

SECTOR IN-DEPTH

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State and Local Government – US

Sea level rise increases credit risk for coastal states and local governments

Rising sea levels pose increasing credit risks for many coastal state and local governments. More frequent and severe flooding from high tides and storm surges from major weather events threaten coastal economies, property values and critical infrastructure. Over the next several decades, increased investment in adaptation and coordinated government responses will become essential for federal, state and local governments to more effectively respond to sea level rise. The scale of the challenges will make federal government leadership and funding even more vital.

- » **Sea level rise is leading to more frequent coastal flooding, signaling a need for state and local governments to increase funding to manage risks.** Between 2000 and 2019 the Atlantic and Gulf coasts experienced a 100% to 150% (depending on location) increase in annual days of high-tide flooding,¹ according to the National Oceanic and Atmospheric Administration (NOAA). Also, Four Twenty Seven, a Moody's affiliate, estimates that by 2040 rising sea levels and flooding will impact every coastal state, most of their coastal counties,² and over 110 cities with a population greater than 50,000.
- » **Increased vulnerability to coastal flooding heightens credit risks.** More frequent coastal flooding poses risks for localities, states and the federal government because of a large and growing coastal population and vulnerable infrastructure. For state and local governments, a weaker economy, increased maintenance costs and lost tax revenue are particular credit risks over a multi-decade horizon.
- » **Sea level rise adaptation efforts are credit positive, but capital intensive and stand to increase leverage.** At all levels of government, policies that encourage or mandate sustainable development (smart growth)³ and the capacity to invest in combating the effects of sea level rise will be critical to reducing threats. State and local governments' ability to manage debt levels while investing in adaptation efforts will become increasingly crucial to credit quality. Governments will have to balance investments to combat environmental threats with competing spending priorities.
- » **Coordinated efforts between the federal, state and local governments will reduce threats from sea level rise.** Governments that share adaptation strategies and financial burdens to address coastal flooding will be in a stronger position to reduce risks. Increased federal support and leadership will be increasingly critical to state and local adaptation efforts and credit quality.

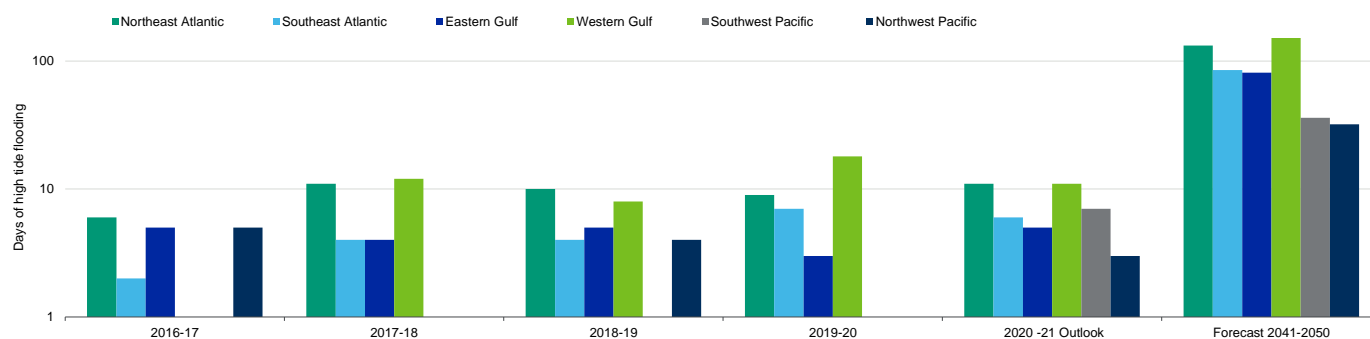
Sea level rise is leading to more frequent coastal flooding, signaling a need for state and local governments to increase funding to manage risks

In many regions, sea levels are rising at a rapid pace, notably along the Atlantic and Gulf coasts. This is a harbinger of heightened economic risks and increased costs to maintain infrastructure. NOAA, for example, described high-tide flooding in 2019 as "extraordinary," citing locations on the Atlantic and Gulf coasts as experiencing a 100% to 150% increase in annual days of flooding since 2000. NOAA projects that by 2050 the Atlantic and Gulf coasts will endure 100 or more days annually of high tide-induced flooding⁴ (see Exhibit 1). Tidal flooding has resulted in limited economic and tax revenue effects to date, partly because of adaptation efforts by impacted governments. However, as tidal flooding and storm surge events occur more often, economic and property ownership risks will require local governments to fund projects that reduce risk.

Exhibit 1

Flooding during high tide will increase for decades to come

Median number of days annually of high-tide flooding by region



No bar indicates one day or less of high-tide flooding.

