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Report to Congressional Requesters

September 2019

COAST GUARD SHORE INFRASTRUCTURE

Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework

GAO-19-675

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GAO Highlights

Highlights of GAO-19-675, a report to congressional requesters

Why GAO Did This Study

The Coast Guard, within DHS, owns or leases more than 20,000 shore facilities such as piers, boat and air stations, and housing units at over 2,700 locations. This infrastructure is often positioned on coastlines where it is vulnerable to damage from extreme weather. Noting the importance of protecting critical infrastructure from such risks, in 2013 DHS updated its risk management guidance for enhancing infrastructure resilience—which is the ability to prepare and plan for, absorb and recover from, or successfully adapt to adverse events.

GAO was asked to review Coast Guard efforts to improve the resilience of its shore infrastructure. This report (1) describes Coast Guard actions to improve shore infrastructure resilience since 2005, and (2) examines the extent to which its processes to improve shore infrastructure resilience follow DHS's key steps for critical infrastructure risk management. GAO reviewed and analyzed Coast Guard guidance and data on assessed infrastructure and interviewed Coast Guard officials. GAO also compared Coast Guard policies, procedures, and actions to manage shore infrastructure against DHS's framework for managing risks to critical infrastructure.

What GAO Recommends

GAO recommends that the Coast Guard revise its processes for improving shore infrastructure resilience to more fully align with key steps of the DHS critical infrastructure risk management framework. This should include, for example, identifying critical infrastructure, assessing risks, and implementing risk management activities. DHS concurred with our recommendation.

View GAO-19-675. For more information, contact Nathan Anderson at (202) 512-3841 or AndersonN@gao.gov.

What GAO Found

Since 2005, the U.S. Coast Guard's main actions to improve resilience have been to repair or rebuild shore infrastructure to higher building standards after it has been damaged by extreme weather events. The Coast Guard has received more than $2 billion in supplemental appropriations since 2005 to improve resilience after severe storms (see figure). The Coast Guard has also developed new guidance requiring that repairs and new construction meet higher building standards to make it more resilient. Further, in 2015, the Coast Guard began an assessment of certain occupied buildings to identify their vulnerabilities to ten natural hazards, such as hurricanes and earthquakes. As of 2018, this assessment covered approximately 16 percent of the Coast Guard's shore infrastructure. The Coast Guard aims to complete the assessment in 2025.

Coast Guard Station Sabine Pass, Texas, Rebuilt to Be More Resilient in 2013

Station Sabine Pass, damaged by Hurricane Ike in 2008.

Station Sabine Pass, rebuilt in 2013 to withstand wind speeds up to 130 mph.

Source: U.S. Coast Guard. | GAO-19-675

Coast Guard processes to improve shore infrastructure resilience do not fully align with the Department of Homeland Security's (DHS) key steps for critical infrastructure risk management. These steps are described in DHS's Critical Infrastructure Risk Management Framework, which recommends that DHS components, among other things, identify critical infrastructure, assess risks, and implement risk management activities. While the Coast Guard has identified some vulnerable shore infrastructure through its ongoing assessment, it has not identified all shore assets that may be vulnerable, such as piers and runways; or assessed operational risks affecting its ability to complete missions with these assets. In addition, the Coast Guard has not taken steps to develop mitigation strategies for buildings already identified as vulnerable. Moreover, Coast Guard data show a growing backlog of at least $2.6 billion in recapitalization, new construction, and deferred maintenance projects that compete for finite funding. However, Coast Guard officials were unable to verify that they have consistently selected projects to also enhance resilience. Coast Guard officials stated that they have not used the DHS framework and have instead focused on implementing their ongoing vulnerability assessment. Fully aligning its processes with the DHS framework would better position the Coast Guard to reduce its future fiscal exposure to the effects of extreme weather events.

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Abbreviations

CVI	Coastal Vulnerability Index
DHS	Department of Homeland Security
DOD	Department of Defense
FEMA	Federal Emergency Management Agency
NIPP	National Infrastructure Protection Plan
NOAA	National Oceanographic and Atmospheric Administration

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September 25, 2019

The Honorable Sam Graves
Ranking Member
Committee on Transportation and Infrastructure

The Honorable John Thune
United States Senate

The Honorable John Garamendi
House of Representatives

The Honorable Duncan Hunter
House of Representatives

The U.S. Coast Guard, within the Department of Homeland Security (DHS), is the principal federal agency charged with ensuring the security and safety of the high seas and other waters subject to U.S. jurisdiction. To help carry out its missions, the Coast Guard owns or leases more than 20,000 shore facilities—such as piers, boat stations, air facilities, and housing units—at more than 2,700 locations. However, this infrastructure is often positioned along the nation's coastlines and can be vulnerable to damage from extreme weather and other natural disasters, such as hurricanes, earthquakes, and tsunamis.

Hurricanes have destroyed or severely damaged multiple Coast Guard facilities, leaving them unable to support mission objectives. For example, hurricanes Katrina, Rita, and Wilma in 2005 caused significant damage to Coast Guard facilities, and repairing this damage required an appropriation of $266 million. More recent hurricanes, such as Harvey, Irma, and Maria in 2017 have also severely damaged Coast Guard facilities. Such events recently prompted Congress to direct the Coast Guard to identify natural disaster risks and develop a plan to mitigate the identified risks and improve the resiliency of stations.[1] Further, the effects of climate change may continue to damage infrastructure in the future and result in increased costs to the Coast Guard. According to the U.S. Global Change Research Program's *Fourth National Climate Assessment*, the

[1]H.R. Conf. Rep. No. 116-9, at 487 (2019), accompanying the Consolidated Appropriations Act, 2019, Pub. L. No. 116-6, 133 Stat. 13.

observed and projected effects of climate change include increases in the incidence of extremely high temperatures, heavy precipitation events, and high tide flooding events along the coastline.[2] The assessment states that such effects are already being felt in the United States and are projected to intensify in the future.

Over many years, we and others, such as the National Academies of Sciences, Engineering, and Medicine (National Academies), have reported on climate change issues.[3] We have recommended enhancing climate resilience as one strategy to help limit the federal government's fiscal exposure to disasters related to climate change.[4] While enhancing climate resilience can create additional costs up front, it could also reduce potential future costs resulting from climate-related events. For example, in a 2018 report, we found that investments in disaster resilience reduced the damage and costs of subsequent severe weather events such as hurricanes Harvey, Irma, and Maria.[5] Similarly, the Congressional Budget Office reported in April 2019 that the federal government could reduce the damage caused by natural disasters by increasing the stringency of building codes, by for example, requiring elevated buildings or placing heating and cooling equipment on roofs in areas that are at risk of flooding from extreme weather events.[6]

DHS also recognized the importance of protecting critical infrastructure from these and other risks. In 2013, it updated its National Infrastructure

[2]Jay, A.,D.R. Reidmiller, C.W. Avery, D. Barrie, B.J. DeAngelo, A. Dave, M. Dzaugis, M. Kolian, K.L.M. Lewis, K. Reeves, and D. Winner, 2018: Overview. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, D.C.

[3]See, for example, GAO, *High Risk Series: Substantial Efforts Needed to Achieve Greater Progress on High-Risk Areas*, GAO-19-157SP. (Washington, D.C.: Mar. 6, 2019). The National Academies, Committee on Increasing National Resilience to Hazards and Disasters and Committee on Science, Engineering, and Public Policy, *Disaster Resilience: A National Imperative* (Washington, D.C.: 2012). The National Academies of Sciences, Engineering, and Medicine defines resilience as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

[4]GAO-19-157SP.

[5]GAO, *2017 Hurricanes and Wildfires: Initial Observations on the Federal Response and Key Recovery Challenges*, GAO-18-472, (Washington, D.C.: Sept 4, 2018).

[6]Congressional Budget Office, *Expected Costs of Damage From Hurricane Winds and Storm-Related Flooding,* (Washington, D.C: April 10, 2019).

Protection Plan (NIPP) guidance for critical infrastructure owners and operators to emphasize security and resilience as the primary aim of homeland security planning efforts for critical infrastructure.[7] As part of the NIPP, DHS established a five step risk management framework for assessing critical infrastructure (DHS Critical Infrastructure Risk Management Framework) and recommended that owners and operators of critical infrastructure, whether private or public, use the framework to identify priorities, articulate clear goals, mitigate risk, measure progress, and adapt based on feedback and the changing environment.

You requested that we assess Coast Guard actions and processes to improve the resilience of its shore infrastructure to better manage future damage from extreme weather events. In this report, we (1) describe actions the Coast Guard has taken since 2005 to improve the resilience of its shore infrastructure to natural disasters, and (2) examine the extent to which Coast Guard processes to improve shore infrastructure resilience to natural disasters align with key steps from the DHS Critical Infrastructure Risk Management Framework.

For both objectives, we obtained data from the Coast Guard on the locations and replacement value of its infrastructure[8] as well as the scope, methodology, and results of the shore infrastructure vulnerability assessment the Coast Guard conducted from 2015 through 2018.[9] We also reviewed our prior work on the Coast Guard's shore infrastructure

[7]Department of Homeland Security, *National Infrastructure Protection Plan (NIPP) 2013: Partnering for Critical Infrastructure Security and Resilience* (Washington, D.C.: 2013). In accordance with the Homeland Security Act of 2002, Pub. L. No. 107-296, § 201(d)(5), 116 Stat. 2135, 2146 and Homeland Security Presidential Directive/HSPD-7, DHS released the NIPP in 2006, which it updated in 2009 and 2013. The NIPP defines critical infrastructure as "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." The NIPP recommends infrastructure owners and operators take action to support risk management planning and investments by building increased resilience and redundancy into business processes and systems to reduce vulnerabilities to natural disasters among other risks.

[8]This review excludes Waterways Operations (which includes fixed and floating aids to navigation and signal equipment)—a segment of shore infrastructure that includes different types of assets used to mark federal waterways to safeguard maritime safety and commerce.

