Building Coastal Resilience Through Infrastructure Planning Technique Inventory

Data Tools and Sources

FEMA Map Service Center

https://msc.fema.gov/portal/home

Type of Resource: Data Repository

Summary: The FEMA Map Service Center (MSC) should be the first stop for information about flood vulnerability in a given community. Here, the most up-to-date flood maps created through the National Flood Insurance Program (NFIP) can be accessed simply by inputting an address, place, or latitude/longitude in the search bar. Both Flood Insurance Rate Maps (FIRMs) and the smaller, more easily printed FIRMettes can be found here. All of this is accessed through the National Flood Hazard Layer (NFHL) dataset, which is a compilation of effective FIRMs that is updated as newer maps are produced.

US Climate Resilience Toolkit

https://toolkit.climate.gov/

Type of Resource: Data Tool

Summary: The U.S. Climate Resilience Toolkit is an effort by NOAA to share case studies, tools, and informational resources to help communities develop workable solutions to reduce climate-related risks. It also allows individuals to access training courses or local climate science centers for more individualized information. The intended audience for the interface is broad, from city officials to the general public. The “topics” section explains the background information for various aspects of climate with key points and steps that can be taken on a local scale to address them. To enhance local capacity even further, links are provided to contact regional climatologists and other potential partners.

Sea-Level Rise and Coastal Flood Web Tools Comparison Matrix

sealevel.climatecentral.org/matrix

Type of Resource: Tool Comparison Tool

Summary: With this matrix, a planner can compare web-based sea level rise and coastal flood risk tools available for any given state. The matrix describes the features of each tool, including the level of skill required, how recently it was updated, and the geographic scope. It also lists the top three strengths and limitations of the approach, and provides quick links and contact information for all included tools. While the Sea Level Rise and Coastal Flood Web Tools Comparison Matrix cannot be used directly to determine future climate conditions, it is a good first step for navigating the multitude of available tools for a particular state. Planners can review the matrix and decide for themselves which tool suits their needs best.

Surging Seas Risk Zone Map

ss2.climatecentral.org

Type of Resource: Data Tool

Summary: The Surging Seas Risk Zone Map is a worldwide sea level and flood visualizer created by Climate Central, an independent environmental activism organization. With this tool, a user can explore inundation risk worldwide based on data gathered by more than 1,000 tide gauges. Each of the 1,000 gauges marked on this interactive map has downloadable sea level rise projections through the year 2200 for three scenarios: extreme carbon cuts, moderate carbon cuts, or unchecked pollution.

Hudson River Flood Impact Decision Support System

www.ciesin.columbia.edu/hudson-river-flood-map/index_new.html

Type of Resource: Regional Data Tool

Summary: The Hudson River Flood Impact Decision Support System (Version 2) is an interactive mapping application produced by Columbia University. With this tool, residents of the Hudson River watershed in New York State can see, on a city block scale, the anticipated impacts of several sea-level rise scenarios and flooding on critical infrastructure, natural features, and social vulnerability. Sea level rise scenarios are available from zero to six feet above the base mean sea level from 1983 through 2001. The application also includes flood event scenarios with different return periods (the average amount of time between events of this size). The output “impact summary” includes an estimation of financial losses, which can generate more support or stronger rationales for better floodproofing.

Intensity Duration Frequency Curves for New York State

Ny-idf-projections.nrcc.cornell.edu

Type of Resource: Regional Data Tool

Summary: With this New York State specific tool, planners can choose a high or low emissions scenario and, with relative ease, produce downscaled projections of extreme rainfall within the state to the year 2099. This tool provides the total volume of rain associated with different events, and the planner or engineer is responsible for layering that additional water on existing topography to determine the resulting inundation. Intensity, duration, and frequency of precipitation are all considered. While perhaps less valuable for capital infrastructure planning, another interesting feature for raising awareness is a grid map of the entire state with projected changes of precipitation and how different parts of the state compare. The website for these frequency curves offers a video that describes how to use the tool in greater detail.

Delaware's FirstMap Site

https://firstmap.delaware.gov/

Type of Resource: Data Repository

Summary: Delaware's FirstMap site serves as a centralized repository for commonly used geospatial data layers for the state of Delaware. It supports inter-agency collaboration, as universities, counties, and other organizations are able to upload their own data to the site. All data are publicly available for all users. Such a centralized repository is very useful, as it can help avoid duplication of data and decrease the amount of time a community may spend tracking down the most current sources for their planning purposes.