Source: NOAA Technical Reports 2016-2020, *State of U.S. High Tide Flooding*

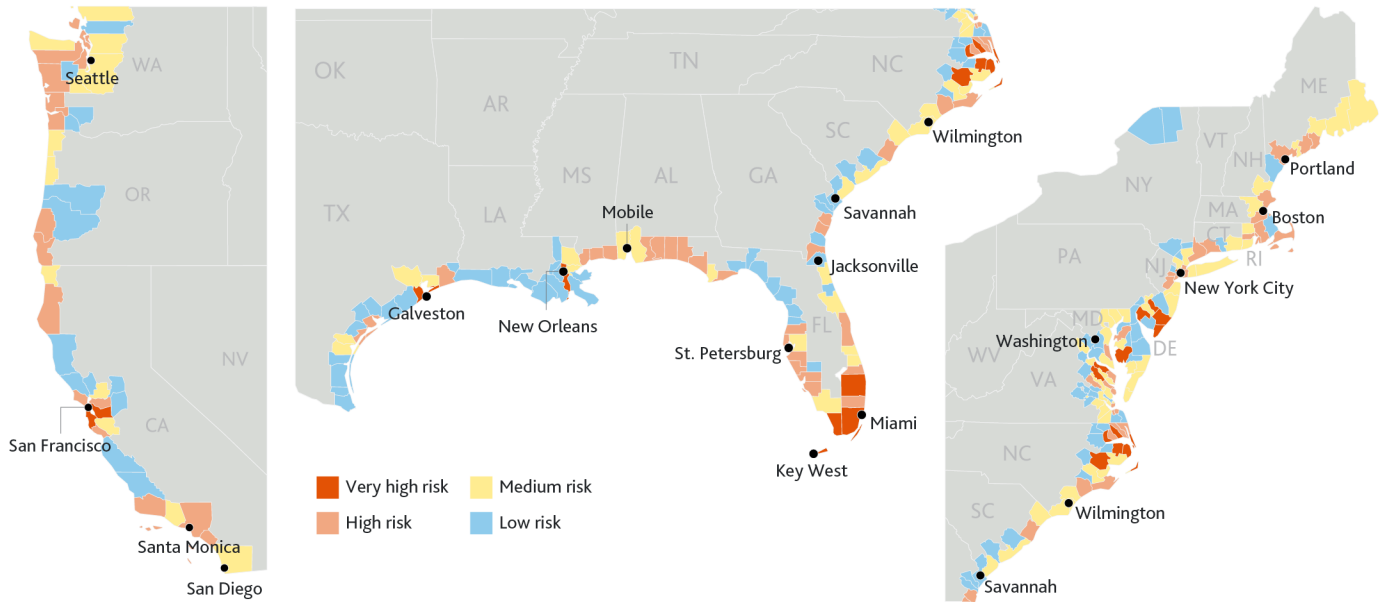
Four Twenty Seven estimates that by 2040 increased sea level rise will significantly affect every coastal state, the majority of coastal counties, and over 110 cities with a population of greater than 50,000. While many states and counties have a few decades to adapt to sea level rise, a number of areas with the highest risk (see blue box on Four Twenty Seven methodology in following page) already face frequent high-tide flooding and damaging storm surge. Without near-term adaptation efforts, which in some areas are underway, property value growth will likely diminish and the cost of property ownership will increase as insurance and adaptation costs reflect increasingly severe coastal conditions.⁵

By 2040, nearly 5% of coastal counties will fall within Four Twenty Seven's highest risk category with 26% and 35% in the high and medium risk categories, respectively (see Exhibit 2). Four Twenty Seven risk reflects population density, such that the greater the population density, the greater the risk. North Carolina leads with five counties with the highest exposure, followed by three in New Jersey, two in Virginia and one each in Maryland, Washington and Florida. Four Twenty Seven places nine cities in the highest risk category: [Miami Beach, Florida](#) (Aa2 stable); [Jupiter, Florida](#) (Aaa stable); Kenner, Louisiana; Camden, New Jersey; [Bayonne, New Jersey](#) (A3); [Galveston, Texas](#) (Aa3 stable); Alameda, California; and [San Mateo, California](#) (Aaa stable).

This publication does not announce a credit rating action. For any credit ratings referenced in this publication, please see the ratings tab on the issuer/entity page on www.moody.com for the most updated credit rating action information and rating history.

Exhibit 2

Risk from sea level rise at county level



Cities marked for informational purposes only. Risk is at the county level, meaning certain cities may have higher or lower exposure to sea level rise than their respective counties.
 Sources: *Four Twenty Seven* and *Moody's Investors Service*

Four Twenty Seven methodology

To project future sea level rise risk to 2040 (and thus exposure to coastal flooding), Four Twenty Seven uses Representative Concentration Pathway (RCP) 8.5 (see below). Four Twenty Seven uses the RCP 8.5 to project relative change from historical values of extreme water levels (sea level rise plus storm surge) and combines this with digital elevation models (DEM) and population data. Coastal cities and counties (those with at least a portion of land area within approximately three miles of the coastline) are evaluated for absolute and relative exposure to flooding based on the elevation of populated areas. Non-coastal cities and counties, those beyond three miles from the coastline, are considered not exposed to coastal flooding.

Categories of risk

- » Red flag (very high risk) – Populated areas highly exposed to coastal flooding;
- » High risk – Populated areas susceptible to some degree of coastal flooding in 2040 and/or already exposed to coastal flooding;
- » Medium risk – Populated areas under 10 meters above sea level; flooding is possible, but limited in extent; and
- » Low risk – Populated areas over 10 meters above sea level; flooding is unlikely.

Four Twenty Seven projections for sea level rise use RCP 8.5 up to approximately mid-century as the physical impacts of climate change are "locked in" due to historical accumulation of greenhouse gases and to account for tipping points and feedback loops. RCPs are standardized scenarios adopted by the United Nations' Intergovernmental Panel on Climate Change. RCPs incorporate an array of projection time frames, such as through the year 2100 (and in some cases beyond that time), and a wide range of assumed greenhouse gas emissions and concentrations.

Our base assumptions for sea level rise and climate change are outlined in [Climate scenarios vital to assess credit impact of carbon transition, physical risks](#).

Increased vulnerability to coastal flooding heightens credit risks

National, coastal state and coastal county economies and infrastructure are experiencing more frequent adverse effects from high-tide flooding and storm surge. Approximately 60% of national economic activity is produced in coastal states and a significant portion of coastal state economies is generated in a state's coastal counties (see Exhibit 3). On average approximately 10% of coastal county GDP is produced in the 100-year flood zone⁶, areas considered at significant risk of flooding.

