amended to reduce flood exposure of vulnerable population

Agency: Department of Housing and Urban Development (HUD), http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/about/conplan

Hazard Mitigation Plan [Preparedness Grants, Hazard Mitigation Grant Program, Pre-disaster Mitigation Grants, Flood Mitigation Assistance]- State, tribal, and local governments identify risks, vulnerabilities, or natural disasters and develop long-term strategies to protect people and property as a condition for receiving types of non-emergency disaster assistance

Align: Community risk assessment often includes maps and descriptions of areas affected by hazards; mitigation actions are included, many of which contain place-specific terms; aligning hazard mitigation with other community goals is rarely considered

Agency: Federal Emergency Management Agency (FEMA), within the Department of Homeland Security (DHS), https://www.fema.gov/hazard-mitigation-planning-process

Community Rating System (CRS)- a program which provides up to 45% reduction of flood insurance premiums for policyholders when communities invest and plan for flood mitigation and other floodplain management activities.

Align: Communities can enhance their CRS score within Activity 510, Floodplain Management Planning by using the Plan Integration for Resilience Scorecard, which reveals and supports tasks within the activity.

Agency: National Flood Insurance Program (NFIP) within the Federal Emergency Management Agency (FEMA), https://www.fema.gov/national-flood-insurance-program

Community Resilience Planning Guide- The NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems (Guide) provides a practical and flexible approach to help all communities improve their resilience by setting priorities and allocating resources to manage risks for their prevailing hazards.

Align: Communities can first conduct the Plan Integration for Resilience Scorecard to understand plan consistencies as a direct input into the Community Resilience Planning Guide, which is a part of step one.

Agency: National Institute for Science and Technology (NIST), https://www.nist.gov/topics/community-resilience/community-resilience-planning-guide

Habitat Management Plan (HMP) and Annual Habitat Work Plans (AHWP)- Wildlife-Refuge-scale documents that guide analysis, management, and decision-making according to a long-term vision, emphasizing continuity and consistency; plans stress the role of refuge habitat in international, national, regional, tribal, State, ecosystem, and refuge goals and objectives

Align: National Wildlife Refuge System lands that exist in communities or in their extra-territorial jurisdiction (ETJ) may be within or may affect hazard zones; their management therefore impacts vulnerability; opportunities to preserve or expand such areas would likely have benefits for hazard mitigation and preventing increased exposure of people and infrastructure

Agency: United States Fish and Wildlife Service (USFWS), within

the Department of the Interior (DOI), https://www.fws.gov/policy/620fw1.html

State Wildlife Action Plans (SWAP), aka Comprehensive Wildlife Conservation Strategies [Wildlife Conservation and Restoration Program (WCRP) funds; State and Tribal Wildlife Grants (SWG) program]-States are required to develop a strategic plan for wildlife and habitat conservation to be eligible for funds

Align: Overlap between wildlife areas and hazard zones in communities; planners and decision makers can partner on projects of mutual interest[1]

Agency: Congress by the Conservation and Reinvestment Act of 2000, "http://teaming.com/state-wildlife-action-plans-swaps, http://teaming.com/swap-overview"

Coastal Zone Management Program (CZMP) [Coastal Zone Enhancement Program; Coastal Nonpoint Pollution Control Program]- Voluntary partnership between federal government and coastal states; tasked with helping to responsibly manage coastal communities; issues addressed include coastal development, water quality, public access, habitat protection, energy facility siting, ocean governance and planning, coastal hazards, and climate change; federal funding matched with state and local funding

Align: Coastal flood risk and resilience are key aspects of the CZMP, and related studies and actions are frequent recipients of funding from the program; the PIRS method may improve targeting of such funds to the most vulnerable areas (and may further justify expenditures)

Agency: National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce via the Coastal Zone Management Act (CZMA) of 1972, https://coast.noaa.gov/czm/about/, https://coast.noaa.gov/czm/media/funding-summary.pdf"

Forest Plan (Land Management Plan)- Every national forest or grassland managed by the United States Forest Service must develop and maintain a management plan, revised at a minimum every 15 years; plans consider multiple-use goals and objectives, management standards and prescriptions, and ¬monitoring requirements; proposed projects inconsistent with the plan cannot proceed (unless the plan is amended, which requires preparation of an EIS and public participation)

Align: The management of national forests and grasslands located within or adjacent to community is likely to affect its flood vulnerability; the forest managers that create Forest Plans are therefore important stakeholders and potential allies in help to shape the resilience of a community

Agency: United States Forest Service (USFS), within the Department of Agricultulre (USDA) via the National Forest Management Act (NFMA) of 1976, http://www.fs.usda.gov/main/planningrule/101, http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5110094.pdf"

Endangered Species Recovery Plan- All species considered threatened or endangered must have a recovery plan as a foundation for a recovery effort; contents include a description of what is needed to return the species to a healthy state, specific criteria for this 'healthy state', and estimates of time and cost requirements

Align: Habitat conservation is an important element of most species recovery plans. Opportunities exist to leverage policies designed to protect species and help them recover to improve neighborhood-level and citywide resilience, especially in riparian areas.