[9]The report on the vulnerability assessment results was signed in 2019. See U.S. Coast Guard, Shore Infrastructure Vulnerability Assessment Phase 1 Findings: Risks to Coast Guard People & Operations, Washington, D.C.: March 4, 2019).

where we examined its Procurement, Construction, and Improvements backlog of projects from fiscal years 2012 through 2018, as well as its depot-level maintenance backlog as of March 2018.[10] Where applicable, we updated that information with the most recent available information for this report. We assessed the reliability of the Coast Guard's data by interviewing agency officials responsible for maintaining these data, and reviewed documentation, such as database manuals, to understand the procedures for entering and maintaining the data. We determined that the data were sufficiently reliable for the purposes of reporting on the replacement value and locations of Coast Guard infrastructure. For both objectives, we also reviewed budget documents, such as the Congressional Budget Justifications for fiscal years 2012 through 2020, to examine how the Coast Guard budgeted for its Procurement, Construction, and Improvements funds.

To identify Coast Guard actions since 2005[11] to improve the resilience of its shore infrastructure to natural disasters, we reviewed Coast Guard documents, including guidance on shore facility planning,[12] a study on Coast Guard resiliency reconstruction efforts following Hurricanes Katrina, Ike, and Sandy,[13] four annual reports on the Coast Guard's shore

[10]GAO, *Coast Guard Shore Infrastructure: Applying Leading Practices Could Help Better Manage Project Backlogs of at Least $2.6 Billion*, GAO-19-82, (Washington, D.C.: Feb. 21, 2019). Procurement, Construction, and Improvements funds provide for the acquisition, procurement, construction, rebuilding, and improvement of shore facilities and military housing, as well as vessels, aircraft, and other assets. Depot-level maintenance is non-recurring major maintenance beyond the capability and authority of a local Coast Guard unit to execute. Data from March 2018 was the most recent available at the time we requested information about the depot-level maintenance backlog.

[11]We selected 2005 as the starting point for our review because, according to the National Oceanic and Atmospheric Admiration's National Hurricane Center, nine of the ten tropical cyclones that caused the greatest damage to the United States in terms of cost occurred between 2005 and 2017, and Hurricane Katrina in 2005 was the costliest tropical cyclone. Additionally, as previously noted, Hurricanes Katrina, Wilma, and Rita in 2005 caused significant damage to Coast Guard facilities.

[12]Bonner, CAPT G.G. "Shore Facilities Planning Factors Job Aid," Shore Infrastructure Logistics Center. Feb. 23, 2017. *Civil Engineering Manual*. United States Coast Guard, COMDTINST M11000.11B (May 2014).

[13]CAPT John Healy, et al. *"U.S. Coast Guard (USCG) Hurricanes Katrina, Ike, and Sandy Resiliency Reconstruction,"* in *American Society for Civil Engineers 14th Triennial International Conference,* (New Orleans, LA, 2016).

infrastructure for 2015 through 2018,[14] the Coast Guard's Congressional Budget Justifications for fiscal years 2012 through 2020, and related laws.[15] We also reviewed Coast Guard documentation on building planning and the restoration of facilities damaged or destroyed by hurricanes.[16] We interviewed Coast Guard Headquarters and field officials responsible for civil engineering, risk management, and shore infrastructure planning. We also interviewed personnel from the Coast Guard's Facilities Design and Construction Center, a unit responsible for, among other things, designing Coast Guard buildings, and ensuring they comply with relevant buildings codes and engineering standards.

To evaluate the extent to which Coast Guard processes to improve shore infrastructure resilience to natural disasters align with key steps from the DHS Critical Infrastructure Risk Management Framework, we analyzed Coast Guard and DHS guidance, manuals, plans, and studies related to resilience processes. We verified with Coast Guard officials that these documents described all elements of the Coast Guard's processes to improve shore infrastructure resilience. We also interviewed officials from Coast Guard Headquarters and the Shore Infrastructure Logistics Center to obtain their perspectives on Coast Guard actions to improve the resilience of its shore facilities. We assessed the Coast Guard's processes to improve shore infrastructure resilience against the five key steps of the DHS Critical Infrastructure Risk Management Framework: (1) set goals and objectives, (2) identify infrastructure, (3) assess and analyze risks, (4) implement risk management activities, and (5) measure effectiveness.

[14]The Coast Guard did not produce annual reports for years prior to 2015. United States Coast Guard, *Shore Infrastructure Logistics Center 2015 Annual Report* (2015); United States Coast Guard, *Shore Infrastructure Logistics Center 2016 Annual Report* (2016); United States Coast Guard, *Shore Infrastructure Logistics Center 2017 Annual Report* (2017); United States Coast Guard, *Shore Infrastructure Logistics Center 2018 Annual Report* (2018).

[15]Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, 2006, Pub. L. No. 109-148, 119 Stat. 2680 (2005). Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006, Pub. L. No. 109-234, 120 Stat. 418 (2006). Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009, Pub. L. No. 110-329, 122 Stat. 3574 (2008). Disaster Relief Appropriations Act, 2013, Pub. L. No. 113-2, 127 Stat. 4 (2013). Bipartisan Budget Act, 2018, Pub. L. No. 115-123, 132 Stat. 64 (2018). Additional Supplemental Appropriations for Disaster Relief Act, 2019, Pub. L. No. 116-20, 133 Stat. 871 (2019).

[16]U.S. Coast Guard, *2017 Hurricane Supplemental – Adjusted Planning Factors Response* (Washington, D.C.: December 21, 2018).

We conducted this performance audit from July 2018 to September 2019 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Coast Guard Shore Infrastructure

The Coast Guard owns or leases more than 20,000 shore facilities consisting of various types of buildings and structures. According to Coast Guard guidance, a building is generally defined as a fully enclosed structure that is affixed to the ground, in which personnel work or live, or where equipment is stored. A structure is generally defined as any other construction affixed to the ground that does not meet the definition of a building.[17] The Coast Guard's shore infrastructure is organized into 13 asset types, known as asset lines.[18] Table 1 provides information on 11 of these asset lines, including examples, numbers of assets, and their replacement value as of 2018.[19]

[17]For example, buildings include regional operations centers, aircraft hangars, and houses. Structures include helicopter landing pads, docks, and aircraft runways.

[18]The Coast Guard's five product lines and the thirteen asset lines within them are: (1) Tactical Operations—Aviation, Waterfront, Shore Operations; (2) Mission Support—Civil Works, Base Services, Industrial; (3) Mission Readiness—Housing, Community Services, Training; (4) Strategic Operations—Sector/District, Technology; and (5) Waterways Operations—Fixed and Floating Aids to Navigation, Marine Environmental Response and Signal Equipment.

[19]The Coast Guard defines the replacement value of a building or structure as the amount estimated to be needed to completely replace the asset, not including the land it resides on or personal property within it. The Coast Guard's 2018 data was the most recent information available at the time of our review.

Table 1: Number of Assets and Replacement Values of Select Coast Guard Shore Infrastructure Asset Lines for Fiscal Year 2018

Asset Line	Examples of assets	Number of assets	Replacement Value ($)
Civil works	Utility distribution, water lines, pipelines, fuel storage	6,665	1,871,695,931
Base services	Vehicle garages, parking, hazardous materials storage	4,180	880,425,200
Housing	Housing	2,901	2,922,645,848
Technology	Communication towers, vessel traffic service, Rescue 21[a]	1,910	835,495,120
Waterfront	Piers, wharfs, boathouses, small boat lifts	1,577	2,493,516,056
Community services	Medical, dining, physical fitness and recreation	1,135	1,393,797,869
Shore operations	Stations, maintenance buildings, cutter support operations	1,056	1,950,949,302
Sector/ District	Regional operations centers, command buildings, warehouses	459	2,029,394,665
Aviation	Runways, landing areas, hangars	334	2,570,049,983
Training Facilities	Flight simulators, rescue training facilities	174	420,723,370
Industrial	Maintenance shops, corrosion control facilities, ship lifts	52	466,672,941
Total:	**—**	**20,433**	**17,835,366,285**

Legend: "—" = not available or not applicable.

Source: GAO analysis of Coast Guard documentation. | GAO-19-675

Note: Table excludes two asset lines—fixed and floating aids to navigation and signal equipment—which are used to mark federal waterways to safeguard maritime safety and commerce, among other things. The Coast Guard informed us that some of the annual reports we analyzed, upon which the information is based, are not used by Coast Guard senior leaders for tactical decisions, but provide a snapshot of information that is reliable for the purpose of reporting on the overall portfolio of shore infrastructure.

[a]Rescue 21 is a network of radio towers that receive distress calls in the coastal waters and rivers of the continental United States, Hawaii, Alaska, and U.S. territories.

We reported in February 2019 that the Coast Guard faced recapitalization, new construction, and deferred maintenance backlogs for its shore infrastructure totaling at least $2.6 billion as of 2018 and that its backlogs increased by $300 million since fiscal year 2012.[20] Moreover, according to the Coast Guard Civil Engineering program's 2018 annual report, about 46 percent of the Coast Guard's shore infrastructure was beyond its overall service life.[21] In 2018, the Coast Guard rated[22] its

[20]GAO-19-82.

[21]According to the Coast Guard, its overall shore inventory has a 65 year service life and its asset service life ranges from 6 to 75 years, depending on the type of asset. The Coast Guard determined the percentage of assets beyond their service life using the useful service life assigned to each type of asset.

overall shore infrastructure condition as a C-[23] based on criteria it derived from standards developed by the American Society of Civil Engineers.[24] In addition, some asset lines such as the industrial asset line, whose assets are generally mission-critical, were rated lower.[25] Table 2 shows information about Coast Guard asset lines, including the rate at which the Coast Guard reported that these assets were functioning past their service life, and the condition grades assigned by the Coast Guard for fiscal year 2018.