Exhibit 3

Coastal county economic activity is critical to coastal states' economic health

Percent of state GDP from its coastal counties

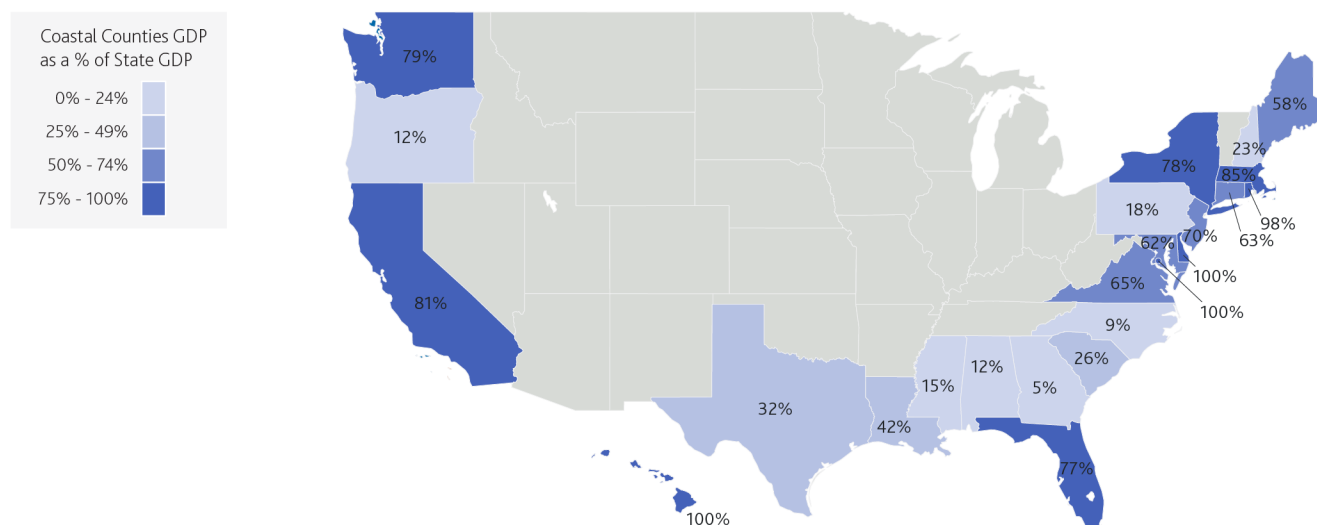


Exhibit based on 2014 data.

Sources: Moody's Investors Service, National Oceanic and Atmospheric Administration and US Bureau of Economic Analysis

Frequent flooding and storm surge disrupts local economies in many coastal areas. These disruptions have significant ripple effects on states when local coastal economies contribute a substantial portion of state economic activity. The states most dependent on coastal economic activity include [Hawaii](#) (Aa1 negative), [Delaware](#) (Aaa stable), [Rhode Island](#) (Aa2 stable), [Massachusetts](#) (Aa1 stable), [New York](#) (Aa1 negative), [Florida](#) (Aaa stable), [New Jersey](#) (A3 negative), [California](#) (Aa2 stable) and [Washington](#) (Aaa stable). Each of these states depends on coastal counties for 70% or more of their GDP. In this group, Florida stands out with 24% of its GDP within the 100-year flood zone while other states generate from 3% to 9% of their GDP in the 100-year flood zone. Areas in the 100-year flood zone have a 26% chance of flooding over the next 30 years, meaning a high probability of a flood impacting economic activity in flood-prone areas.⁷

While many local governments have historically managed flood risks, an increase in flood frequency and storm surge severity will pose challenges over the coming decades. Challenges have typically included short-term effects from damaged property and temporary closing of businesses and roads. As sea level rise continues, flood-prone coastal communities will face additional risks. These include potential degradation of municipal infrastructure from long-term inundation of saltwater, longer and more frequent closure of businesses in impacted areas, and out-migration of businesses and residents. As adaptation takes on greater urgency, relocation has the potential to become more frequent. In 2016, for the first time, a federal grant of \$48 million was used to relocate and resettle a community, Isle de Jean Charles, Louisiana, because of rising sea levels.⁸ Increased flooding and storm surge stand to strain local governments, slow their economies, reduce tax revenue and impair credit quality.

The economic and credit risks are substantial in states such as Florida, New Jersey and Virginia. Their vulnerable coastal areas, which are largely within the 100-year flood zone, generate material portions of overall state and individual county economic activity. For example, 52% of [Cape May County, New Jersey's](#) (Aa1 stable) economy is concentrated in the 100-year flood zone. In Virginia, the [City of Norfolk's](#) (Aa2 stable) economy is concentrated in the 100-year flood zone, at 20% of city economic activity. While [Texas](#) (Aaa stable) has a smaller portion (32%) of its statewide GDP tied to coastal counties versus many other states, [Harris County](#) (Aaa stable) contributes a significant 26% of state GDP. Sixteen percent of the county's GDP is generated in the 100-year flood zone. Several Florida counties also have very high economic dependence on areas in the 100-year flood zone. These include Monroe County (Florida Keys) with 90% of its economy concentrated in the 100-year flood zone, [Miami-Dade County](#) (Aa2 stable) at 47%, [Broward County](#) (Aaa stable) at 30% and [Hillsborough County](#) (Aaa stable) at 24%.⁹

Four Twenty Seven identifies approximately 274 counties that will be exposed to sea level rise by 2040. These coastal counties are home to 165 cities with populations over 50,000, 110 of which are projected to be significantly exposed to sea level rise by 2040, 63 of which are shown in Exhibit 4. Notably, [Honolulu](#) (Aa1 negative) and [Wilmington, Delaware](#) (Aa2 stable) face high risk of sea level rise and their respective counties' economic activity accounts for 76% of their respective state GDP.

