



November 2018

FEDERAL REAL PROPERTY ASSET MANAGEMENT

Agencies Could
Benefit from
Additional Information
on Leading Practices

GAO Highlights

Highlights of [GAO-19-57](#), a report to congressional requesters

Why GAO Did This Study

The federal government is the largest real property owner in the United States and spends billions of dollars to operate and maintain these assets, which include buildings, roads, bridges, and utility systems. Federal agencies are responsible for developing asset management policies, processes, and plans. In 2014, the ISO 55000 asset management standards were issued.

GAO was asked to examine federal agencies' real property asset management practices and the applicability of ISO 55000. This report discusses: (1) key characteristics of an effective asset management framework and how selected federal agencies' frameworks reflect these characteristics, and (2) whether government-wide asset management guidance and information reflect standards and key characteristics of an effective asset management framework, among other objectives.

To conduct this work, GAO reviewed the ISO 55000 standards, relevant studies and literature, and interviewed 22 experts and 10 practitioners. GAO selected six federal agencies as case studies, including agencies with the largest real property portfolio and some agencies that were using the ISO 55000 standards. GAO reviewed documentation and interviewed officials from these six agencies, GSA, and OMB.

What GAO Recommends

OMB should take steps to improve information on asset management to reflect leading practices. OMB had no comments on this recommendation.

View [GAO-19-57](#). For more information, contact Lori Rectanus at (202) 512-2834 or rectanusl@gao.gov.

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Agencies Could Benefit from Additional Information on Leading Practices

What GAO Found

GAO identified six key characteristics of an effective asset management framework (see table 1) that can help federal agencies manage their assets and resources effectively. GAO identified these key characteristics through reviews of the International Organization for Standardization (ISO) 55000 standards—an international consensus standard on asset management—studies and articles on asset management practices, and interviews with experts. GAO reviewed the asset management practices of six federal agencies: the U.S. Coast Guard (Coast Guard); U.S. Army Corps of Engineers (Corps); General Services Administration (GSA); National Park Service (Park Service); National Aeronautics and Space Administration (NASA); and U.S. Forest Service (Forest Service). Each of the six federal-agency frameworks GAO reviewed included some of the key characteristics.

Table 1: Key Characteristics of an Asset Management Framework

Characteristic	Description
Establishing formal policies and plans	Define a governance regime and identify staff responsibilities.
Maximizing an asset portfolio's value	Develop a policy to identify the value of assets and to derive the greatest value.
Maintaining leadership support	Articulate leadership support and provide necessary resources.
Using quality data	Collect, analyze, and verify accuracy of asset data.
Promoting a collaborative organizational culture	Promote a culture of information sharing and enterprise-wide decision making.
Evaluating and improving asset management practices	Evaluate the performance of the asset management system and implement necessary improvements.

Source: GAO analysis of ISO 55000 standards, asset management literature, and comments from experts. | GAO-19-57

While the Office of Management and Budget (OMB) has issued guidance to inform federal agencies' real property management efforts, the existing guidance does not reflect an effective asset management framework because it does not fully align with ISO 55000 standards and the key characteristics. For example, this guidance does not direct agencies to develop a comprehensive approach to asset management that incorporates strategic planning, capital planning, and operations, or maintaining leadership support, promoting a collaborative organizational culture, or evaluating and improving asset management practices. In addition, the guidance does not reflect information on successful agency asset management practices, information that officials from three of the six agencies GAO spoke with said would be helpful to them. OMB staff said that they did not plan to update existing government-wide guidance because OMB's real property management focus has shifted to the *Reduce the Footprint* initiative, which emphasizes efficiently managing and using buildings and warehouse space, rather than all assets. Without a more comprehensive approach, as described above, federal agencies may not have the knowledge needed to maximize the value of their limited resources.

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Abbreviations

CFO Act	Chief Financial Officers Act
Coast Guard	U.S. Coast Guard
Corps	U.S. Army Corps of Engineers
FCM	Federation of Canadian Municipalities
FRPC	Federal Real Property Council
FRPP	Federal Real Property Profile
Forest Service	U.S. Forest Service
GSA	General Services Administration
ISO	International Organization for Standardization
NASA	National Aeronautics and Space Administration
OMB	Office of Management and Budget
Park Service	National Park Service
PAS 55	Publicly Available Specification 55
PG&E	Pacific Gas & Electric Company
PSPC	Public Services and Procurement Canada

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November 5, 2018

The Honorable Claire McCaskill
Ranking Member
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Thomas Carper
United States Senate

The federal government is the largest real property owner in the United States and spends billions of dollars annually to operate and maintain its real property portfolio. While the General Services Administration (GSA) provides real property asset management guidance and support to federal agencies—such as support to reduce their space requirements and to effectively manage their inventory and reduce costs—federal agencies are responsible for developing asset management policies, processes, and plans for their portfolios. Specifically, Executive Order 13327, issued in 2004, directed federal agencies to develop an asset management planning process and plan to promote the efficient and economical use of their real property assets.¹ A number of standards and leading practices exist to guide organizations in developing an effective asset management framework,² including the International Organization for Standardization (ISO) “ISO 55000” standards³ which were published in 2014.⁴ The ISO 55000 standards are international consensus standards that describe leading practices for implementing, maintaining, and improving an effective asset management framework to manage all types of assets including real property assets. While some federal agencies have taken steps to adopt some of the practices described in

¹Exec. Order No. 13327, 69 Fed. Reg. 5897 (Feb. 6, 2004).