Replicability: FirstMap may be a good model for other states that seek to create a "one stop shop" center for their data needs. It also provides training for new users so that they can better understand how data can be used and how to create interactive web maps with these data. However, to sustain a site like this would require technical expertise and ongoing maintenance indefinitely, which may be costly and time consuming. For practitioners in Delaware, this is an excellent resource. To replicate such a site in other places should be encouraged, but may be prohibitive depending on local capacity.

Sea Level Rise and Storm Surge Projections for the National Park Service

https://www.nps.gov/subjects/climatechange/upload/2018-NPS-Sea-Level-Change-Storm-Surge-Report-508Compliant.pdf

Type of Resource: Report

Summary: Many of the nation's national parks are on the coast, and are therefore subject to current and future storm surge and sea level rise. In this report, the University of Colorado and National Parks Service collaborate to create sea level rise and storm surge projections for over 70 parks, using NOAA and IPCC data and models. Results depict conditions under four different greenhouse gas emissions scenarios and three different timelines: 2030, 2050, and 2100. NOAA's Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model was used in conjunction with Digital Coast's DEM topography data.The storm surge maps created by this effort for each park are also accessible online.

Replicability: This report follows a clear process for how to make storm surge maps that inform land use planning. It is relatively easy to understand for an audience with moderate background in climate science. However, to actually conduct the analyses described in the report may require a greater knowledge of geographic information systems and climate modeling. Another barrier to replicability of this resource is that it refers to federally owned public park planning, as opposed to infrastructure projects on the municipal scale. Funding mechanisms to conduct these analyses would be different for an individual community than is described in this report.

Using Scenarios to Explore Climate Change: A Handbook for Practitioners

http://climate.calcommons.org/sites/default/files/CCScenarios-Handbook%20FINAL%20080113.pdf

Type of Resource: Guidance Document

Summary: This resource provides a solid explanation of multivariate climate scenarios, how to build an appropriate scenario, and one hypothetical example to illustrate how this process should be enacted. However, it also acknowledges and accounts for the fact that the process of scenario building must be flexible, adaptive, and may vary depending on local needs and circumstances. After a clear introduction about what climate scenarios are, the different types, and why they should be used, the handbook lays out a five step process for choosing and using a particular scenario: Orient, Explore, Synthesize, Apply, and Monitor.

Replicability: Although this resource was primarily designed for national park planning, many of the concepts and recommendations within it are relevant and transferable to a municipal setting. Determining scope, assembling a team of individuals from pertinent stakeholder groups, and identifying uncertainties are all elements of best practice for virtually any project. Classic planning strategies such as the SWOT (Strengths, Weaknesses, Opportunities, and

Threats) are referenced. This is a thorough, thoughtful guide that can help a practitioner break down the many complicated aspects of climate planning and make each element manageable and coordinated. The hypothetical example provided from Alaska is also very helpful to make the abstract concepts presented earlier in the document tangible.

Vulnerability Assessment

SoVI

http://artsandsciences.sc.edu/geog/hvri/sovi%C2%AE-0

Type of Resource: Social Vulnerability Assessment Tool

Summary: Since its inception, the SoVI has been considered a standard for social vulnerability assessment for both academics and professionals. Currently in its third edition, the SoVI was developed by Dr. Susan Cutter at the University of South Carolina's Hazards and Vulnerability Research Institute. It is intended to measure social vulnerability to environmental hazards at the county level. This index synthesizes 29 socioeconomic variables identified in the research as relevant to hazards, including family structure, housing status, and access to medical services. Much of the data comes from the U.S. Census Bureau. The numeric score that results from this analysis is a relative score when compared with other counties, which may be a limitation of this tool. The output of the index is statewide maps that display relative vulnerabilities of each county as compared to others within that state and when compared on a national scale.

CDC's Social Vulnerability Index

https://svi.cdc.gov/

Type of Resource: Social Vulnerability Assessment Tool

Summary: The CDC's Social Vulnerability Index (SVI) has four themes: socioeconomic status, household composition, race/ethnicity/language, and housing/transportation. For disaster events, this database can be used to estimate amounts of needed supplies, such as food, water, medicine, and bedding; help decide how many emergency personnel are required to assist people; identify areas in need of emergency shelters; plan the best way to evacuate people, accounting for those who have special needs, such as people without vehicles, the elderly, or people who do not understand English well; and identify communities that will need continued support to recover following an emergency or natural disaster.

Community Based Vulnerability Assessment Guidebook

www.mdcinc.org/wp-content/uploads/2017/11/Community-Based-Vulnerability-Assessment.pdf.