Exhibit 4

Coastal economic activity is exposed to increasing risk of sea level rise

Exhibit shows cities' exposure to sea level rise and their respective counties' share of state GDP

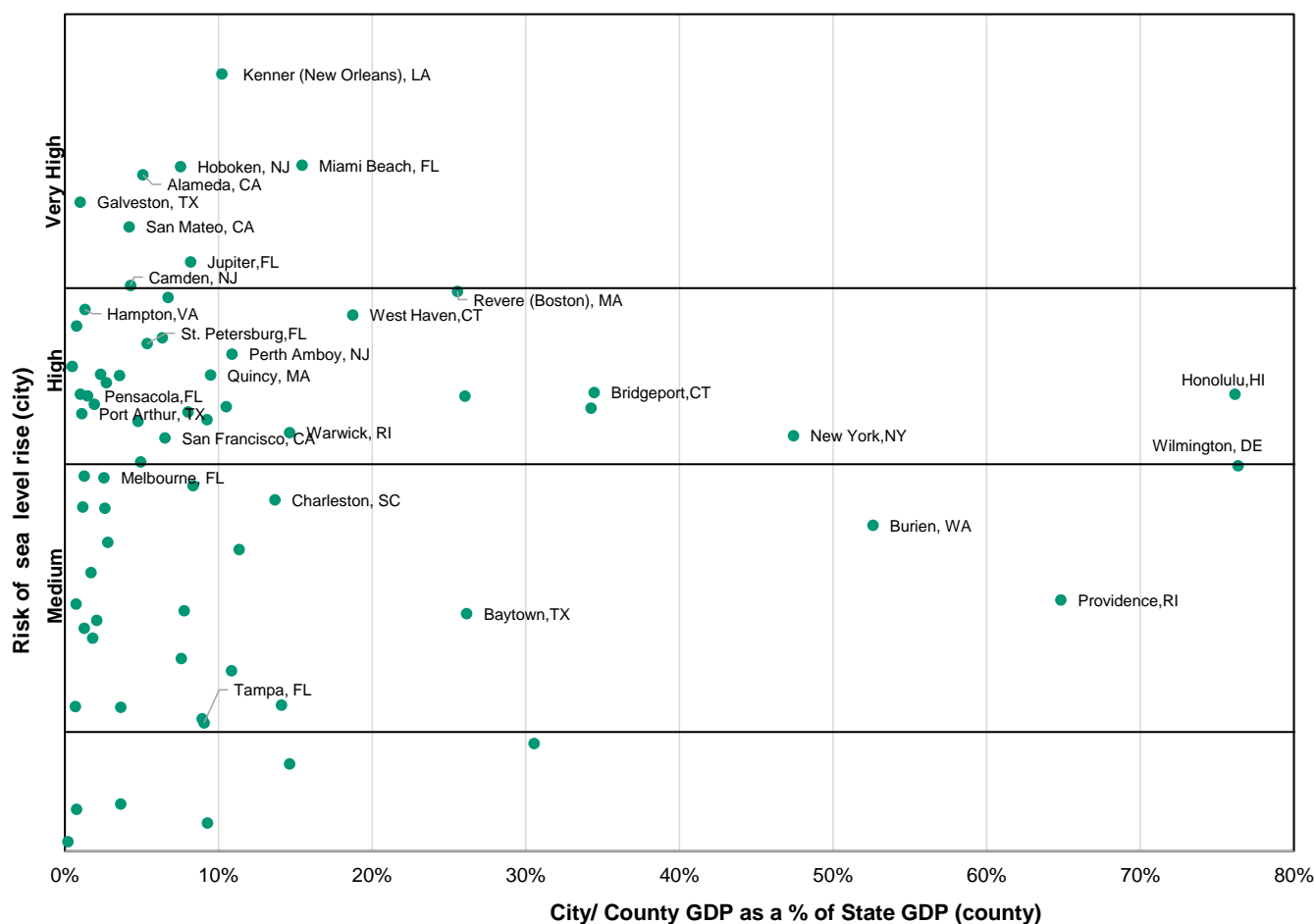


Exhibit uses a city's projected 2040 risk associated with sea level rise, according to Four Twenty Seven, and the city's respective county GDP. Exhibit GDP is from 2014. Cities with low exposure are not all shown in the exhibit.

Sources: Moody's Investors Service, Four Twenty Seven, National Oceanic and Atmospheric Administration and US Bureau of Economic Analysis

An economy highly concentrated in a coastal zone prone to flooding is subject to climate gentrification¹⁰ or migration from wealthy flood-prone areas to low wealth areas less prone to flooding. Climate gentrification is caused partly by insurance costs increasing and climate-change adaptation driving up coastal property ownership costs, making it unaffordable for some residents to stay in their homes. A recent report¹¹ from the actuarial firm Milliman, based on an analysis of housing data in Florida's Miami-Dade and Broward counties, concluded that, if county-level projections for sea level rise hold, substantial intraregional out-migration from areas with a high risk of flooding to sites with a lower risk will occur in the coming decades. Positively, this has the potential to increase property values in less flood-prone neighborhoods, while negatively, it displaces less-wealthy residents from their homes. Adaptation to rising sea levels will reduce flood-prone property vulnerability, counter growing social inequities and support local government credit quality.

Miami-Dade County in partnership with localities has developed the Resilient305¹² strategy to support the local economy and community by enhancing climate adaptation, addressing challenges in the most vulnerable neighborhoods and collaborating across political boundaries. Specific investments in the community include a capital plan commitment of \$500 million for flood control projects announced in 2015, which the City of Miami Beach is funding with local taxes and an increase in stormwater fees, as well as the City of Miami's \$400 million Miami Forever bond issuance in support of adaptation projects.

Banks writing mortgages in flood-prone areas are selling mortgages on homes with flood risk to government-backed entities at ever-increasing rates.¹³ The selling of mortgages to government-backed entities indicates a recognition by local banks that sea level rise increases mortgage risk, as well as their desire to reduce exposure to potentially flood-prone properties. A study published in 2019 by the National Bureau of Economic Research found overvalued homes in floodplains.¹⁴ It attributed this to flood risk not fully reflected in a home's price, largely because of a lack of information. Together these factors stand to reduce property values and economic activity if communities do not adapt.