Table 2: Select Asset Line Grades and Shore Infrastructure Operating Past Their Overall Service Life for Fiscal Year 2018 as Determined by the U.S. Coast Guard

Asset line	Percent of assets past service life[a]	Percent of assets operating more than 5 years past service life[a]	2018 condition grade[b]
Shore operations	38	19	B
Housing	28	26	B-
Training Facilities	35	25	C+
Sector/ District	27	16	C
Civil Works	55	33	C
Waterfront	55	26	C-
Base Services	50	33	C-

[22]The Coast Guard assigned each asset line a letter grade based on standards adapted from the American Society of Civil Engineers, which according to Coast Guard officials, consider the following eight attributes: Capacity, Funding, Operations and Maintenance, Resilience, Condition, Future Need, Public Safety, and Innovation. As noted by the Coast Guard's fiscal year 2018 shore infrastructure reports, these infrastructure grades provide a broad basis for performance analysis and consider how well the Coast Guard is able to achieve mission objectives in relation to its dependencies on shore infrastructure.

[23]According to the American Society of Civil Engineers, upon which Coast Guard based its grades, an "A" is generally excellent condition, a "B" is in good to excellent condition, a "C" is in mediocre/fair to good condition but showing signs of deterioration and increasingly vulnerable to risk, a "D" is in poor to fair condition and mostly below standard, and an "F" is failing/critical, unfit for purpose, and in an unacceptable condition with widespread advanced signs of deterioration.

[24]According to Coast Guard officials, the 2018 grades are to provide a snapshot of what the Coast Guard considered the condition of its shore infrastructure to be for that year.

[25]For example, the Coast Guard rated its industrial asset line as a D-, in part because 7 of the 9 assets which comprise the Coast Guard Yard—the only Coast Guard facility that can perform drydock maintenance on its large ships—are more than 5 years beyond their service life.

Asset line	Percent of assets past service life[a]	Percent of assets operating more than 5 years past service life[a]	2018 condition grade[b]
Technology	24	15	D+
Community Services	68	37	D+
Aviation	63	35	D
Industrial	57	38	D-
Total	**46**	**29**	**C-**

Source: GAO analysis of Coast Guard documents. | GAO-19-675

Note: Table excludes two asset lines—fixed and floating aids to navigation and signal equipment—which are used to mark federal waterways to safeguard maritime safety and commerce, among other things. The Coast Guard informed us that some of the annual reports we analyzed, upon which the information is based, are not used by Coast Guard senior leaders for tactical decisions, but provide a snapshot of information that is reliable for the purpose of reporting on the overall portfolio of shore infrastructure.

[a]The Coast Guard does not have complete service life data on all of its assets. For example, the Coast Guard does not have data on the remaining service life for 16% of its aviation assets.

[b]According to the American Society of Civil Engineers, upon which Coast Guard based its grades, an "A" is generally in excellent condition, a "B" is in good to excellent condition, a "C" is in mediocre/fair to good condition but showing signs of deterioration and increasingly vulnerable to risk, a "D" is in poor to fair condition and mostly below standard, and an "F" is failing/critical, unfit for purpose, and in an unacceptable condition with widespread advanced signs of deterioration. The formula the Coast Guard uses to assign grades is based on a number of factors, including the results of its facility inspections, and the percent of assets past service life is independent of the grade calculation. According to Coast Guard officials, in 2018 some of its data on shore infrastructure may not be complete if field inspectors did not identify and record problems at facilities they inspected. As a result, condition grades could be overly positive.

Coast Guard Roles and Processes for Managing Shore Infrastructure

According to Coast Guard guidance, the Office of Civil Engineering and the Shore Infrastructure Logistics Center each play a role in managing the Coast Guard's infrastructure by assessing risks and helping to mitigate damage from natural disasters or other events. The Office of Civil Engineering is responsible for setting Coast Guard-wide civil engineering policy, which includes facility planning, design, construction, maintenance, and disposal. The Shore Infrastructure Logistics Center is to establish project priorities for the acquisition, programmed depot maintenance, major repair, and modification of shore facilities. This center is also responsible for implementing the Coast Guard's shore infrastructure policies.[26]

[26]These policies include: (1) assuring that all Coast Guard facilities meet their operational and functional requirements; (2) taking corrective action before advanced deterioration requires major repairs; (3) ensuring preventative maintenance is performed on a routine schedule; and (4) preventing over-maintenance and under-maintenance.

According to its guidance, the Coast Guard makes procurement, construction, and improvements funding decisions for its shore infrastructure through enterprise-level planning boards that meet twice a year.[27] These planning boards are to prioritize Coast Guard shore infrastructure needs based on expected appropriations and other prioritization factors or considerations, such as damage caused by natural disasters or the Coast Guard's need to construct new shore infrastructure or recapitalize existing facilities. The boards are responsible for evaluating potential shore infrastructure projects that have been assessed, ranked, and recommended by Coast Guard managers of various asset lines. For example, aviation asset line managers may recommend to the planning boards aviation-related shore infrastructure projects, such as the recapitalization of runways, landing areas, and hangars.[28]

Climate Change Effects and Extreme Weather

According to the National Academies, climate change poses serious risks to many of the physical and ecological systems on which society depends, although the exact details cannot be predicted with certainty.[29] Moreover, the effects and costs of extreme weather events, such as floods and droughts, are expected to increase in significance as they

[27]The procurement, construction, and improvements planning board is responsible for prioritizing approved Procurement, Construction, and Improvements-funded projects such as new construction or modifying existing facilities to meet new requirements. It serves to influence long-term capital planning and prioritize future planning work. District planners, headquarters program managers, asset and product line managers, facility engineers, and Coast Guard civil engineering units provide input to the board, which makes decisions by voting on project proposals. The board's voting members are representatives from various Coast Guard units: Pacific Area Command, Atlantic Area Command, the Deputy Commandant for Operations, and the Deputy Commandant for Mission Support. The Shore Infrastructure Logistics Center's deputy casts the tiebreaker vote when the four member board is tied.

[28]According to the Department of Defense, recapitalization refers to major renovation or reconstruction activities (including facility replacements) needed to keep existing facilities modern and relevant in an environment of changing standards and missions. Recapitalization extends the service life of facilities or restores lost service life. It includes restoration and modernization of existing facilities, as well as replacement of existing facilities with new ones.

[29]The National Academies of Sciences, Engineering, and Medicine, National Research Council, Committee on America's Climate Choices, America's Climate Choices (Washington, D.C.: 2011); National Research Council, Climate Change: Evidence, Impacts, and Choices (Washington, D.C.: 2012).

become more common and intense because of climate change.[30] For example, the National Oceanic and Atmospheric Administration (NOAA) has reported that eight of the 10 costliest tropical cyclones in U.S. history occurred in recent years—from 2005 to 2017.[31]

DOD documented seven effects commonly associated with climate change and their potential effects on its infrastructure and operations (see table 3).[32] Although the Coast Guard operates on a smaller scale, it maintains many of the same types of infrastructure as DOD, and these infrastructure are also situated in coastal and riverine locations, and thus subject to the same potential effects from extreme weather events. For example, Coast Guard facilities along the East and Gulf coasts of the United States are vulnerable to hurricanes—which NOAA projects will increase in frequency and severity because of climate change—and may cause flooding or wind damage to Coast Guard infrastructure.

[30]Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe, eds., Climate Change Impacts in the United States: The Third National Climate Assessment, (Washington, D.C.: U.S. Global Change Research Program, May 2014) and Intergovernmental Panel on Climate Change, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.

[31]National Oceanic and Atmospheric Administration, National Hurricane Center, *Costliest U.S. Tropical Cyclone Tables Updated,* (Miami, FL: Jan. 26th, 2018).

[32]Office of the Secretary of Defense, draft Screening Level Vulnerability Assessment Survey Report (December 2016).

Table 3: Seven Observed and Potential Effects of Climate Change on Weather Events and on Department of Defense (DOD) Infrastructure and Operations, as Identified by DOD

Category	Potential effects of climate change on weather events	Observed and potential effects on DOD infrastructure and operations
Flooding due to storm surge	Increased severity and frequency of flooding caused by storm surge	Coastal erosion (e.g., shoreline facilities), damage to coastal infrastructure (e.g., piers and utilities)
Flooding due to non-storm surge	Increased severity and frequency of flooding not caused by storm surge	Inundation of inland sites, damage to infrastructure (e.g., training area facilities), encroachment on training lands (e.g., excessive damage to maneuver training lands), storm water and wastewater disposal issues, shifting river flows
Extreme temperatures	Hot: Increased frequency of extremely hot days, thawing of permafrost, seasonal weather shifts	Strained electricity supply, changing demand for cooling of buildings (e.g., effects on an installation's energy intensity and operating costs), training encroachment (e.g., more red and black flag days),[a] erosion and facility damage from thawing permafrost, water supply shortages, increased maintenance requirements for runways or roads
Extreme temperatures	Cold: Increased frequency of extremely cold days, seasonal weather shifts	Strained electricity supply, changing demand for heating of buildings (e.g., effects on an installation's energy intensity and operating costs), training encroachment, increased maintenance requirements for runways or roads
Wind	Stronger and more frequent wind	Damage to above-ground electric/power infrastructure (e.g., power lines), roofs of buildings, and housing
Drought	Increased frequency of drought	Water supply shortages
Wildfire	Increased frequency of wildfires	Training encroachment (e.g., restrictions on types of ammunition used, halting or delaying of training activities)
Changes in mean sea level	Increased frequency and severity of coastal flooding	Coastal site damage from erosion and inundation, water supply interruptions, wastewater disposal issues

Source: GAO analysis of the 2010 Quadrennial Defense Review, 2012 DOD Climate Change Adaptation Roadmap (Roadmap), 2014 Roadmap, Fiscal Year 2015 DOD Strategic Sustainability Performance Plan (Sustainability Plan), Fiscal Year 2016 Sustainability Plan, and the December 2016 draft of the DOD Screening Level Vulnerability Assessment Survey Report. | GAO-19-675

[a]According to the U.S. Navy, red flag days are days on which strenuous exercise must be curtailed in hot weather for all personnel with fewer than 12 weeks of training; black flag days are days on which non-mission essential physical training and strenuous exercise must be suspended for all personnel.

Coast Guard infrastructure is also vulnerable to natural disasters that are not associated with climate change. For example, Coast Guard facilities situated on the West Coast, Hawaii and Alaska, are located on or near historic earthquake fault lines. As a result, this infrastructure is more likely to be damaged by earthquakes than infrastructure located elsewhere in the country, according to the Coast Guard.