Type of Resource: Guidance Document

Summary: The Community Based Vulnerability Assessment Guidebook was developed by the University of North Carolina's Institute for the Environment with support from a FEMA grant. The greatest strength of this tool is that it lays out, in a stepwise fashion, a process through which planners can engage their communities and complete a comprehensive assessment of environmental vulnerability. This guidebook is especially useful in that it offers a community-based approach that assesses both physical and social vulnerability in one document. It also provides thoughtful advice about how to meaningfully engage those community members who often suffer the most after a disaster but are never brought to the table to develop policy.

Climate Resilience Evaluation and Assessment Tool (CREAT)

https://www.epa.gov/crwu/creat-risk-assessment-application-water-utilities

Type of Resource: Data Tool

Summary: The EPA's Climate Resilience Evaluation and Assessment Tool (CREAT) guides users through five modules to review historic climate conditions for an area, evaluate how those conditions may change, identify critical community assets (such as water bodies, buildings, and communications infrastructure), and compare different adaptation strategies to find those that are most effective and affordable. CREAT is particularly useful as an awareness-building tool that can provide rationale and build support for adaptation planning for specific utilities. It guides the user through each step, including directions and links for more information, but may be most effective if completed by an informed user such as an engineer or public works official. The user begins by creating a summary report of historic climate statistics and how they are anticipated to change for a particular region. The user identifies key assets within the community and estimates the time period for which each asset will be relevant (for example, the design life of the structure). Users also describe current adaptation strategies being implemented in the community as well as potential strategies that could be explored in the future. Ultimately, a user may download intuitive tables and charts related to their infrastructure that may be used to convince stakeholders or officials of the value in climate adaptation planning.

Guidance for Incorporating Sea Level Rise Into Capital Planning in San Francisco: Assessing Vulnerability and Risk to Support Adaptation

https://onesanfrancisco.org/sites/default/files/inline-files/Guidance-for-Incorporating-Sea-Level-Rise-into-Capital-Planning1.pdf

Type of Resource: Guidance Document

Summary: This document presents a framework for considering sea level rise within the capital planning process for the City and County of San Francisco. It also outlines some key issues related to sea level rise adaptation planning; however, specific adaptation strategies and approaches are not provided. Its key goal is to provide direction from the Capital Planning Committee (CPC) to all departments on how to incorporate sea level rise into new construction, capital improvement, and maintenance projects. The document identifies and describes four key steps for assessing and adapting to the effects of sea level rise in capital planning: Sea Level Rise Science Review, Vulnerability Assessment, Risk Assessment, and Adaptation Planning. All in all, this is a great comprehensive document, but the vulnerability assessment section is of particular interest and use.

Replicability: The general process found here is straightforward and useful. However, to implement actual strategies to increase resilience in response to findings from the vulnerability assessment may be costly. San Francisco may not be an appropriate proxy community for many municipalities due to its relative wealth and political willingness to address climate issues.

Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware

http://www.dnrec.delaware.gov/coastal/documents/sealevelrise/assesmentforweb.pdf

Type of Resource: Vulnerability Assessment

Summary: This vulnerability assessment was prepared by the State's Sea Level Rise Advisory Committee and the Department of Natural Resources and Environmental Control. This comprehensive assessment describes how to evaluate exposure and sensitivity of many kinds of infrastructure, from dams to rail lines to septic tanks. 140 potential resources to be mapped and quantified are identified. Not limited to infrastructure, social vulnerability and economic considerations are also discussed. Of the original 140 resources, throughout the vulnerability assessment process, the State chose 16 to be considered the highest priority, most of which are directly related to capital infrastructure. These priority resources include evacuation routes, the Port of Wilmington, and coastal impoundments.

Replicability: Communities have many competing interests and assets that need to be protected and promoted. Unfortunately, financial, technical, and staff resources are almost always limited. Taking the full list of potential priorities and using a clear, data-supported

process to rank them can begin to elucidate needs and help plan for future resource allocation. As with any assessment this large in scope, commitment and collaboration from many agencies is necessary to be successful. Inter-agency communication is a recurring requirement for flood resilience success in any community.

Urban Planning Tools and Plans

Planning for Equity Policy Guide

www.planning.org/publications/document/9178541/

Type of Resource: Guidance Document

Summary: The Planning for Equity Policy Guide provides specific, actionable policy guidance through an equity lens on crossing-cutting topics and areas of planning. This document is specifically a “call to action” for individuals in the planning profession to consider their role in promoting inclusion and justice in their communities. Here, different aspects of equity relevant to planning are discussed, such as gentrification, environmental justice, and climate change. Policies are presented for each of these larger topics as action items for planners to consider. The guide is also successful in describing the intersection of planning with many other sectors with regard to justice, such as education and health. It is an important reminder for planning professionals that they play an active role in ensuring equitable outcomes for the constituents in their communities.