As risks increase and information about them improves, property ownership costs will increase in coastal zones if state and local governments do not provide effective adaptation measures to protect residents, economic activity and infrastructure. Likewise, a local government's credit quality will reflect the effort or lack of effort to adapt to its changing risk profile and coastal location. In some cases, credit quality has the potential to deteriorate as sea levels rise and storm surges increase, especially where high-risk areas account for a high proportion of the tax base. Positively, many coastal counties and cities continue to address these risks by developing adaptation measures, which have largely protected credit quality so far. While still recovering from Hurricane Harvey, [Houston](#) (Aa3 stable), for example, will benefit from initiatives including \$2.5 billion in bond authorization by [Harris County](#) (Aaa stable) for flood control and multiple adaptation projects planned by the Army Corps of Engineers.

Many state and local governments also depend on business taxes to support government services and high-tide flooding reduces tax collections, especially in low-elevation waterfront municipalities. [Annapolis, Maryland](#) (Aa2 positive) serves as an example of how high-tide flooding stands to significantly affect business activity over time, including tourist traffic. The city's historic waterfront area, which attracts tourist traffic that contributes to the city's strong credit profile, is experiencing increased stress from high-tide flooding. A 2019 study¹⁵ indicates high-tide flooding reduces visits by 1.7% annually and that by 2100, without adaptation actions, annual visits could decline by 24%. The study indicates that for every 1% loss in visits, business revenue declines by 0.61% in the historic City Dock waterfront business district. Four Twenty Seven identifies the City Dock historic waterfront area as having "very high" exposure to flood risks by 2040. NOAA estimates the number of high-tide flood days at 170 by 2050, compared with the highest recorded 18 days in 2019. The city is actively engaged in a redevelopment and preservation plan with [Anne Arundel County](#) (Aa1 stable) to reduce threats from tidal flooding and storm surge based on sustainability criteria developed by the University of Maryland. Funding for the initiative is expected to come from the city, county and the [State of Maryland](#) (Aaa stable) through various programs.

Localities in Virginia's Hampton Roads region, encompassing Norfolk, nine other cities and six counties, are engaged in a multi-city adaptation effort, including strengthening infrastructure and addressing social inequities associated with high-tide flooding and storm surge. A Virginia Coastal Policy Center report¹⁶ concludes that without further adaptation measures by 2040, the amount of residential home damage resulting from a combination of severe storms and rising sea levels would increase to \$50 million from \$12 million annually and to \$100 million by 2060. Dangerous flooding, which has a 1% chance of occurring annually, would result in a decline of the regional GDP by \$1 billion by 2040 and \$2 billion by 2060 without adaptation, potentially threatening credit quality.

While many states and local governments are proactively addressing coastal flooding, sea level rise remains a material long-term credit risk. Migration away from flood-prone areas, modification of the National Flood Insurance Program, a change in flood-zone boundaries, Fannie Mae or Freddie Mac limits on buying mortgages of properties in flood zones and home values that don't adequately reflect risk all threaten to have a significant impact on local economies and property value growth rates. Adaptation, however, is a double-edged sword. On the one hand, it is expensive and has the potential, over time, to result in significant growth in leverage and fixed costs, while on the other hand, without it, rising sea levels have the potential to overwhelm local economies and tax bases.

Sea level rise adaptation efforts are credit positive, but are capital intensive and stand to increase leverage

Protecting developed areas from sea level rise and storm surge often involves large-scale capital projects that increase leverage for local governments. The financial capacity to take on debt, willingness and ability to raise taxes, and implementation of smart growth strategies will be critical to protecting vulnerable local economies and property values. The states, counties and cities best positioned to leverage their resources for adaptation to more frequent flooding have sizable and diverse tax bases, moderate leverage, policies that encourage smart growth and a willingness to coordinate with other local and state governments on large-scale projects and regional policies. Funding projects will be more difficult for local governments with elevated leverage (see Exhibit 5).

Exhibit 5

Cities and counties with modest leverage likely have greater financial flexibility to fund sea level rise adaptation projects

Exhibit shows cities' exposure to sea level rise and their respective counties' overlapping debt to full value ratio (a measure of leverage)