According to Coast Guard officials, it can take months and sometimes years to repair or replace Coast Guard facilities damaged by severe

natural disasters.[33] For example, as shown in Figure 1, Coast Guard facilities at Station Port Aransas in Texas suffered significant damage during Hurricane Harvey in 2017. As of April 2019, the Coast Guard was working to demolish these damaged facilities so they could be replaced by one facility that is resilient to hurricanes.

Figure 1: Damage at Station Port Aransas in Texas Resulting from Hurricane Harvey in 2017

Source: GAO. | GAO-19-675

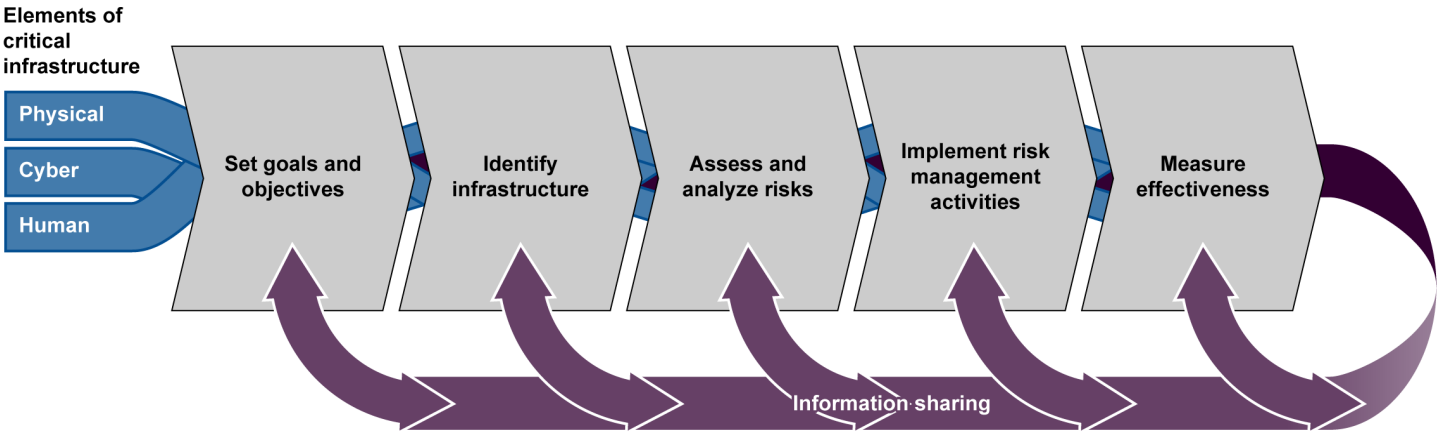
DHS Critical Infrastructure Risk Management Framework

DHS established its Critical Infrastructure Risk Management Framework to guide critical infrastructure owners and operators, from both the public and private sector, in investing limited resources to protect critical infrastructure.[34] As shown in Figure 2, the framework consists of five steps that involve (1) setting goals and objectives, (2) identifying infrastructure, (3) assessing and analyzing risk, (4) implementing risk management activities, and (5) measuring the effectiveness of actions taken to address identified risks.

[33]Healy, et al., "U.S. Coast Guard (USCG) Hurricanes Katrina, Ike, and Sandy Resiliency Reconstruction" 2016.

[34]Department of Homeland Security, *2013 National Infrastructure Protection Plan (NIPP), Partnering for Critical Infrastructure Security and Resilience* (Washington, D.C.: December 2013).

Figure 2: DHS Critical Infrastructure Risk Management Framework



Source: Department of Homeland Security National Infrastructure Protection Plan 2013. | GAO-19-675

According to DHS, agency decision makers can use this framework to prioritize investments, develop plans, and allocate resources for critical infrastructure in a risk-informed way. The framework is based on risk management activities, which call for cost-effective use of resources by taking protective actions that offer the greatest mitigation of risk for any given expenditure. According to the NIPP, a risk management approach that aligns with the five key steps can help guide organizational decision making and prioritize actions to more effectively achieve desired outcomes.

Coast Guard Has Rebuilt Some Damaged Facilities and Is Conducting a Vulnerability Assessment of Selected Buildings

Since 2005, the Coast Guard has taken actions to improve the resilience of at least 15 storm-damaged shore facilities and has rebuilt them to new standards largely by using supplemental appropriations provided for this purpose. The Coast Guard has also developed new guidance to increase the likelihood that new or recapitalized buildings will withstand natural disasters and follows updated state and local building codes, which a senior Coast Guard official told us led to more resilient buildings, thus limiting risks to Coast Guard personnel and operations. In 2015, the Coast Guard's Civil Engineering program initiated a formal assessment of owned and occupied Coast Guard buildings to determine which were

vulnerable to 10 natural disasters, which, according to agency officials, it aims to complete in 2025.[35]

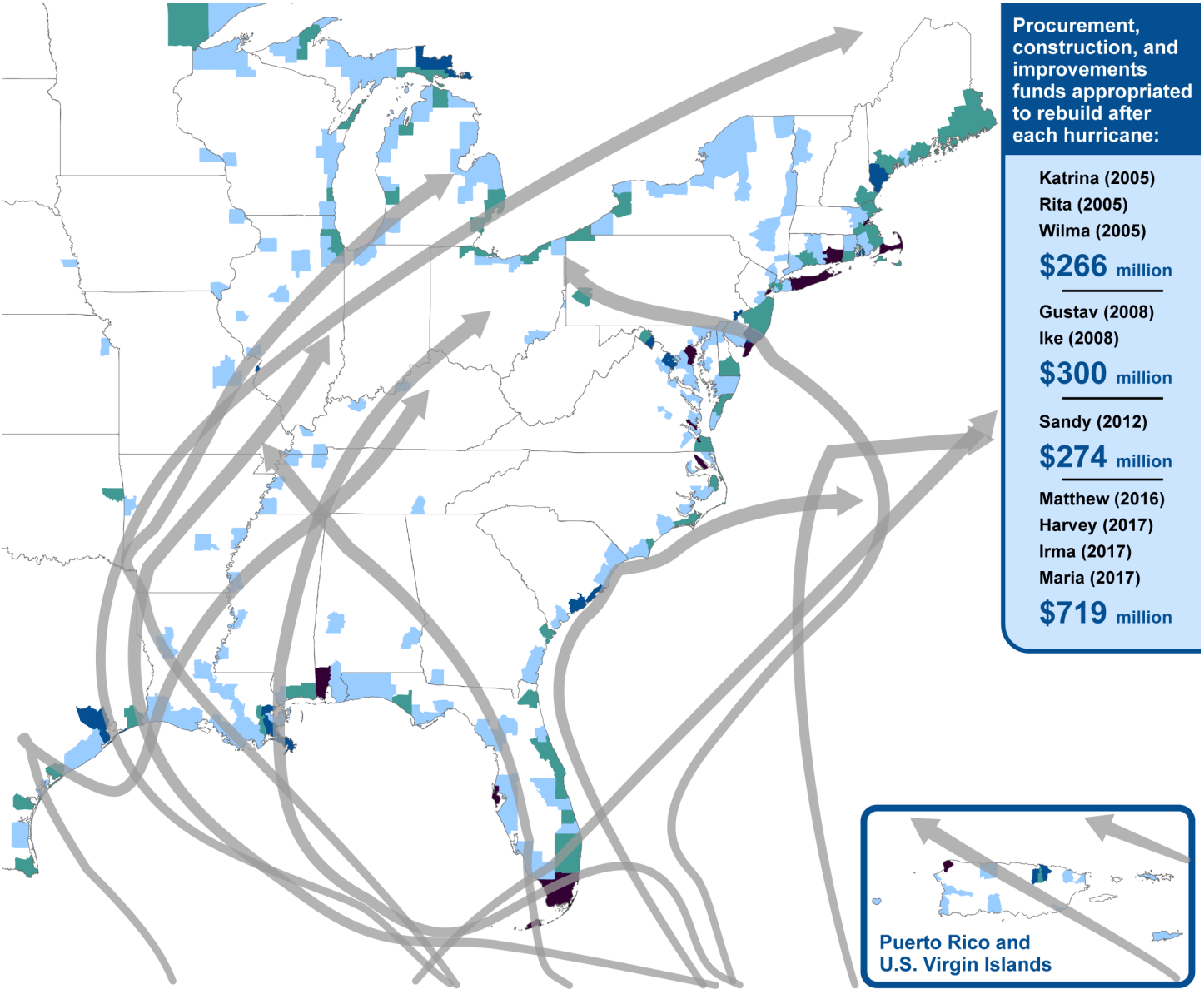
Coast Guard Has Received Supplemental Appropriations to Rebuild Some Damaged Facilities

Since 2005, the Coast Guard has taken actions to improve the resilience of its shore infrastructure, largely by using supplemental appropriations for rebuilding facilities damaged by major storms. Specifically, from December 2005 through June 2019, the Coast Guard was appropriated about $2 billion in supplemental funds to, among other things, rebuild or relocate 15 facilities damaged by hurricanes. During this time, the Coast Guard has relocated facilities further inland or to higher ground, upgraded facilities to be more resilient, and designed new facilities with features to protect them from natural disasters. The 2016 and 2017 hurricane seasons were particularly destructive, and the Coast Guard received $719 million in supplemental funding to restore facilities damaged by Hurricanes Matthew, Harvey, Irma, and Maria.[36] Figure 3 below shows Coast Guard shore infrastructure, and associated replacement values, located along the East and Southeast coasts of the United States and the general paths of selected hurricanes in those regions since 2005.

[35]The 10 natural disaster vulnerabilities assessed were the risk of: seismic/earthquake, flood, tsunami, sea level rise, coastal vulnerability index (CVI), hurricane/typhoon wind, wildfire, volcano, tornado/wind, and drought. CVI quantifies the likelihood that physical changes may occur in the coastal zone based on analysis of the location's tidal range, ice cover, wave height, coastal slope, historical shoreline change rate, geomorphology, and sea level rise. The Coast Guard's CVI analysis was based on the U.S. Geological Survey National Assessment of Coastal Vulnerability to Sea-Level Rise.