Plan Integration for Resilience Scorecard

http://ifsc.tamu.edu/getattachment/News/July-2017/Plan-Integration-for-Resilience-Scorecard-Guideboo/Scorecard-(1).pdf.aspx

Type of Resource: Guidance Document

Summary: While many plans exist in most communities, never before has a tool been created that systematically evaluates the consistency between these plans. It is essential that community plans agree on broad goals, needs, and priorities with regard to climate risks, even when these plans were written at different times and by different departments or individuals. To address this need, the Plan Integration for Resilience Scorecard was developed to: identify incongruities within networks of plans, help integrate and improve local plans in ways that reduce losses from hazard events, provide communities developing new plans or updating existing plans with a guidance framework to reduce future hazard exposure, and provide a validated tool to address on-the-ground needs and build capacity. 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.

CMAP's OnTo2050 Plan

https://www.cmap.illinois.gov/2050

Type of Resource: Community Plan

Summary: The Chicago Metropolitan Agency for Planning (CMAP) is a regional planning agency for the counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will in northeastern Illinois. CMAP plays a key role in the region for climate resilience, adaptation, sustainability, and determining how infrastructure can meet current and future climate challenges. These efforts are reflected in its Go To 2040 regional comprehensive plan, and most recently in its draft plan update On To 2050. On To 2050 provides a six-point framework for how CMAP intends to meet these challenges: Incorporate climate resilience and adaptation measures into planning and development; Strengthen gray and green infrastructure to withstand climate change; Improve the operational response to weather events to ensure mobility; Create a more flexible and decentralized electric grid; Diversify agricultural systems to promote resilience; and Explore a regional climate resilience platform to coordinate initiatives and provide data and resources.

Replicability: CMAP is a relatively unique organization in that it is able to coordinate so many entities on a regional scale. This serves as an excellent model, but may be challenging for other parts of the nation that are not as well coordinated or do not have a hub city such as Chicago to organize around. The language in this plan may be reworked to be used in other communities to accomplish climate relevant goals. It is an ambitious and comprehensive document.

Implementing Infrastructure Resilience in Comprehensive Plans: Monroe County, Florida

http://www.monroecounty-fl.gov/180/Comprehensive-Planning

Type of Resource: Community Plan

Summary: Monroe County is a coastal community in South Florida that includes the islands of the Florida Keys. While most of the county's land area is located on the mainland, nearly all 77,000 residents live in the Florida Keys. In its recent comprehensive plan update, the county developed a number of policies tied to goals and objectives to improve the use of information related to future flood risk and climate change when implementing infrastructure projects. Several policies described in this comprehensive plan provide good "best practice" language that other communities could adopt in their own plans. One example policy is as follows:

Policy 1502.1.5. Within five (5) years after the adoption of the 2030 Comprehensive Plan, Monroe County shall initiate an inventory of existing and planned infrastructure up to the 2030 horizon, based upon the vulnerability mapping identified in Policy 1502.1.4, for capacity to accommodate projected sea level rise over the life expectancy of that infrastructure. Monroe County shall identify the infrastructure within those areas, its useful life and any retrofits or capital projects necessary to address the impacts of sea level rise. These strategies may include defense, accommodation, or and retreat projects, or not building planned infrastructure in vulnerable locations, to address the impacts of sea level rise. Monroe County will consider developing design criteria, in conjunction with a broader asset management planning process.

Replicability: Many of the goals outlined in the Monroe County Comprehensive Plan could easily be adjusted and used for other counties in both coastal and non-coastal areas. These policies are tangible and well defined, which enhances their enforceability.

PAS Report 560, Hazard Mitigation: Integrating Best Practices into Planning

https://www.fema.gov/media-library-data/20130726-1739-25045-4373/pas_560_final.pdf

Type of Resource: Report

Summary: This PAS report describes the role urban planners have to play in the realm of hazard mitigation. It describes the other actors involved in hazard mitigation, the relationship of state and federal laws in local plan making, and how hazard mitigation can be incorporated into existing local plans such as the comprehensive plan. To supplement these abstract concepts, six case studies are described in the final chapters of the report. One helpful aspect of this particular report is a summary in the last chapter of what its authors learned about what works and what doesn't work on a community level with regard to hazard management.