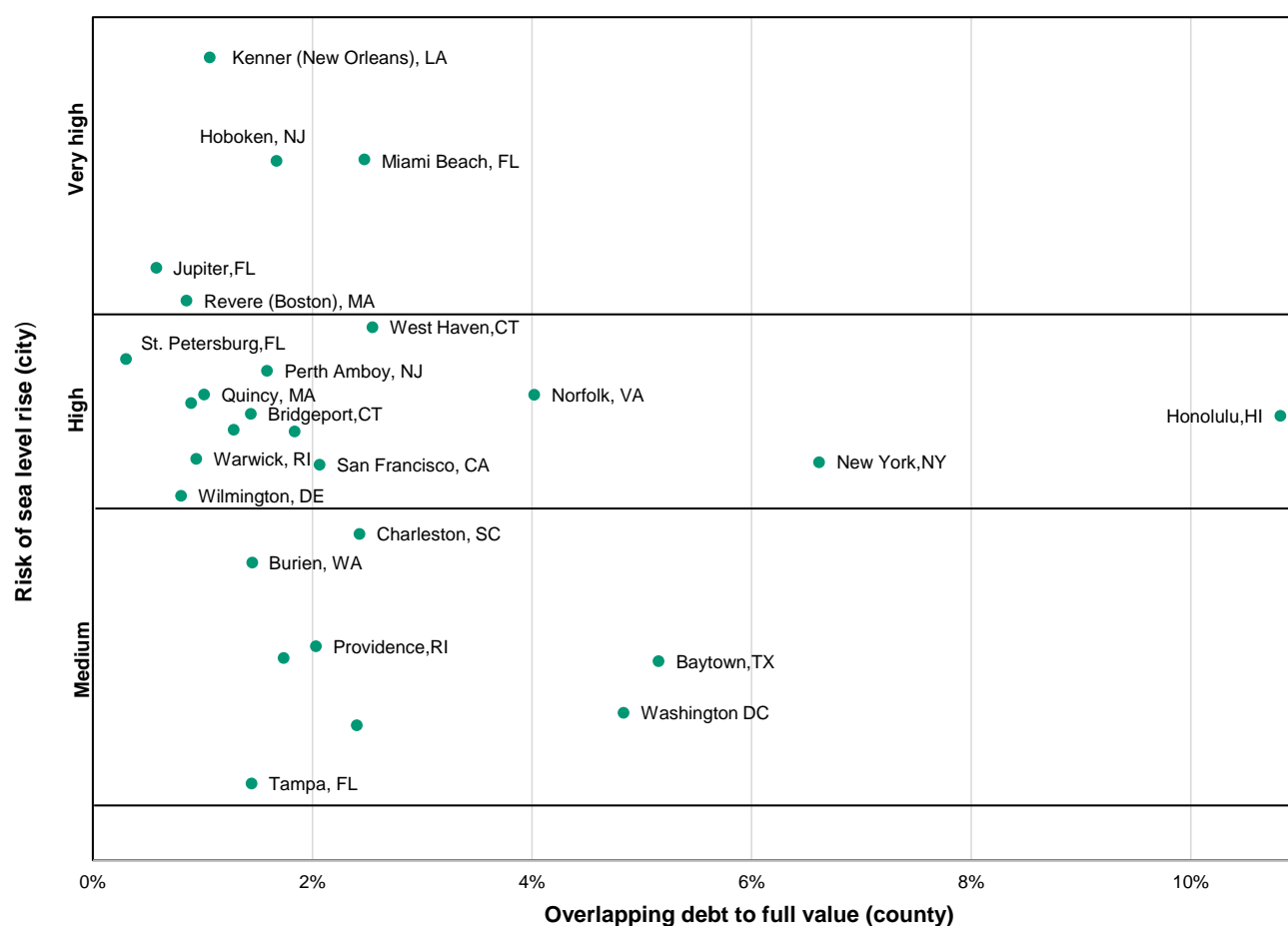


Exhibit uses the city's projected 2040 risk associated with sea level rise, according to Four Twenty Seven. Cities with low exposure are not all shown in the exhibit. Overlapping debt is the aggregate of municipal, school district and county debt within a county divided by the full property value of the county.

Sources: Moody's Investor's Service, audited financial statements and Four Twenty Seven

Many localities are considering large-scale capital projects to protect against damage from storm surge and sea level rise. However, coronavirus-induced budget challenges may delay them. Initiatives include [New York City](#) (Aa1 negative) Mayor Bill de Blasio's proposed Plan to Climate Proof Lower Manhattan at an estimated cost of \$10 billion.¹⁷ Early in 2020, [Boston](#) (Aaa stable) Mayor Marty Walsh indicated the city will spend \$30 million annually on sea level rise adaptation.¹⁸ In [Charleston, South Carolina](#) (Aaa stable), the Army Corps of Engineers estimates that protecting the peninsula from rising sea levels could cost over \$1.7 billion.¹⁹ The proposed plan,

which would be partially funded with federal assistance, calls for installation of a new storm surge wall and other projects. The ability to fund adaptation projects will be critical to localities' maintaining credit quality in the coming decades.

Capacity to increase leverage and raise taxes to meet debt service in order to fund capital projects will be critical to a local government's ability to fund adaptation efforts. As local governments consider how to deploy their resources, they face competing priorities between investing in adaptation, increasing pension and retiree healthcare contributions, funding community services and supporting other priorities. The coronavirus-driven economic slowdown has eroded local and state government revenue while unfunded pension liabilities have continued to grow. How governments manage competing spending priorities and maintain reasonable debt levels amid growing exposure to the effects of sea level rise will be critical to credit quality.

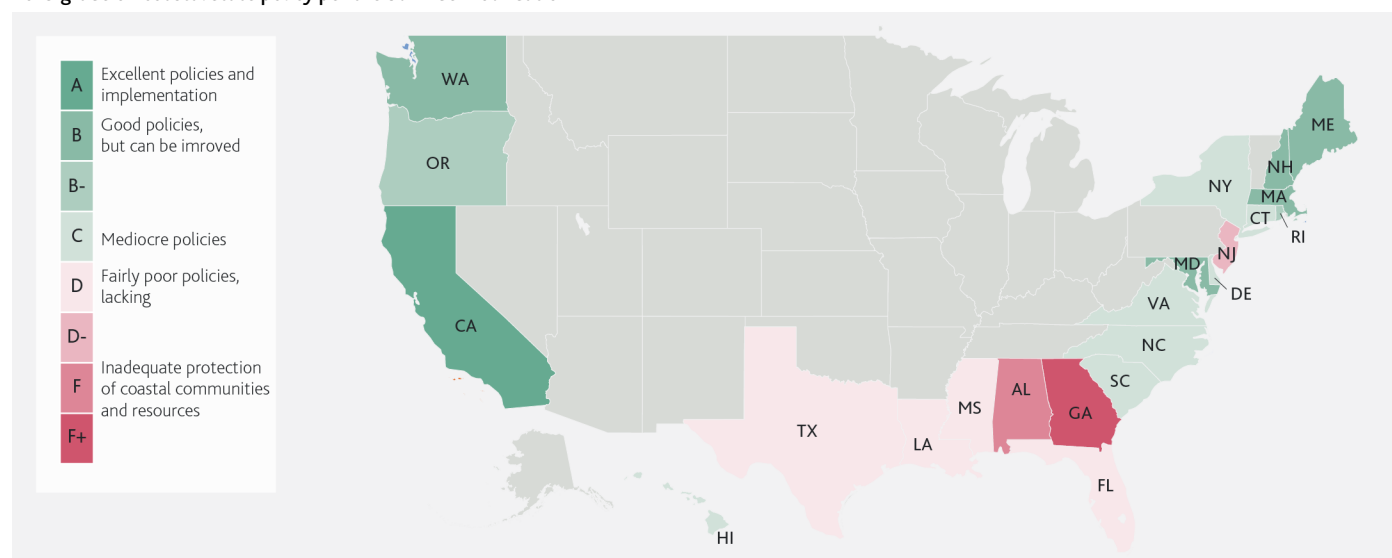
Coordinated efforts between the federal, state and local governments will reduce threats from sea level rise