[36]Bipartisan Budget Act, 2018, Pub. L. No. 115-123, 132 Stat. 64, 82-83 (2018)

Figure 3: General Paths of Selected Hurricanes, Replacement Value of Coast Guard Shore Infrastructure, and Supplemental Funds Appropriated for the Repair of Facilities Damaged from 2005 through 2018



Source: GAO analysis of U.S. Coast Guard and National Oceanic and Atmospheric Administration data. | GAO-19-675

Note: Although not shown in the figure, in 2019, the Coast Guard received an additional $476,750,000 in Procurement, Construction, and Improvements appropriations to pay for necessary expenses related hurricanes Florence, Michael, and Lane; Tropical Storm Gordon, and Typhoon Mangkhut.

The Coast Guard has used supplemental funding to rebuild or relocate at least 15 damaged facilities to enhance their resilience.[37] To improve the resilience of its facilities when rebuilding after hurricanes, Coast Guard officials reported that they generally either relocated the facility inland for better protection from extreme weather or modified the facility to be more resilient by elevating it to protect it from storm surge and flooding. For example:

- **Station Houston, Texas.** After this station was damaged by Hurricane Ike in 2008, the Coast Guard determined that this station's boathouse could not be built above the local floodplain and still meet mission requirements. As a result, the Coast Guard took steps to protect the boathouse from future water damage by using water resistant materials in its construction, elevating its electrical and telecommunications systems above the flood plain, and placing the heating, ventilation, and air conditioning systems on the roof of the building.
- **Sector Houston-Galveston, Texas.** After being damaged by Hurricane Ike in 2008, this regional command facility was relocated further inland to provide the new facility with greater protection from extreme weather. It was also designed to withstand wind speeds of up to 115 miles per hour.
- **Station Sandy Hook, New Jersey.** After this station was damaged by Hurricane Sandy in 2012, the old building was demolished and replaced on the same site with a facility that was designed to be more resilient. The station's first floor was constructed with openings to allow flood waters to pass beneath the station.
- **Station Sabine Pass, Texas.** Following damage by Hurricane Ike in 2008, the Coast Guard rebuilt this station in 2013 to better withstand floods and high winds (see fig. 4). The new station's first floor was elevated to a height that exceeds the projected depth of a 100-year flood to protect station equipment. The station was also designed to

[37]Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, 2006, Pub. L. No. 109-148, 119 Stat. 2680, 2764 (2005). Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006, Pub. L. No. 109-234, 120 Stat. 418, 458 (2006). Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009, Pub. L. No. 110-329, 122 Stat. 3574, 3592 (2008). Disaster Relief Appropriations Act, 2013, Pub. L. No. 113-2, 127 Stat. 4, 8, 28 (2013). Bipartisan Budget Act, 2018, Pub. L. No. 115-123, 132 Stat. 64, 82-83 (2018). Additional Supplemental Appropriations for Disaster Relief Act, 2019, Pub. L. No. 116-20, 133 Stat. 871, 882 (2019).

resist wind speeds up to 130 miles per hour—sufficient to withstand a Category III hurricane.[38]

Figure 4: Coast Guard Station Sabine Pass, Texas, Rebuilt for Resilience in 2013

Station Sabine Pass, Hurricane Ike, category II damage to station.

Station Sabine Pass rebuilt to withstand 100 year flood, category III hurricane wind speeds.

Source: U.S. Coast Guard. | GAO-19-675

The Coast Guard Has Updated Its Guidance to Reflect Higher Building Standards

The Coast Guard has also developed new guidance reflecting higher building standards, and follows updated state and local building codes which a senior Coast Guard official told us led to more resilient buildings. In February 2017, the Coast Guard's Civil Engineering program issued engineering planning guidance intended to increase the likelihood that new or recapitalized buildings would withstand natural disasters and that the design of these buildings would minimize risks to Coast Guard

[38]According to NOAA, the Saffir-Simpson hurricane wind scale is a rating system with five categories based on a hurricane's sustained windspeed. Hurricanes that reach Category III wind speeds are considered major hurricanes because of their potential for significant loss of life and damage to property, and have sustained wind speeds of 111 to 129 miles per hour. The types of damage associated with Category III hurricane include potential damage to well-built framed homes or the removal of roof decking. Trees may be snapped or uprooted, which could result in blocked roads. Electricity and water could be unavailable for several days to weeks after the storm passes.

operations and personnel, among other things.[39] This new guidance contains the following requirements:

- All new permanent, regularly occupied buildings will either be located at least 2 feet above the Federal Emergency Management Agency's (FEMA) 100-year base flood elevation or meet the level of the 500-year base flood elevation for the proposed site location.[40]
- To account for storm surge, sea level rise, or periodic flooding, buildings may also be constructed above this elevation as necessary.[41]
- To ensure operational continuity and safety after a flood event, critical building systems—such as utility and communications systems—are to be located at least 3 feet above the 100-year base flood elevation.
- Each site will be evaluated for vulnerability to natural hazards, such as earthquakes, tornadoes, and wildfires. This evaluation will identify risk to Coast Guard operations and personnel.

A senior Coast Guard official testified to Congress in November 2017 that Coast Guard buildings rebuilt after being damaged by Hurricane Ike in 2008 suffered minimal damage from Hurricanes Harvey and Irma. The official also said that the resilience of these buildings resulted from the recapitalization efforts that made them more storm-resilient and allowed them to align the buildings with modern building codes and standards.[42] Further, according to Coast Guard civil engineering officials, units

[39]U.S. Coast Guard, *Shore Facilities Planning Factors Job Aid* (Norfolk, VA: Feb. 23, 2017).

[40]According to the US Geological Survey, a 100- or 500-year flood is a statistical description based on the study of past flood data in order to determine the probability that a flood of any given size will be equaled or exceeded in a specific area during any year. Since this term is used to describe recurrence intervals, it is possible to have multiple 100 or 500 year floods in consecutive years. A 100-year flood is an event that statistically has a 1 percent chance of occurring in a given year, and a 500-year flood is an event that statistically has a 0.2 percent chance of occurring in a given year. These flood designations are subject to change over time as more data about past floods are collected or when a river basin is altered in a way that affects the flow of water in a river.

[41]According to NOAA, storm surge is an abnormal rise of water generated by a storm, over and above the level predicted by astronomical tides.

[42]Vice Admiral Karl Shultz, U.S. Coast Guard, *Emergency Response and Recovery: Central Takeaways from the Unprecedented 2017 Hurricane Season,* testimony before the House Committee on Transportation and Infrastructure, 115th Cong., 1st sess., November 2, 2017.

impacted by Hurricanes Harvey, Irma and Maria—which had been recapitalized to resilient standards—returned to full mission capability within 2 to 3 days and, in some instances, avoided damage or a loss of mission capability as a result of more resilient construction. For example, operations at Sector Houston-Galveston, which supports a wide range of Coast Guard missions, were not interrupted during Hurricane Harvey, allowing it to serve as the primary federal response hub during this disaster.

A senior official from the Coast Guard Facilities Design and Construction Center told us that state and local building codes, which have been updated as a result of lessons learned from natural disasters, have also led to more resilient Coast Guard buildings because the Coast Guard is required to align its facilities standards with these codes.[43] For example, according to this official, Florida updated its building codes after Hurricane Andrew in 1992, which resulted in more resilient buildings in this state.

In December 2018, the Coast Guard Civil Engineering program issued updated planning guidance for reconstructing facilities damaged by Hurricanes Matthew, Harvey, Irma, and Maria in 2016 and 2017.[44] According to this guidance, new and renovated facilities are to incorporate resilient construction techniques including, but not limited to, hurricane resistant construction and design, and infrastructure resiliency. These facilities are to have the ability to return to full operations after an event, minimizing any major reconstruction and long-term mission impact. In addition, when the Coast Guard builds a new facility or renovates an existing one that directly supports Coast Guard natural disaster response efforts, that facility is to be built to a higher resiliency level to increase the likelihood that it will remain operational during a natural disaster.[45]

[43]The Facilities Design and Construction Center is responsible for planning and executing Coast Guard construction projects, among other responsibilities.

[44]U.S. Coast Guard, 2017 *Hurricane Supplemental – Adjusted Planning Factors Response* (Washington, D.C.: December 21, 2018).

[45]The Coast Guard's facilities in Puerto Rico are to be able to provide power and fuel for 14 days.

Coast Guard Began Assessing Certain Buildings for Vulnerabilities to Natural Disasters in 2015 and Aims to Complete the Assessment in 2025

In 2015, the Coast Guard's Civil Engineering program initiated a formal vulnerability assessment of owned and occupied Coast Guard buildings, and according to Coast Guard officials they aim to complete this assessment in 2025. The Coast Guard calls this assessment the Shore Infrastructure Vulnerability Assessment. According to Coast Guard documentation, its focus was to determine the vulnerability of these buildings and Coast Guard personnel to natural disasters.[46] Further, the assessment results are intended to assist with contingency planning by identifying which Coast Guard facilities are likely to remain operational after a natural disaster.

According to its documentation, this vulnerability assessment is to be completed in two phases. During Phase I, completed in 2018, the Coast Guard analyzed 3,214 buildings, or approximately 16 percent of its infrastructure, for vulnerabilities to disasters such as floods, earthquakes, and hurricanes. To conduct its analysis, Coast Guard officials analyzed the vulnerability of these buildings to 10 natural disasters using information from other government agencies and professional organizations. For example, the Coast Guard assessed its vulnerability to flooding using FEMA, National Weather Service information, state sources and websites. This analysis identified Coast Guard-wide infrastructure vulnerabilities to coastal risks such as shoreline loss, coastal erosion and earthquakes, as well as tsunami risks on the West Coast of the United States, Alaska, Guam, and Hawaii, and immediate and serious flood risks in Puerto Rico and the Gulf and East Coasts. The Phase I report recommended that Coast Guard units and contingency planners consider these vulnerabilities when preparing contingency plans or making capital investments in Coast Guard facilities.