Integrating Hazard Mitigation, Climate Adaptation, and Infrastructure Planning in Baltimore

www.baltimoresustainability.org/plans/disaster-preparedness-plan

Type of Resource: Case Study

Summary: The City of Baltimore through its Disaster Preparedness and Planning Project (DP3) has worked to comprehensively integrate both hazard mitigation and climate adaptation planning to better assess future risk and plan for the future. Completed in 2013 and updated in 2018, DP3 analysis and recommendations centered on four strategy areas: Infrastructure (maintaining quality and capacity to meet future existing needs); Buildings (improving building design and codes to protect against existing and future hazards and improve the conservation of natural resources); Natural systems (preserving natural systems as community resources and as natural infrastructure); and Public services (coordinating public services to ensure

safety and improve outreach and education on hazards and climate impacts). The city, in accordance with this plan, undertook asset inventory and vulnerability assessment which ultimately guided them to choose several projects most closely aligned with their identified goals. These included extending wetland and riparian buffers, improving communication systems, and requiring the integration of hazard mitigation and climate adaptation into the capital improvement program. DP3 was updated in 2018.

Replicability: Baltimore provides a great example of a comprehensive, start to finish approach to viewing the holistic situation of hazard mitigation. It is exhaustive in cataloguing floods, wind events, locations of dams, and many other valuable community statistics and attributes. The website also includes helpful public health infographics as well as a thorough appendix that explains the committees, subcommittees, and meetings that took place in order to make this plan a reality. Dozens of people were involved in this effort-- coming to this consensus among many departments may be a challenge, but providing this case study may build rationale among unconvinced stakeholders. The most valuable aspect of this particular case study may be these appendix materials that would be helpful for organizing the many people and events to get a disaster plan off the ground.

A Green Infrastructure Plan for Norfolk

http://www.gicinc.org/virginia.htm

Type of Resource: Case Study

Summary: As part of its participation in the Rockefeller Foundation's 100 Resilient Cities initiative and its own plaNorfolk2030 comprehensive planning efforts, in 2018 the city of Norfolk, Virginia developed a green infrastructure plan intended to advance environmental outcomes, improve community health, and protect vital infrastructure systems. The plan is designed around expanding the city's existing network of green infrastructure to provide a wide variety of co-benefits such as improving air and water quality, reducing the impacts of stormwater flooding, and increasing recreational opportunities for residents. Following an extensive public outreach process and analysis of existing conditions, the city developed a series of strategies centered on the themes of "Land" and "Water." The city developed a series of criteria for green infrastructure based on how it will be impacted by sea-level rise over its expected useful life. Additionally, all city departments involved in implementation will be required to assess their current and future workplans for areas in which the green infrastructure strategy can be included.

Replicability: This ambitious project was completed in large part due to guidance from Virginia's Green Infrastructure Center. While support from Norfolk staff was necessary, this external group was the main driver. However, for communities in Virginia, there are many resources created by the Green Infrastructure Center to support similar projects, including a Virginia Planning Guide. Their website also includes many more case studies from across the state.

St Joseph Michigan Edgewater Beach Overlay District

http://greatlakesresilience.org/case-studies/land-use-zoning/engaging-communities-promote-coastal-zoning

Type of Resource: Case Study

Summary: In 2012, a lakeshore homeowner submitted a request to the city of St. Joseph, Michigan, to build a large seawall protecting the applicant's property from storm surges. However, environmentalists and technical experts raised concerns that such a structure would both exacerbate shoreline erosion and limit public access to the beach. The city conducted an engineering study to determine a solution that would serve both private and public interests. This study concluded that a fixed setback line for a portion of the shoreline was the most appropriate solution. Later that year, after robust public engagement to obtain feedback, the city commission established the Edgewater Beach Overlay District, which included a "no-build" ordinance that prohibited construction of permanent structures at a fixed elevation above sea-level based on Michigan's record high water level plus a two-foot storm surge.

Replicability: In this case, a zoning ordinance proved a more widely accepted tool than massive structural solutions. Such approaches should be a critical part of a city's resilient infrastructure strategy. Zoning can be easily adapted over time and is relatively inexpensive. Structural solutions, by contrast, may be difficult to adapt, may have far fewer co-benefits, may fail in the face of more frequent or unexpected flood impacts, and are likely to be far more expensive. By pursuing regulatory solutions where possible, communities reduce the need for highly specific design standards for specific pieces of stationary gray infrastructure.