Agency: National Marine Fisheries Service of NOAA, within the Department of Commerce and the USFWS, within the Department of the Interior via the Endangered Species Act of 1973, https://en.wikipedia.org/wiki/Endangered_species_recovery_plan, http://www.nmfs.noaa.gov/pr/recovery/"

empower local communities, organizations, and individuals to action.

Align: State Historic Preservation plan policies and actions are necessarily place-specific. Preventing (re)development in/near historic structures and lands may reduce exposure, and therefore vulnerability, to flooding. Preservation policies/actions may potentially have the opposite effect, though, protecting and encouraging the continued use of buildings (or entire districts) in flood-vulnerable parts of a community.

Agency: Nation Park Service (NPS) within the USDA via the National Historic Preservation Act of 1966, https://www.nps.gov/preservation-planning/, https://www.nps.gov/preservation-planning/stateplanning.html"

National Conservation Innovation Grants- The purpose of CIG is to stimulate the development and adoption of innovative conservation approaches and technologies, while leveraging the Federal investment in environmental enhancement and protection in conjunction with agricultural production.

Align: PIRS might be a useful analytical tool with respect to some of the 'innovative conservation approaches' funded by National Conservation Innovation Grants

Agency: Natural Resources Conservation Service (NRCS), within the USDA, http://www.grants.gov/search-grants?html?fundingCategories%3DENV%7CEnvironment

NOAA Climate Program Office: Regional Integrated Sciences and Assessments (RISA) Program- CPO funds a network of RISA teams which are a model for interdisciplinary science and assessment and work to inform improvements in resilience and preparedness in diverse socio-economic regions and sectors throughout the US and abroad through the use of climate knowledge and information; research advances the nation's understanding of climate-related risks and vulnerabilities across sectors and regions, and the development of tools to foster more informed decision making.

Align: The PIRS methodology might be used to assess or better integrate many of the innovations produced by the interdisciplinary RISA teams; further development of the method may even be eligible for funding from the RISA program

Agency: NOAA, within the Department of Commerce, http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram.aspx, http://cpo.noaa.gov/sites/cpo/RISA/UPDATED%20RISA-2pager-11-02-16.pdf"

Resilience AmeriCorps- A program that builds capacity for climate resilience planning and implementation in low-income communities. The program provides technical assistance to local communities.

Align: PIRS can be utilized as part of the tools and training; The engagement team of the PIRS can work with the program to engage the community.

Agency: Corporation for National and Community Service (CNCS) with NOAA, EPA, DOE, and non-federal partners, http://www.nationalservice.gov/programs/americorps/americorps-initiatives/resilience-americorps

Resilience Dialogues- A program to address the need for training and technical assistance for communities. It provides a platform for communities to discuss issues related to climate change and to take steps to become more resilient.

Align: PIRS can be utilized as part of the tools and training; The engagement team of the PIRS can work with the program to engage the community.

Agency: USGCRP, http://www.resiliencedialogues.org/

Regional Integrated Sciences and Assessments- Regional teams that leverages a trusted network of research teams around the country to advance the knowledge base, provide expertise to support

responses to extreme events.

Align: RISA can work with already established relationships, such as managers and planners, and use PIRS to advance a regional approach to plan integration.

Agency: NOAA, http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/RISAProgram/AboutRISA.aspx

Landscape Conservation Cooperatives- Regional teams that work collaboratively to identify best practices, connect efforts, identify science gaps, and avoid duplication through conservation planning and design.

Align: LCC can use PIRS to integrate planning efforts to reduce vulnerabilities to climate change.

Agency: DOI, https://lccnetwork.org

Regional Climate Hubs- A program that develops and delivers science-based, region-specific information and technologies for rural producers.

Align: When conducting PIRS, communities should engage with the RCH and extension professionals; rural communities can utilize data from the RCH for data for physical vulnerabilities, etc.

Agency: USDA, https://www.climatehubs.oce.usda.gov/

Climate Adaptation Community of Practice- A network of practitioners that share tools, information, and best practices and work to develop federal government-wide goals and strategies for climate change training.

Align: The network can train and share best practices of plan integration.

Agency: USGCRP

Clean Water State Revolving Fund (CWSRF)- A financial assistance program that can be used for a variety of water infrastructure projects.