Although the Shore Infrastructure Vulnerability Assessment Phase I report identified multiple vulnerabilities to sixty-eight percent of the assessed infrastructure, Coast Guard Civil Engineering program officials told us they were unable to conclusively determine whether approximately 1,500 assessed buildings were vulnerable to hurricane winds, earthquakes, or tornadoes—leading officials to conclude that they needed to conduct further structural analysis. Accordingly, Coast Guard Civil Engineering program officials initiated plans for Phase II of the assessment, which involves more detailed structural analyses of 1,500

[46]Specifically, the Shore Infrastructure Vulnerability Assessment analyzed all Coast Guard owned and occupied buildings over 1,000 gross square feet for vulnerabilities to natural disasters. Towers, aids to navigation, and leased facilities were not included.

buildings to determine whether they can withstand either earthquakes or tornado and hurricane winds, depending on the building.[47]

Since earthquakes strike with essentially no warning, unlike hurricanes and tornadoes, Coast Guard Civil Engineering program officials told us that the Coast Guard considered them to be a greater threat to its personnel and infrastructure. Accordingly, the Coast Guard decided that Phase II of the assessment would prioritize structural analyses for buildings it believes to be more susceptible to damage from earthquakes. Further, it would prioritize the order in which it assesses these buildings based on how critical the building is to Coast Guard operations, building occupant density, and the overall age and condition of the building. The Shore Infrastructure Vulnerability Assessment Phase II analysis began in September 2018 with a contract for about $700,000 to determine if 15 buildings at multiple Coast Guard sites are vulnerable to earthquakes. According to the contract, these assessments are to be completed in October 2021.

Coast Guard Processes to Improve Shore Infrastructure Resilience Do Not Fully Align with Key Steps of DHS's Critical Infrastructure Risk Management Framework

While the Coast Guard has taken steps to improve the resilience of its shore infrastructure by rebuilding storm damaged facilities and initiating a vulnerability assessment, its overarching processes to improve shore infrastructure resilience are not fully aligned with the five steps of the DHS Critical Infrastructure Risk Management Framework.[48] As previously mentioned, DHS established this framework to guide both public and private resource investment decisions for protecting critical infrastructure. Its five steps include (1) setting goals and objectives, (2) identifying infrastructure, (3) assessing and analyzing risk, (4) implementing risk management activities, and (5) measuring the effectiveness of actions taken to address identified risks.

[47]The Coast Guard entered into a contract for professional structural engineering seismic analysis services for a series of buildings to be assessed using the most recent Seismic Evaluation and Retrofit of Existing Buildings standards established by the American Society of Civil Engineers. According to Coast Guard officials, the decision to use contractors for these assessments was due to having too few structural engineers internally to perform the required work.

[48]Department of Homeland Security, *2013 National Infrastructure Protection Plan, Partnering for Critical Infrastructure Security and Resilience* (Washington, D.C.: December 2013).

Set Goals and Objectives

According to the first step of the DHS Critical Infrastructure Risk Management Framework, organizations should define specific goals for what they intend to accomplish and establish objectives to help them achieve the goals (see text box). Organizations that establish broad strategic goals for risk management can also benefit from translating these goals into specific, measurable objectives to assess the extent to which its actions actually reduce risk (see text box).[49]

DHS Critical Infrastructure Risk Management Framework—Step 1

Organizations should define specific outcomes, conditions, end points, or performance targets that collectively describe an effective and desired risk management posture. By defining risk management goals and expressing them in terms of the objectives and outcomes the organization intends to accomplish, stakeholders, including those at all levels of government and the private sector, would be better able to tailor their risk management programs and activities to address infrastructure resilience needs.

Source: Department of Homeland Security National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience and Supplemental Tool: Executing A Critical Infrastructure Risk Management Approach. | GAO-19-675

Our review of four key Coast Guard documents related to managing its shore infrastructure showed that some of these documents refer to resilience and identify it as an important factor to its operational success. However, none of the documents we reviewed identified a measurable goal or objective for improving shore infrastructure resilience. Instead, the documents either include goals related to management of the shore infrastructure program, or include no goals at all. Specifically:

[49]We have also previously reported on the importance of developing outcome-based performance goals and measures as part of program evaluation design efforts. GAO, Designing Evaluations: 2012 Revisions, GAO-12-208G (Washington, D.C.: Jan. 2012). For example, we previously reported on a Coast Guard goal of reducing maritime security risk and how the Coast Guard measured its progress toward this goal by identifying the level of risk reduction that resulted from its various security actions. GAO, *COAST GUARD: Security Risk Model Meets DHS Criteria, but More Training Could Enhance Its Use for Managing Programs and Operations*, GAO-12-14 (Washington, D.C.: Nov. 17, 2011).

- The Coast Guard Shore Infrastructure Strategic Plan for 2017-2021 includes what it describes as performance and foundational goals, including a foundational goal for improving resilience, contingency preparedness, and response to natural hazards.[50] However, the plan does not link this foundational goal to a specific objective and performance target that could guide Coast Guard actions to improve shore infrastructure resilience. For example, an objective could be to increase the percentage of mission critical buildings that are within or above base flood elevations by a certain date, and annual targets could be established to assess progress toward this goal.
- The Coast Guard issued its agency-wide strategic plan in November 2018 which states that resilient shore infrastructure is directly connected to Coast Guard operational readiness and successful mission execution. The plan further stated that to meet its operational needs, the Coast Guard will prioritize the repair or replacement of degraded shore infrastructure that negatively affects operations or hinders workforce readiness. However, this plan does not identify the shore infrastructure resilience goals the Coast Guard hopes to achieve or any objectives to measure progress toward these goals. Moreover, this plan does not include goals or measures to guide such prioritization. In February 2019, we reported that Coast Guard Engineering program officials were not able to provide documents showing how they had directed field units to prioritize the repair or replacement of degraded shore infrastructure.[51] In July 2019, the Coast Guard was able to provide one planning document that was specifically created to help manage its response to Hurricanes Harvey, Irma, Maria, and Matthew that included guidance on improving infrastructure resilience.[52]

[50]This plan identifies eleven strategic goals including four performance goals and seven foundational goals. The performance goals pertain to the more traditional execution of funds and ancillary programs such as the Shore acquisition, construction and improvements, and depot-level programs. The foundational goals cover the areas of technology, personnel, and processes which enable the Civil Engineering program to manage the shore plant and execute various funding programs.

[51]GAO-19-82.

[52]U.S. Coast Guard, *2017 Hurricane Supplemental – Adjusted Planning Factors Response.*

- Based on our interviews with Coast Guard engineering program and Shore Infrastructure Logistics Center officials, the Coast Guard is still in the initial stages of incorporating resilience plans and objectives into the shore infrastructure program. In July 2019, Civil Engineering program officials told us that the Coast Guard had updated its Civil Engineering Strategic Plan to direct its personnel to develop a communication plan and resource strategy for infrastructure resiliency projects based on the Shore Infrastructure Vulnerability Assessment's Phase II results. The Coast Guard provided us with a copy of this plan in August 2019, and while this document includes two measures that can be useful to account for actions taken, it did not include goals or performance targets to guide the prioritization of resiliency projects, and Civil Engineering program officials were not able to provide documents showing how they had made decisions to incorporate resilience into the repair and replacement of degraded shore infrastructure.[53]
- Coast Guard officials also reported that they had initiated a separate resilience effort in 2018 at the direction of DHS, which required all operational components to participate in the development of the 2018 DHS Resilience Framework, and to develop individual component resilience plans to guide its approach to resilience planning. According to the Coast Guard, their plan was submitted to DHS in August 2019. When we discussed this effort with Coast Guard officials, they were able to provide few details about their efforts and no documentation about their progress to date. We also discussed this effort with DHS officials managing the process, but they were not able to tell us whether this new endeavor will align with or compete for resources with ongoing Coast Guard assessment processes.

Identify Infrastructure

According to the second step of the DHS Critical Infrastructure Risk Management Framework, organizations should identify infrastructure assets that are critical for security and national preparedness (see text box).

[53]This excludes supplemental funding provided to the Coast Guard for the purposes of rebuilding storm damaged infrastructure discussed earlier in this report.

DHS Critical Infrastructure Risk Management Framework—Step 2

Organizations should identify assets, systems, and networks that contribute to critical functionality, and collect information pertinent to risk management, including analysis of dependencies and interdependencies. Through this step, it is important to identify assets that are both nationally significant and those that may not be significant on a national level but are, nonetheless, important to state, local, or regional critical infrastructure security and resilience and national preparedness efforts.

Source: Department of Homeland Security National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience and Supplemental Tool: Executing A Critical Infrastructure Risk Management Approach. | GAO-19-675

We found that the Coast Guard identified many occupied buildings that may be important to operations and assessed their vulnerability through its Shore Infrastructure Vulnerability Assessment process, but this process did not identify all shore infrastructure assets that are critical to its missions or screen them for all vulnerabilities. Specifically, through the Shore Infrastructure Vulnerability Assessment Phase I, the Coast Guard identified and screened all occupied Coast Guard buildings over 1,000 gross square feet—about 16 percent of all Coast Guard infrastructure—for vulnerabilities to 10 natural disasters. The analysis found that approximately 68 percent (2,200) of the 3,214 buildings it assessed are vulnerable to certain natural disasters.

However, the initial screening did not include other mission critical infrastructure, as the framework recommends, even though the loss of such structures could also impact its ability to carry out its missions. For example, the Coast Guard did not include structures in Phase I of the Shore Infrastructure Vulnerability Assessment, such as aircraft runways, and therefore has not determined whether such structures are vulnerable to flooding following a severe storm, or which ones are at greatest risk for such flooding. Phase II is also not expected to include these assets, as Civil Engineering program officials stated it is not intended to identify any additional infrastructure. Rather, in Phase II for example, Civil Engineering program officials will determine whether roughly 45 percent of the buildings on the West Coast that were screened in Phase I, are vulnerable to earthquakes, as the results of Phase I were inconclusive for these buildings.