Standards, Guidelines, and Regulations

New York City's Climate Design Standards

https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v3-0.pdf

Type of Resource: Guidance Document

Summary: In Fall 2016, the Design Guidelines Working Group, which includes more than 15 City agencies, was convened to collaborate and advise on the development of Climate Design Guidelines. Within this document, types of hazards and anticipated design life of various types of capital infrastructure projects is well defined as well as the process for determining risks and costs. Also, sources for certain data are well documented. However, specific guidance on what to do with the information gained from vulnerability analysis and cost benefit analysis is not clear.

Replicability: Design considerations and data sources for precipitation are not thoroughly explained in this document alone, but sea level rise is described more adequately with nice examples (such as how to determine a sea level adjusted DFE). This resource is somewhat unique in that it also considers heat as a current and future hazard. Many of the items in the cost benefit analysis section may be too specific to New York City law and governmental structure to be helpful to a different community.

PAS Report 584, Subdivision Design Standards and Flood Hazard Areas

Type of Resource: Report

Summary: *Subdivision Design Standards and Flood Hazard Areas* provides a guide to planning professionals who hope to develop more robust subdivision design standards in their communities to mitigate flood hazard and improve resilience. The document lays out general principles for laying the foundation of sound subdivision design, guidance as to balancing the needs of the community, development, and risk reduction, all within a frame of integrated collaborative effort across public and private sectors. The report is complete with case studies and descriptions of other resources and tools for more information.

Avoiding and Minimizing Risk of Flood Damage to State Assets: A Guide for Delaware State Agencies

http://www.dnrec.delaware.gov/energy/Documents/DE%20Flood%20Avoidance%20Guide%20For%20State%20Agencies.pdf

Type of Resource: Guidance Document

Summary: This document outlines step-by-step instructions and principles for state agencies to follow to minimize flood risk to existing and new facilities/investments. Some of the principles described include: understanding existing and future risk on potential project sites by using mapping tools when possible, avoiding project sites within areas of existing or future flood risk, and incorporating design features to minimize risk where avoidance is not feasible. For example, the document recommends using an 18” freeboard above base flood elevation for projects that must be sited in floodprone areas. Green infrastructure is also encouraged. Appendix A has a flowchart to help with decision making and documentation required to avoid flood risk and meet the guidelines.

Replicability: This document provides a great model for communities that wish to provide more specific flood design guidelines, but don’t know where to start. As of now, there are no nationally accepted and agreed upon guidelines to provide at the local level. It may seem daunting to determine guidelines without external guidance. This resource may serve as a starting point to minimize that uncertainty until national standards are more well defined.

Guiding Principles for Sustainable Federal Buildings

https://www4.eere.energy.gov/femp/requirements/guidelines_filtering?tid%5B%5D=301&tid_1%5B%5D=300

Type of Resource: Guidance Document

Summary: Similar to the previously described Delaware guidance document, this set of principles from FEMA seeks to provide standards for not only flood resilient, but environmentally sustainable structures in general. It is also quite comprehensive in that it includes sections for existing buildings as well as new construction. The website under which these principles are housed allows the user to filter to see only particular types of recommendations, in order to make the search process easier and less overwhelming.

Replicability: While for some communities it may be useful to have all of these recommendations in one place, it may be too large a scope for others who hope to focus specifically on flood resilience and not on other sustainability features. Furthermore, some of the language in this guidance is broad and vague, which can diminish the enforceability of many of the principles. While this document could be a cursory resource for design language, it would need to be reinforced with other more specific tools and resources.

Adaptation

Fort Pickens Road

https://www.doi.gov/sites/doi.gov/files/migrated/deepwaterhorizon/adminrecord/upload/Fort-Pickens-Gateway-Community-Alternative-Transportation-Study-Gulf-Islands-National-Seashore-Florida-District-Fort-Pickens-Area-prepared-by-NPS-February-2009.pdf

Type of Resource: Case Study

Summary: Fort Pickens Road is a 7 mile highway on Santa Rosa Island, Florida, within the Gulf Islands National Seashore. It provides access to very popular park amenities, but is also subject to regular flooding due to its proximity to the coast. In this case study, several alternative options for transportation are explored thoroughly to determine the best options for the future, in light of climate change. This case study demonstrates the value of adopting multiple strategies in tandem to combat sea level rise and reinforcing resilience through diverse tactics.

Replicability: This case study was an enormous undertaking incorporating many separate studies. However, this model would be useful for a specific subset of coastal communities with transportation concerns. Robust financing and political will would need to be secured to implement any of the suggested alternative transit options. Because this particular road is in a national seashore, funding mechanisms used for this case study may not be replicable on the community level. Efficient inter-agency collaboration is essential to conduct an analysis such as this.