Align: PIRS can be used as an analytical tool to justify projects funded by the program; PIRS can be used to identify physically and socially vulnerable areas across a community's network of plans.

Agency: EPA, https://www.epa.gov/cwsrf

Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE)- Funds critical freight and highway projects and includes climate resilience considerations.

Align: PIRS can be used as an analytical tool to justify transportation projects funded by the program.

Agency: DOT, https://www.transportation.gov/buildamerica/FASTLANEgrants

Sustainable Communities Initiative- Provides grants to improve regional and local planning efforts that integrate housing and transportation decisions, and increase the capacity to improve land use and zoning to support market investments that support sustainable communities.

Align: PIRS can be used as an analytical tool to justify projects funded by the program; PIRS can be used to identify physically and socially vulnerable areas across a community's network of plans.

Agency: HUD, http://portal.hud.gov/hudportal/HUD?src=/hudprograms/sci

APPENDIX C

Detailed Policy Tools: Land Use Policy categories and sub-categories (continued from table 2.4)

Land Use Approach	Description	Example of measurements	S* / NS**
Development Regulations			
Permitted Land Use	Provision regulating the types of land use (e.g. residential, commercial, industrial, open space, etc.) permitted in areas of community; may be tied to zoning code	- Bonus and incentive zoning - Mandatory low-income housing construction ordinance - Rolling easement - Coastal construction control line (CCCL)	N N N N
Density of Land Use	Provision regulating density (e.g. units per acre); may be tied to zoning code	- Cumulative substantial improvement - Lower substantial improvement threshold	S S
Subdivision Regulations	Provision controlling the subdivision of parcels into developable units and governing the design of new development (e.g. site storm water management)	- Strict conformance with development regulations	N
Zoning Overlays	Provision to use zoning overlays that restrict permitted land use/density in hazardous areas; may be special hazard zones or sensitive open space protection zones	- Velocity zone regulations to Coastal "A" zones	N
Setbacks or Buffer Zones	Provision requiring setbacks or buffers around hazardous areas (e.g. riparian buffers and ocean setbacks)	- Coastal forests - Dunes, shore physical barriers (debris, logs, etc.) - Floodplain storage - Shore vegetation - Detention and Retention within watershed	N S N N S
Cluster Development	Provision requiring clustering of development away from hazardous areas, such as through conservation subdivisions	- Setting development caps / population limits - Maintaining public infrastructure for clustering development intensity away from hazard areas	N N
Land Acquisition			
Acquire Land & Property	Purchase land/property in hazard area	- Eminent domain - Acquiring vacant riverfront parcels	N N
Open Space or Easement Requirement/Purchase	Provision encouraging open space purchase by the community or open space easements as an element of development approval	- Conservation easement	N

Density Transfer Provisions			
Transfer/Purchase of Development Rights	Provision for transferring development rights to control density; may be transfer of development rights or purchase of development rights	- Density/intensity credits	N
Financial Incentives and Penalties			
Density Bonuses	Density bonuses such as ability to develop with greater density in return for dedication or donation of land in areas subject to hazards	- CBD periphery Bonus	N
Tax Abatement	Tax breaks offered to property owners and developers who use mitigation methods for new development	- Development exactions - Land gains taxation - Special assessment districts	N N N
Impact / Special Study / Protection Fees	Provision requiring impact fees, special study fees, or protection fees for development in hazardous areas; fees could cover costs of structural protection	- Impact fees and system development charges	N
Land Use Analysis and Permitting Process			
Land Suitability	Hazards are one of the criteria used in analyzing and determining the suitability of land for development		
Site Review	Provision requiring addressing hazard mitigation in process of reviewing site proposals for development	- Site specific surveys and field documentation	N
Design/Construction Guidelines/Requirements	Guidelines or requirements that apply to the design or construction of developments in hazard areas	- Requiring specific building standards - Seismic retrofitting and design - Setting environmental performance standards	S S N
Public Facilities (including Public Housing)			
Siting	Provision to site public facilities, including municipal buildings and public housing, out of hazard areas	- Preserving hazard areas for new road alignments - Limiting public expenditures for infrastructure	N N
Sizing/Capacity	Provision limiting capacity of public facilities, including public housing, in hazard areas to cap amount of development	-	