This DHS framework step recommends that stakeholders identify assets and networks that contribute to critical functionality and analyze their dependencies and interdependencies. The Coast Guard has two such

measures to help identify the criticality of its shore infrastructure for conducting its missions. The Mission Essentiality Index measure classifies shore infrastructure assets into one of four tiers based on the degree to which they are mission critical.[54] Similarly, the Mission Dependency Index scores building criticality based on how quickly the loss of utilities would impact operations, and how difficult it would be to relocate operations in advance of a natural disaster.[55] Coast Guard officials told us they used Mission Dependency Index scores to help identify which buildings to include first during Phase II of the Shore Infrastructure Vulnerability Assessment. However, they did not consider either of these measures when they conducted the initial screening for Phase I, which prevented operational risks from being fully considered. Using this information at the beginning of its Shore Infrastructure Vulnerability Assessment process could have provided the Coast Guard with useful information to help it assess its critical infrastructure, as the DHS framework recommends.

Coast Guard officials stated in July 2019 that they believe that the mission critical assets collocated with the assessed buildings would have the same vulnerabilities given their geographic proximity. While this may be the case for structures that are collocated with assessed buildings, unoccupied structures (such as piers and runways) may be built with different requirements and building codes; consequently, they may differ in the extent of their vulnerabilities to the same natural hazard threats. Furthermore, the Shore Infrastructure Vulnerability Assessment Phase I report did not demonstrate the extent to which Coast Guard structure are collocated with the occupied buildings the Coast Guard analyzed. They also told us that the Coast Guard has not tracked the performance of its infrastructure, particularly piers and runways, because it has always been able to find alternative means to continue operations. However, by identifying all of its mission critical infrastructure that may be vulnerable to natural disasters, the Coast Guard would be more fully informed of the possible scenarios that could affect their capabilities in the event of a natural disaster, and which infrastructure facilities are most likely to be affected. Such information could also better position the Coast Guard to

[54]The Coast Guard classifies tier one assets as mission critical and tier four assets as mission supportive.

[55]The Mission Dependency scores for the infrastructure evaluated as part of the Shore Infrastructure Vulnerability Assessment ranged from a low of 1 to a high of 85.

plan for and execute mission operations from alternative locations if needed.

Assess and Analyze Risks

According to the third step of the DHS Critical Infrastructure Risk Management Framework, organizations should assess and analyze risks to understand infrastructure vulnerabilities and threats, as well as the potential consequences of an incident or known vulnerabilities (see text box).

DHS Critical Infrastructure Risk Management Framework—Step 3

Organizations should assess and analyze risks, taking into consideration the potential direct and indirect consequences of an incident, known vulnerabilities to various potential threats or hazards, and general or specific threat information. Risks can be assessed in terms of their likelihood and potential consequences. This step supports an assessment strategy that results in sound, scenario-based consequence and vulnerability estimates, as well as an assessment of the likelihood that the given threat or hazard will occur. Organizations should consider potential harm to operations and impacts on mission in executing a critical infrastructure risk management approach.

Source: Department of Homeland Security National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience and Supplemental Tool: Executing A Critical Infrastructure Risk Management Approach. | GAO-19-675

The Shore Infrastructure Vulnerability Assessment process is the Coast Guard's main action to formally assess and analyze its shore infrastructure, according to Civil Engineering program officials. This process was intended to help contingency planners anticipate which infrastructure is likely to remain operational following a natural disaster, and assist with operational and future capital investment decisions, according to a senior Coast Guard official. We found that through this process, the Coast Guard assessed and analyzed certain elements of risk for its shore infrastructure, such as potential vulnerabilities of certain infrastructure to multiple natural disasters—information which could help inform its processes to improve resilience. However, the Coast Guard has not identified the potential direct and indirect consequences posed by natural disasters on its infrastructure, or the consequences associated with its operational risks—that is, risks affecting its ability to carry out its missions if shore infrastructure is damaged. Specifically:

- Through Phase I of the Shore Infrastructure Vulnerability Assessment process, the Coast Guard determined that its personnel and operations are generally more vulnerable to certain threats. For

example, Phase I determined that about 880 assessed buildings may be vulnerable to earthquakes, which according to the Coast Guard, represent approximately 45 percent of its assessed buildings on the West Coast. Similarly, it also identified about 800 buildings that may be vulnerable to tornadoes and approximately 1,000 buildings vulnerable to hurricanes. However, the Coast Guard has not analyzed the potential consequences of damage to the infrastructure that it identified as vulnerable. For example, it has not assessed the economic losses associated with potential catastrophic disasters, such as costs for rebuilding assets or taking other actions to respond to and recover from natural disasters. Additionally, the Coast Guard has not assessed long-term costs that could result from environmental damage to its property caused by these events. Without also determining consequence information, the Coast Guard is not positioned to provide decision makers with the type of information the DHS Critical Infrastructure Risk Management Framework recommends for making cost effective risk management decisions.

- As the Coast Guard begins to conduct Phase II, it is unclear whether it will include information on potential consequences in its assessment. The Coast Guard initiated Phase II in September 2018 and intends to assess about 1,500 buildings for vulnerabilities to natural disasters by 2025. Coast Guard officials stated that Phase II would entail following civil engineering standards for conducting the assessments. These assessments are expected to entail on-site contractor assessments of about 1,500 buildings. In 2018, the first year of Phase II, the Coast Guard contracted for an assessment of 15 buildings, and Shore Infrastructure Logistics Center officials said they expect this assessment to be completed in 2021. According to Civil Engineering program officials, the purpose of Phase II is to understand whether 1,500 buildings identified in Phase I as inconclusive are indeed vulnerable to certain natural hazards. This information can help Coast Guard officials better understand the likelihood that vulnerabilities exist, but the plan for Phase II does not support an assessment strategy that results in sound, scenario-based consequence and vulnerability estimates, as well as an assessment of the likelihood that the given threat or hazard will occur or the operational risks that may be affected, as this step recommends.

Implement Risk Management Activities

According to the fourth step of the DHS Critical Infrastructure Risk Management Framework, organizations should implement risk management activities by evaluating risk reduction methods that consider countermeasures that result in controlling, accepting, transferring, or avoiding risks (see text box).

DHS Critical Infrastructure Risk Management Framework—Step 4

Organizations should evaluate risk reduction methods by considering countermeasures that result in controlling, accepting, transferring, or avoiding risks. Approaches can include prevention, protection, mitigation, response, and recovery activities. Ideally, the selection and implementation of appropriate risk management activities helps to focus planning, increase coordination, and support effective resource allocation and incident management decisions.

Source: Department of Homeland Security National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience and Supplemental Tool: Executing A Critical Infrastructure Risk Management Approach. | GAO-19-675

We found that the Coast Guard identified thousands of infrastructure vulnerabilities to natural disasters through its Shore Infrastructure Vulnerability Assessment process, and has contracted for more detailed structural analyses of the buildings with vulnerabilities that were deemed inconclusive with respect to seismic and windstorm threats. However, the Coast Guard has not taken action to mitigate risks for those buildings with confirmed vulnerabilities. Our analysis of Phase I results showed that of the 3,214 buildings the Coast Guard analyzed, 32 percent had two or more identified vulnerabilities and an average Mission Dependency Index of 34, and 10 percent had three or more identified vulnerabilities with an average Mission Dependency Index of 38.[56] The average Mission Dependency Index score for all 3,214 buildings was 30. These results indicate that the Coast Guard has data on buildings that may be more vulnerable than others and have relatively greater mission value. Despite the availability of this information, the Coast Guard has not taken steps to develop a mitigation strategy for these buildings, as the DHS Critical Infrastructure Risk Management Framework recommends. Coast Guard officials stated that they had sufficient information from Phase I about how their facilities would perform against eight of the ten disasters, so they elected to further study those buildings with inconclusive results on earthquakes and wind.

According to the DHS Critical Infrastructure Risk Management Framework, risk assessments are to inform the selection and implementation of mitigation activities and the establishment of risk management priorities for organizations. Effective risk management activities are comprehensive, coordinated, and cost-effective. The

[56]According to the Coast Guard, assets with a high Mission Dependency Index are more likely to significantly impact mission operations in the event of failure.

framework further states that risk management decisions should be made based on an analysis of the costs and other impacts, as well as the projected benefits of identified courses of action—including the no-action alternative if a risk is considered to be effectively managed already.[57]

However, it is unclear whether and to what extent the civil engineering staff and other decision makers consider the Shore Infrastructure Vulnerability Assessment results as part of the planning board processes where decisions are made about which infrastructure projects will be prioritized for funding. Civil Engineering program officials told us that hazard mitigation strategies will be employed for buildings determined to be vulnerable, as the Coast Guard plans and executes major construction and recapitalization projects through its existing planning board processes. They also provided us with updated planning board guidance, issued in March 2019, which directs Coast Guard officials to consider improving shore infrastructure resilience as a significant factor in the decision-making process. They also noted that the Coast Guard's updated policy described earlier requires compliance with higher building standards, which helps ensure that newly constructed facilities will be more resilient than the ones they replace.

Shore Infrastructure Logistics Center officials, however, were unable to provide us with documentation showing whether and to what extent risk reduction methods were considered during past planning board processes. Furthermore, since they are not required to incorporate Shore Infrastructure Vulnerability Assessment results into future planning board decisions, it is unclear whether future Coast Guard planning boards will be focused on addressing the most critical risks, or will consider resilience as a factor when choosing projects to fund. This is of particular concern since in at least 5 cases, the Coast Guard's backlog list for Procurement,

[57]For example, DOD manages similar types of infrastructure as the Coast Guard that face similar vulnerabilities to natural hazards, and in our May 2014 report we found that DOD officials intend for their screening-level vulnerability assessments to allow the services to prioritize subsequent vulnerability assessment and mitigation actions. See GAO, *Climate Change Adaptation: DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, GAO-14-446 (Washington, D.C.: May 30, 2014). In short, according to DOD officials, assessment results from one installation may be used to inform mitigation decisions at others while other, more detailed assessments are being conducted.