Coastal Resiliency: Adapting to Climate Change in Hampton Roads

https://www.hrpdcva.gov/uploads/docs/HRPDCAgendas/2013/June/Website/06202013-PDC-E4.pdf

Type of Resource: Report

Summary: This report provides a summary of the Hampton Roads Planning District Commission's Coastal Resiliency work over fiscal years 2012 and 2013 . Since 2008, the Hampton Roads Planning District Commission has been engaged in a series of projects, studies, and efforts related to helping the region adapt to more frequent flooding, rising sea levels and other projected impacts of climate change. The report contains six major parts. The first part describes global sea level rise scenarios and projections, including recent scientific findings related to the acceleration of sea level rise. The second part discusses how adaptive management, a form of planning usually associated with natural resources planning, and other planning paradigms can be used to plan for sea level rise. The third part discusses where and how local governments can plan for sea level rise in their existing planning processes. The fourth part describes efforts to update sea level rise inundation maps with new elevation data. The fifth part summarizes the various outreach and coordination efforts HRPDC staff has participated in during the grant. The sixth and final part summarizes the project's activities, findings, and recommendations. There are also four appendices which provide helpful sample documents for public outreach presentations, brochures, and the elevation data used to complete the project.

Adaptation Action Areas: Policy Options for Adaptive Planning For Rising Sea Levels

https://southeastfloridaclimatecompact.org/wp-content/uploads/2018/01/guidebook-aaa.pdf

Type of Resource: Guidance Document

Summary: In 2012, the Florida Department of Economic Opportunity (DEO) initiated a five year project to integrate sea level rise adaptation into current planning mechanisms, including the local comprehensive plan, hazard mitigation plan, and post disaster redevelopment plan. One of the focus areas is to provide statewide guidance on how to implement an Adaptation

Action Area at the local level. An Adaptation Action Area or “adaptation area” is defined as a designation in the coastal management element of a local government’s comprehensive plan which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning. This report should be read as a resource for the state of Florida's coastal communities, providing guidance on the benefits of incorporating adaptation strategies into local planning policy and programs. The report begins with a summary of sea level rise impacts to Florida’s coastal communities and the importance of engaging in adaptation planning efforts. In addition, the state’s recent growth management law revision to allow for the designation of Adaptation Action Area is explained and a snapshot of Broward County’s related adaptation policies are highlighted.

Great Lakes Resilience Case Studies

http://greatlakesresilience.org/case-studies

Type of Resource: Case Studies

Summary: The Great Lakes Resilience Planning Guide provides a variety of resources for communities in the Great Lakes Region, including maps, tools, data, and links to other sources and regional points of contact. One of the many resources here is a series of case studies from Minnesota, Wisconsin, Michigan, and Ohio about four topics: Infrastructure, Habitat & Environment, Public Health & Safety, and Land Use & Zoning. Many of the cities in these case studies are small to medium sized municipalities, so their strategies may be appropriate and relevant even for communities without an elaborate financing and planning structure. Although these case studies are all in the Midwest, many if not all of the techniques described could be implemented in other regions. Some of the specific case studies in this repository are described in more detail within this Technique Inventory.

Relocation of Key Facilities

Relocating Visitor facilities on the Assateague Island National Seashore (Maryland and Virginia)

http://npshistory.com/publications/asis/draft-gmp-2016.pdf

Type of Resource: Case Study

Summary: The goal of this case study was to identify a cost-effective, sustainable way to maintain the recreational beach at Assateague Island National Seashore, which is a driver of the local economy in Chincoteague, VA. One of the successful strategies implemented here

was introducing portable infrastructure, particularly roads and parking lots constructed using local clay and clam shells that can be dug up and reused when the parking lot is moved.

Replicability: This case study may be difficult to replicate because federal road funds were used for its implementation, and structures made from clay and clam shells require twice weekly maintenance and yearly addition of new shells. However, maintenance of traditional roads in flooded areas may prove to be more costly in the long term. It would be the responsibility of an individual community to determine the costs and benefits of “portable”, natural material infrastructure in their unique circumstances.

Relocating Historic Lighthouse on Cape Hatteras National Seashore (North Carolina)

https://www.nps.gov/subjects/climatechange/upload/CAS_Case_Study_8.pdf

Type of Resource: Case Study

Summary: The Cape Hatteras National Seashore Lighthouse has served as a prominent cultural resource and tourist attraction in coastal North Carolina. However, the lighthouse has been subject to flooding and erosion of its base for years. Many hard erosion prevention structures have been attempted over time, with mixed results. The lighthouse was ultimately relocated after an 11 year effort in 1999. The original position of the lighthouse was documented with engraved granite stones listing the names of previous lighthouse keepers. In addition to relocation, the park constructed a new amphitheater associated with the lighthouse to enhance opportunities for educational activities. This serves as an example of how relocation of key structures can not only preserve historic character, but provide new ways to enrich the experience of park visitors.