How state and local governments respond to rising sea levels in coordination with the federal government will have a potential impact on state and local credit quality. Policy and strategic coordination, as well as sharing financial burdens, will be key to managing risk. Federal government strategic and financial support will become increasingly important to managing coastal flooding threats given the scale of need along the nation's coastline.

Robust regulations at the state level set the framework for local governments. Many states have improved their regulations in response to high-tide flooding and storm surge; however, there is limited research providing a comprehensive evaluation of state regulations. One such evaluation, provided by the Surfrider Foundation, a not-for-profit environmental advocacy organization, compares all coastal state regulations and evaluates state policies and planning relative to the Coastal Zone Management Act (CZMA).⁴⁰ The Surfrider Foundation provides one perspective on state legislation across coastal states. The organization provides a [grade for each state](#) based on how its current legislation responds to CZMA guidance regarding sediment management, coastal armoring, development and sea level rise (see Exhibit 6).

Exhibit 6

Research suggests Gulf coast states and New Jersey have the weakest policies addressing sea level rise
2019 grade on coastal state policy per the Surfrider Foundation



Source: Surfrider Foundation, 2019

The Atlantic Coast states from Virginia north have been proactive at tackling the effects of sea level rise and storm surge event risk. Statewide regulations generally exist, but local coordination remains limited in many areas. New Jersey, one of the states most exposed to sea level rise and storm surge, lags its neighboring states in addressing sea level rise at a state level, according to the Surfrider Foundation (see Exhibit 6 above). However, early this year, the governor of [New Jersey signed an executive order](#) directing

the state Department of Environmental Protection to write new regulations to integrate climate change into the state's regulatory and permitting process, similar to other states.

In Florida, modest amounts of planning has begun at the state level, but significant hurdles remain. At the regional and local levels, proactive examples include The Southeast Florida Regional Climate Change Compact. This provides for coordination across multiple local governments on initiatives such as planning and funding programs aimed at managing the expected 1-foot or more of sea level rise by 2050. However, Florida and Georgia, continue to have poor policies compared to other states along the Atlantic Seaboard that are grappling with sea level rise.

Research shows that the Gulf Coast states lag other areas in the effectiveness of state-level policies protecting against the effects of sea level rise and storm surge. The potential result: local governments will be left to largely manage the adaptation costs and other burdens posed by sea level rise themselves. And the lack of state oversight and vision will likely continue to leave communities vulnerable to substantial flood damage, putting their credit quality at risk. Texas A&M University research on coastal resilience indicates only Florida and [Louisiana](#) (Aa3 stable) mandate state building codes for areas on the coast. Texas has no state-mandated building code for residential or commercial structures in a municipality, leaving it to the local entities to adopt and implement them, though they are not required.

West Coast states are generally at moderate risks of coastal flooding. Local governments in California benefit from the California Coastal Commission, which helps coordinate land-use planning efforts. California has some of the most stringent regulations when it comes to managing the coastline and protective actions against sea level rise. However, a number of areas remain at risk and significant adaptation efforts will be critical for many communities.

Federal government leadership and increased funding will be vital to sea level rise adaptation efforts

An active federal government through leadership and funding will become increasingly critical to assist state and local governments in managing threats from sea level rise and storm surge at a level commensurate with the challenges. Historically, the federal government has taken a supporting role and provided state and local governments with funding, policy help and project implementation at their request. The federal government taking a leading role in implementing policies and ensuring funding of programs and agencies to address the risks of sea level rise would benefit states and local governments.

The National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA), provides over 5 million flood insurance policies in 22,000 communities and over \$1.3 trillion in coverage while collecting about \$4.6 billion in annual fees. The NFIP supports property values through its role as the primary provider of flood insurance, which is required for all federally backed mortgages.²¹ Participation in the NFIP is optional for local governments though widely used. The program's balance sheet, however has weakened with the increased frequency and severity of storms and flood damage. As of December 2019, the Congressional Research Service indicated Congress canceled \$16 billion of NFIP debt in 2017 to make it possible for the program to pay claims. That marked the first time in history that the NFIP's debt was canceled; program debt totals \$21 billion, with \$9.9 billion of borrowing capacity remaining. As the frequency and scale of coastal flooding grows, NFIP's role will grow. One response to the challenges is the NFIP's new risk model expected in October 2021 that is not based on the 100-year flood zone, which it currently uses, but on individual property risk.²² This change has the potential to increase premiums and, in turn, reduce home values. Local governments with many properties impacted by substantially increased insurance rates stand to endure weaker tax bases over time if property valuation growth slows as insurance and adaption costs increase.

According to the Congressional Research Service, grants under the Coastal Zone Management Act (CZMA), which provides policy guidance and funding to manage coastal resources, have totaled a very modest \$2 billion since enactment, spread across 34 states.²³ In 2016, the US Government Accountability Office concluded that the CZMA had a "limited role in project-level planning central to helping increase protection of marine coastal ecosystems to climate change, because state and local governments are primarily responsible for managing their coastlines."²⁴ Increased funding and greater federal leadership that recognizes sea level rise is a national challenge, not just a state or a local one, and would benefit all levels of government.