Construction and Improvement projects includes boat stations that the Coast Guard had previously identified as suitable for closure.[58]

Measure Effectiveness

According to step five of the DHS Critical Infrastructure Risk Management Framework, organizations should use metrics and other evaluation procedures to measure progress and assess the effectiveness of efforts to secure and strengthen the resilience of critical infrastructure (see text box).

DHS Critical Infrastructure Risk Management Framework—Step 5

Organizations should use metrics and other evaluation procedures to measure progress and assess the effectiveness of efforts to secure and strengthen the resilience of critical infrastructure. They are an important step in the critical infrastructure risk management process to enable assessment of improvements in critical infrastructure security and resilience. They provide a basis for accountability, document actual performance, promote effective management and provide a feedback mechanism for informed decision making.

Source: Department of Homeland Security National Infrastructure Protection Plan 2013: Partnering for Critical Infrastructure Security and Resilience and Supplemental Tool: Executing A Critical Infrastructure Risk Management Approach. | GAO-19-675

We found that the Coast Guard has identified some specific measures, but they are too narrow to measure the agency's progress or assess the effectiveness of its efforts to improve its shore infrastructure resilience. For example, the Coast Guard established metrics to count the number and dollar value of certain projects to improve resilience, such as seismic improvement or floodplain adaptation projects, that the Civil Engineering program plans and accomplishes each year. While these measures can be useful to account for actions taken and funds invested in these particular actions, they do not indicate whether the resilience of Coast

[58]We reported on this issue in 2019 and recommended that the Coast Guard establish guidance for planning boards to document inputs, deliberations, and project prioritization decisions for infrastructure maintenance projects. The Coast Guard concurred with our recommendation but has not yet taken action to implement it. See GAO-19-82. Also see, GAO, *Coast Guard: Actions Needed to Close Stations Identified as Overlapping and Unnecessarily Duplicative*, GAO-18-9 (Washington, D.C.: October 17, 2017).

Guard shore infrastructure has improved or is improving as a result of the actions being measured.[59]

Coast Guard officials told us that they have not used the DHS Critical Infrastructure Risk Management Framework to guide actions to improve the resilience of its critical infrastructure because they have instead focused on implementing the Shore Infrastructure Vulnerability Assessment to provide them information they intend to use to influence resource investment decisions in the future. However, without a complete understanding of the vulnerabilities of its infrastructure and the consequences to Coast Guard operations if it is damaged, the Coast Guard risks questionable recapitalization investments for its resilience when selecting projects to fund from its $2.6 billion maintenance backlogs. Given that the five steps of the DHS Critical Infrastructure Risk Management Framework are intended to guide decision making and prioritize actions to more effectively achieve desired outcomes, having processes that fully align with the five key steps of the framework would provide greater assurance that the Coast Guard is investing its shore infrastructure resources to manage potential damage and expenses from extreme weather events in the future.

Conclusions

The Coast Guard's shore infrastructure program includes a range of facilities and structures that are vital to the agency's ability to fulfill its missions, and it constitutes a significant fiscal commitment that requires ongoing investment to maintain. By nature of their mission and location, many facilities and structures are vulnerable to potentially catastrophic natural disasters that are projected to occur more frequently and have required over $2 billion in supplemental funding over recent years to replace or repair. The Coast Guard faces the difficult decision of determining how best to invest its limited resources in improving the resilience of its shore infrastructure to better manage the costs of repairing or replacing such infrastructure after natural hazards occur.

[59]The previous iteration of the Shore Infrastructure Strategic Plan, published in September 2016, listed January 2017 and January 2019 as completion dates for Shore Infrastructure Vulnerability Assessment Phase I and Phase II respectively. However, the Coast Guard did not meet either of these dates. The updated plan stated that the Coast Guard anticipated completing Phase I by March 2018 but it did not complete Phase I until March 2019.

DHS's Critical Infrastructure Risk Management Framework provides a decision making approach that can help ensure risk-informed resource investments, but the Coast Guard has not fully aligned its processes for improving shore infrastructure resilience with any of the five steps outlined in this framework. The Coast Guard's Shore Infrastructure Vulnerability Assessment process is the agency's main approach to understanding shore infrastructure vulnerabilities, but this process is limited in scope and not expected to be completed until at least 2025. For the Coast Guard's planning board processes, officials were unable to verify that they have consistently considered resilience as a significant factor when selecting projects or that they plan to do so in the future. This is of particular concern given the current condition of Coast Guard shore infrastructure and the existing $2.6 billion backlogs of infrastructure maintenance and recapitalization projects that compete for finite funding. By fully aligning its processes with DHS's recommended risk management framework for critical infrastructure, the Coast Guard would be better positioned to reduce its future fiscal exposure to the effects of catastrophic natural disasters.

Recommendation for Executive Action

The Commandant of the Coast Guard should ensure that the Deputy Commandant for Mission Support implements risk management processes that more fully align with the five key steps outlined in DHS's Critical Infrastructure Risk Management Framework to better guide agency shore infrastructure investment decisions. This should include (1) setting goals and objectives, (2) identifying critical infrastructure, (3) assessing and analyzing risks and costs, (4) implementing risk management activities, and (5) measuring the effectiveness of actions taken. (Recommendation 1)

Agency Comments

We provided a draft of this report to DHS for review and comment. In its comments, reproduced in appendix I, DHS concurred with our recommendation. DHS, through the Coast Guard, also provided technical comments, which we incorporated as appropriate.

DHS concurred with the intent of our recommendation to formalize its shore infrastructure risk management processes, and stated that it plans to make progress towards implementing GAO's recommendation concurrently with the development and implementation of its Component Resilience Plan, in accordance with the recently mandated DHS Resilience Framework. It intends to complete these efforts by the end of 2021. The Coast Guard also intends to develop, by July 2020, goals and

objectives for measuring the effectiveness of actions taken to identify resilience readiness gaps and resource needs. We will continue to monitor these efforts.

We are sending copies of this report to the appropriate congressional committees, the Secretary of the Department of Homeland Security, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or AndersonN@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix II.

Nathan J. Anderson
Director, Homeland Security and Justice

Appendix I: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528

Homeland Security

September 9, 2019

Nathan J. Anderson
Director, Homeland Security and Justice
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Re: Management Response to Draft Report: GAO-19-675, "COAST GUARD SHORE INFRASTRUCTURE: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework"

Dear Mr. Anderson:

Thank you for the opportunity to comment on this draft report. The U.S. Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's acknowledgment that since 2005 the Coast Guard has taken actions to improve the resilience of its shore infrastructure by relocating or upgrading is facilities to be more resilient and designing new facilities with features in alignment with updated building codes to protect them from natural disasters. The Coast Guard is committed to formalizing its shore infrastructure risk management processes as outlined in the DHS Resilience Framework to minimize major reconstruction after an adverse event and limit mission impacts.

The Department concurs with the one recommendation in the draft report. Attached find our detailed response to the recommendation. Technical comments have been previously provided under separate cover.

Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact me if you have any questions. We look forward to working with you again in the future.

Sincerely,

JIM H. CRUMPACKER, CIA, CFE
Director
Departmental GAO-OIG Liaison Office

Attachment

Attachment: Management Response to Recommendation Contained in GAO-19-675

GAO recommended that the Commandant of the Coast Guard:

Recommendation 1: Ensure that the Deputy Commandant for Mission Support implements risk management processes that more fully align with the five key steps outlined in DHS's risk management framework to better guide agency shore infrastructure investment decisions. This should include (1) setting goals and objectives, (2) identifying critical infrastructure, (3) assessing and analyzing risks and costs, (4) implementing risk management activities, and (5) measuring the effectiveness of actions taken.

Response: Concur. The Coast Guard concurs with the spirit of the recommendation to formalize its shore infrastructure risk management processes. As mandated by the DHS Under Secretary for Management in March 2018, the Coast Guard Office of Civil Engineering is following risk management guidance outlined in the DHS Resilience Framework. Progress towards implementing GAO's recommendation is expected to be concurrent with the development and implementation of the Component Resilience Plan in accordance with the DHS Resilience Framework.

The DHS Resilience Framework largely aligns with the DHS Critical Infrastructure Risk Management Framework outlined in the National Infrastructure Protection Plan (NIPP). The DHS Resilience Framework establishes a six-step process which includes (1) engaging stakeholders, (2) identifying critical missions, (3) conducting criticality assessments, (4) assessing liabilities, (5) identifying resilience gaps and solutions, and (6) integrating resilience readiness solutions. This process provides guidance for the development of a comprehensive vulnerability assessment and risk identification and management program. It guides Components to assess facilities against mission-critical requirements, prioritize those facilities based on mission criticality, identify vulnerabilities, assess risks against those vulnerabilities, and implement solutions that improve resilience.

The DHS-mandated Component Resilience Plan assigns a mission criticality level and resilience factor to each shore facility based on a criticality assessment, interdependencies between mission essential assets and functions, and risk. The Coast Guard will align its current resilience factor formulation to that defined through the process in the DHS Resilience Framework. Risks identified through the Framework will be managed through a strategic combination of risk acceptance, mitigation, engineering, and operational controls.

The first iteration of the Coast Guard's Component Resilience Plan was submitted to DHS on August 29, 2019. Subsequent updates to the Plan will address the identification of resilience readiness gaps and resource needs. Goals and objectives for measuring the effectiveness of actions taken will be included in the 2020 Office of Civil Engineering Strategic Plan which will be released by July 31, 2020. Estimated Completion Date: December 31, 2021.

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Appendix II: GAO Contact and Staff Acknowledgements

GAO Contact

Nathan J. Anderson, (202) 512-3841 or andersonn@gao.gov.

Staff Acknowledgements

In addition to the contact above, Dawn Hoff (Assistant Director), Landis Lindsey (Analyst-in-Charge), Michael Armes, John Bauckman, Jason Berman, Chuck Bausell, Rick Cederholm, Kendall Childers, John Crawford, Billy Commons, Andrew Curry, Dominick Dale, Elizabeth Dretsch, Shannon Finnegan, Michele Fejfar, Peter Haderlein, Eric Hauswirth, Susan Hsu, Michael Pinkham, John Mingus, and Jan Montgomery, made key contributions to this report.

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