Replicability: This case study may be interesting to coastal communities with numerous historic structures, such as the original settlements along the eastern seaboard. However, it took 11 years and impressive community collaboration to make this a reality. This would be much more challenging in a city or county with many historic structures to choose from and prioritize.

Legislation

Delaware State Senate Bill 64

DNREC Secretary's Order 2012-WS-0029 (2012)

Type of Resource: Law/Executive Order

Summary: With bipartisan support, Delaware was able to pass a bill in response to ongoing inland and coastal flooding and drainage challenges statewide. Senate Bill 64 established a Flood and Drainage Advisory Committee that includes stakeholders from both private and public interests to review national standards and evaluate which requirements should be adopted by the state. There was also a period of public comment to allow the citizens to also weigh in on standards to be adopted. Another interesting feature of this legislation was that they specifically identified where implementation of standards may represent hardship to the local government so that the State knew how best to provide guidance and technical assistance. The culmination of this bill is a report called *Delaware Floodplain and Drainage Standards and Recommendations*, found here: http://www.dnrec.delaware.gov/swc/Shoreline/Documents/Floodplain%20and%20Drainage%20Code%20WG/FDAC%20Report%20Rev%20032613.pdf

Replicability: Legislation that strives to incorporate diverse interests and community needs will be increasingly valuable as climate change increases the frequency and severity of flooding. Identifying potential barriers to implementation may also reduce hardship and increase the success of these policies. Bills such as this may become more popular as the adverse effects of flooding become more visible and more highly prioritized to the public and local elected officials.

Financing Mechanisms

NOAA's Guide for Assessing Green Infrastructure Costs

https://coast.noaa.gov/digitalcoast/training/gi-cost-benefit.html

Type of Resource: Guidance Document

Summary: NOAA's Guide for Assessing Green Infrastructure Costs outlines a process for defining how green infrastructure can help communities to reduce flooding, and how to estimate the costs and co-benefits of green infrastructure. Communities should use this guide as a framework that can be adapted for their own purposes to inform planning-scale assessments and spark discussion about green infrastructure options to mitigate flooding and provide other watershed benefits. By following the guide's six steps for developing a green infrastructure strategy, including estimation of associated costs and benefits over a chosen planning horizon, communities can demonstrate the cost-effectiveness of implementing green infrastructure projects.

Financing the Resilient City: A demand driven approach to development, disaster risk reduction and climate adaptation

https://www.environmental-finance.com/content/research/financing-the-resilient-city.html

Type of Resource:

Summary: This report presents a strategy for scaling adaptation to climate change impacts within urban areas. It approaches the adaptation challenge within the overall context of other pressing risks and development challenges confronting the world's urban regions. The report proposes a framework for integrating climate and other risk reduction measures into broader public sector and market-driven investments planned for urban areas and systems; and for efficiently matching the different measures to the most suitable types of finance. New types of market-based finance will likely need to be invented.With regard to international development assistance (IDA), the framework proposes three 'inversions' of the conventional development assistance approach. These are:

1. bottom-up planning processes for identifying vulnerabilities and risks and for integrating related risk reduction measures into the other priority performance enhancements for the area or system;
2. bottom-up technical and institutional capacity for designing such comprehensive 'resilience upgrading' projects; for managing and staging complex project execution; and for preparing the different investment propositions related to different components of these projects; and,
3. bottom-up procurement of investment through managed, competitive sourcing mechanisms and processes.

Finance Philosophy and Funding Capital Improvement: City of Fort Collins City Plan, Appendix B

https://www.fcgov.com/planfortcollins/pdf/cityplan.pdf?1415894776

Type of Resource: Community Plan

Summary: This appendix is presented in two sections: · The first section summarizes the City's finance philosophy that is incorporated in its policy and planning documents, procedural manuals, and budget practices. The philosophy is further supported by the Principles and Policies articulated in City Plan, particularly in the sections on Economic Health, Community and Neighborhood Livability, and Environmental Resources. · The second section summarizes how the City currently funds and intends to fund capital improvements in the future and long-range implications that relate to Plan Fort Collins recommendations. This section is organized by Plan Fort Collins topics. While it is not particularly in-depth, it may provide an example for

communities wishing to include a specific capital infrastructure section to their comprehensive plan. The capital infrastructure process may be more robust if its components are integrated into multiple other community plans.