Post-Disaster Reconstruction Decisions			
Development Moratorium	Provision imposing a moratorium on development for a set period of time after a hazard event to allow for consideration of land use change	- Limit redevelopment	N
Post-Disaster Land Use Change	Provision related to changing land use regulations following a hazard event; may include redefining allowable land uses after a hazard event	- Eliminating unsafe conditions and inappropriate uses	N
Post-Disaster Capital Improvements	Provision related to adjusting capital improvements to public facilities following a hazard event	- Relocating city infrastructure	S
Capital Improvements			
Infrastructure "Hardening" or Weatherproofing	Provision encouraging or requiring development in hazard zones to increase structural resilience to hazards	- Levees and dikes - Underground utility lines	S S
Elevating	Provision pertaining to the physical elevation of structures in hazard zones		
Drainage Improvements or Flood Control	Provision that pertains to drainage or flooding issues within the community	- Flood walls / Sediment control structures - Stormwater treatment improvements	S S
Ecosystem Enhancement	Provision that seeks to improve or preserve the functioning of the natural environment within the community	- Retaining ponds - River channel changes - Restoring vegetated shorelines on public lands	S S N
Slope/Dune Stabilization	Provision that pertains specifically to stabilization of slopes or dunes or seeks to control erosion	- Shoreline protection	S/NS

* S: Structural / **NS: non-structural

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS - **Permitted Land Use**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS **-Density of Land Use**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS - **Subdivision Regulations**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS **-Zoning Overlays**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS - **Setbacks or Buffer Zones**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DEVELOPMENT REGULATIONS **-Cluster Density**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

LAND ACQUISITION- **Aquire Land & Property**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

LAND ACQUISITION **-Open Space or Easement Requirement/Purchase**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

DENSITY TRANSFER PROVISIONS- **Transfer/Purchase of Development Rights**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

FINANCIAL INCENTIVES AND PENALITIES **-Density Bonuses**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

FINANCIAL INCENTIVES AND PENALITIES **-Tax Abatement**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

FINANCIAL INCENTIVES AND PENALITIES **-Impact/Special Study/ Protection Fees**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

LAND USE ANALYSIS AND PERMITTING PROCESS **- Land Suitability**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

LAND USE ANALYSIS AND PERMITTING PROCESS - **Site Review**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

LAND USE ANALYSIS AND PERMITTING PROCESS - **Design/Construction Guidelines/Requirements**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

PUBLIC FACILITIES (including Public Housing) - **Siiting**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

PUBLIC FACILITIES (including Public Housing) - **Sizing/Capacity**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

POST-DISASTER RECONSTRUCTION DECISIONS **- Development Moratorium**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

POST-DISASTER RECONSTRUCTION DECISIONS - **Post-Disaster Land Use Change**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

POST-DISASTER RECONSTRUCTION DECISIONS - **Post-Disaster Capital Improvements**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

***CAPITAL IMPROVEMENTS* - Infrastructure "Hardening" or Weatherproofing**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

***CAPITAL IMPROVEMENTS* - Elevating**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

***CAPITAL IMPROVEMENTS* - Drainage Improvements or Flood Control**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

***CAPITAL IMPROVEMENTS* - Ecosystem Enhancement**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

***CAPITAL IMPROVEMENTS* - Slope/Dune Stabilization**												
	District	01	02	03	04	05	06	07	08	Total	Feasibility	Notes
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
	Current Hazard Zone											
	Future Hazard Zone											
Policy Category Total	Current Hazard Zone											
	Future Hazard Zone											

PLAN NAME: **EVALUATOR :**

Policy Total			
		Total	Notes
Development Regulations	Current Hazard Zone		
	Future Hazard Zone		
Land Acquisition	Current Hazard Zone		
	Future Hazard Zone		
Density Transfer Provisions	Current Hazard Zone		
	Future Hazard Zone		
Financial Incentives and Penalties	Current Hazard Zone		
	Future Hazard Zone		
Land Use Analysis and Permitting Process	Current Hazard Zone		
	Future Hazard Zone		
Public Facilities (including Public Housing)	Current Hazard Zone		
	Future Hazard Zone		
Post-Disaster Reconstruction Decisions	Current Hazard Zone		
	Future Hazard Zone		
Capital Improvements	Current Hazard Zone		
	Future Hazard Zone		
Total	Current Hazard Zone		
	Future Hazard Zone		

APPENDIX D

Engagement Team Worksheet

Negative Scoring Policies Worksheet

Plan: _____ Responsible department:_____

District	Policy	Physical Vulnerability	Social Vulnerability	In conflict with which plan?	Suggested amendments (in meeting)	Investment level (in meeting)
Ex. 23		High	High	Hazard Mitigation plan		

Districts with Few Resilience Policies Worksheet

Plan: _____ Responsible department:_____

District	Physical Vulnerability	Social Vulnerability	Suggested policy tools (in meeting)
Ex. 4	High	High	

Engage Elected and Appointed Officials

Negative Scoring Policies Worksheet

Plan: _____ Responsible department:_____

District	Policy	Physical Vulnerability	Social Vulnerability	In conflict with which plan?	Suggested amendments	Investment level	Political opposition? (in meeting)
Ex. 23		High	High	Hazard Mitigation plan			