The Army Corps of Engineers (ACE) is the primary government agency providing assessment, solutions and construction of large-scale adaptation projects to protect coastal zones from flooding and storm surge. However, state and local governments must request its assistance and are required to match funds up to 35% of project costs, limiting the ability of many state and local governments to take

advantage. Additionally, ACE is limited by its capacity. Unless the federal government invests in expanding ACE's efforts to combat sea level rise and storm surges, a project backlog will remain. A Congressional Research Service report from 2018 identified a \$98 billion backlog of construction projects that have authorization. The report further indicates that annual appropriations for construction funding are just over \$2 billion annually,²⁵ a modest amount given the backlog of authorized projects. For example, challenges include, ACE's NY & NJ Harbor & Tributaries Area Feasibility Study on how to provide protection of the New York City Harbor region from sea level rise and storm surge has been "postponed indefinitely"²⁶ due to budget constraints. This stands to delay adaptation efforts in the New York and New Jersey area at a time when sea level rise is accelerating.

FEMA administers multiple programs that help state and local governments address sea level rise and storm surge, but funding for pre-disaster adaptation is modest compared to the need. FEMA support will be increasingly critical as the federal, state and local governments aim to address sea level rise in a timely manner and offset the impact of the increased frequency in high-tide flooding and storm surge. Yet FEMA has historically appropriated only a small amount of its budget to pre-disaster mitigation. The Pew Charitable Trusts indicates that between 2007 and 2016, FEMA provided \$8.3 billion in mitigation grants, with only 6% going to pre-disaster mitigation funding.²⁷ While pre-disaster mitigation funding has increased since 2016, the need continues to increase, leaving coastal areas' tax bases and residents vulnerable to sea level rise.

Moody's related publications

Methodology

- » [General Principles for Assessing Environmental, Social and Governance Risks](#), January 9, 2019

Sector In-Depth

- » [Local government - US: Cities' heightened focus on mitigating climate risk is credit positive](#), January 17, 2019
- » [Local government - US: Growing exposure to heat stress mitigated by economic and fiscal strengths](#), September 24, 2019
- » [Local government - US: Farm-based local governments will maintain credit quality, though climate risks loom](#), May 19, 2020
- » [Regional & Local Governments: France: Higher flooding frequency adversely affects revenue and expenditure](#), April 18, 2018
- » [Environmental - Sovereigns: Credit profiles of small, agriculture-reliant sovereigns most susceptible to climate change risk](#), May 15, 2018
- » [Environmental: Global Heat map: 11 sectors with \\$2.2 trillion debt have elevated environmental risk exposure](#), September, 25 2019
- » [Environmental: Evaluating the impact of climate change on US state and local issuers](#), November 28, 2017
- » [ESG - Global: Climate scenarios vital to assess credit impact of carbon transition, physical risks](#), March 10, 2020
- » [Electric Utilities and Power Companies - US: Nuclear operators face growing climate risk but resiliency investments mitigate impact](#), August 18, 2020
- » [Real Estate - US: REITs can manage climate risk, investments needed to address growing challenges](#), September 1, 2020
- » [Sovereigns - Global: Sea level rise poses long-term credit threat to a number of sovereigns](#), January 16, 2020
- » [Cross-Sector - US - Housing and Housing Finance: Climate change risks present challenges for housing related sectors](#), April 16, 2019
- » [State and local government - US: Increasing HUD's role in administering disaster relief funds brings credit challenges](#), September 23, 2019

Issuer In-Depth

- » [District of Columbia and New York City: Large East Coast cities step up efforts to confront growing climate risks and reduce potential credit stress](#), September 6, 2018
- » [Despite climate risk and hurricane damage, Florida and Texas maintain strong credit quality](#), February 8, 2018
- » [Local government - Virginia: Credit quality likely to remain healthy despite high debt burdens](#), October 19, 2018

Sector Comment

- » [State and Local Government - New Jersey: Proposed overhaul of land use rules will reduce climate risk vulnerability](#), February 14, 2020
- » [ESG - California: Public safety power shutoffs highlight links between environmental and social risks](#), October, 28, 2019
- » [Local Government - Texas: Voter approval of ballot measure to help local governments lessen flood damage is credit positive](#), November 7, 2019
- » [Local government - California: Wildfires amid pandemic compound social and economic risks, but unlikely to hurt credit quality](#), August, 26, 2020

Endnotes

- 1 High-tide flooding, which is also referred to as "nuisance flooding" or "sunny day flooding," leads to public inconveniences such as road closures, overwhelms storm drains and compromises infrastructure. It is distinct from storm surges, though they can overlap.
- 2 The Four Twenty Seven analysis cited in this report is based on data from 274 coastal counties. The data does not include Alaska or counties in the Great Lakes region. It includes 165 cities. Multiple counties have cities over a population of 50,000. Our analysis uses 110 cities of the 165. The 110 cities represent the city with the highest risk profile in each county.
- 3 ["What is Smart Growth,"](#) Environmental Protection Agency
- 4 ["2019 State of U.S. High Tide Flooding with a 2020 Outlook,"](#) NOAA Technical Report NOS CO-OPS 092, July 2020
- 5 ["Assessing Exposure to Climate Change in U.S. Munis,"](#) Four Twenty Seven, May 2018
- 6 The National Flood Insurance Program defines the 100-year flood zone as an area where there is a 1% chance of a flood occurring in any given year; however, during the span of a 30-year mortgage, a home in the 100-year flood zone has a 26% chance of being flooded at least once during those 30 years. NOAA calculates the 26% based on probability theory that accounts for each of the 30 years having a 1% chance of flooding.
- 7 ["Total Economy for Coastal US States and Territories,"](#) Bureau of Economic Analysis, Bureau of Labor Statistics, NOAA Office for Coastal Management, Moody's Investors Service, 2014
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