²For the purposes of our report, we define an asset management framework to refer to the processes, procedures, support systems, organizational roles and responsibilities, and policies used to enable asset management decisions.

³ISO 55000 consists of three separate standards. For the purposes of our report, we refer to the three standards collectively as ISO 55000 standards.

⁴The ISO is an international, independent, non-governmental organization with a membership of 163 national standards bodies, including the American National Standards Institute. According to ISO’s website, ISO has published more than 21,000 international standards and additional documentation across almost every industry. The ISO 55000 standards were developed by an ISO committee with over 30 countries participating.

ISO 55000, it is unclear what actions have been taken across the federal portfolio or what standards and leading practices may be the most applicable to the federal government.

You asked us to examine federal agencies' real property asset management practices and the applicability of ISO 55000. This report discusses:

- key characteristics of an effective asset management framework and how selected federal agencies' frameworks reflect these characteristics;
- views of selected asset management experts and practitioners on challenges and benefits to implementing an asset management framework; and
- whether government-wide asset management guidance and information reflect standards and key characteristics of an effective asset management framework.

To address all three objectives, we collected information from and interviewed a judgmental sample of 22 asset management experts. To identify the potential experts, we performed a literature search and obtained recommendations from preliminary interviews with asset management practitioners, who included representatives from public and private organizations knowledgeable about asset management practices. We then selected the 22 experts using a variety of criteria including type and depth of their experience, affiliations with asset management trade associations, experience with federal asset management practices, relevant published work on our topic, and recommendations from other entities. We interviewed each of these experts using a semi-structured format with open-ended questions and conducted a content analysis of their responses to identify recurring themes. The information gathered from our interviews with experts and practitioners is useful in illustrating a range of views on asset management issues, but is not generalizable.

To identify key characteristics of an effective asset management framework and how selected federal agencies' reflect them, we obtained and reviewed the ISO 55000 standards, which include leading practices, and literature on asset management practices and analyzed our interviews with asset management experts. We synthesized information from these sources and identified six commonly mentioned characteristics. To compare selected agencies' asset management efforts to the six key characteristics that we identified, we selected a non-generalizable sample of six bureau-level and independent federal

agencies as case studies. We used a variety of criteria to select agencies, including selecting agencies with the largest number of real property assets and the largest real property portfolio replacement values.⁵ We also included in our selection some agencies that were using the ISO 55000 standards, and that were recommended by practitioners we interviewed. We selected the following agencies (1) the U.S. Coast Guard (Coast Guard); (2) the U.S. Army Corps of Engineers (Corps); (3) GSA; (4) the National Park Service (Park Service); (5) the National Aeronautics and Space Administration (NASA); and (6) the U.S. Forest Service (Forest Service). We reviewed documents and interviewed officials from each of the six selected agencies to learn about the agencies' practices, their experiences with the ISO 55000 standards, and the challenges they have faced in conducting asset management. In addition, we analyzed fiscal year 2017 Federal Real Property Profile (FRPP) data, as managed by GSA, to obtain information about each agency's portfolio, such as the number of real property assets and total asset-replacement value, and to obtain examples of the types of buildings and structures owned by the six selected agencies. We conducted a data reliability assessment of the FRPP data by interviewing GSA officials and reviewing documentation, and concluded the data were reliable for the purposes of our reporting objectives. We also visited four locations from our case study agencies to discuss and view examples of how our selected case-study agencies are conducting asset management. Agencies are not required to follow the key characteristics we identified and we did not evaluate the extent to which they did so. Instead, we provide this information as illustrative examples of how the agencies' asset management practices reflect these characteristics.

To determine the 32 experts' and practitioners' views on challenges and benefits to implementing an asset management framework, we interviewed and synthesized information from our interviews with all 32 and analyzed the responses to identify key themes. These individuals included the 22 experts previously mentioned and 10 practitioners from public and private organizations we selected who were familiar with asset management practices and the ISO 55000 standards.

To assess whether government-wide guidance and information on asset management reflect standards and key characteristics of an effective

⁵We used Federal Real Property Profile (FRPP) data to assess the size of the agencies' portfolios. The FRPP data fields we examined included operating costs, size, replacement value, repair needs, and asset condition.

asset management framework, we reviewed current Office of Management and Budget (OMB), GSA, and Federal Real Property Council (FRPC) federal guidance and evaluated the extent to which this guidance incorporated practices in the ISO 55000 standards and in the key characteristics. We selected practices described in ISO 55000 because it is the international-consensus asset management standard. We also interviewed officials from the OMB and GSA about their role in supporting federal agencies' asset management efforts. In addition, we obtained information from our interviews with asset management experts and practitioners about practices that could be applicable to the federal government and opportunities to improve federal agencies' approaches. Lastly, we obtained documents and interviewed representatives from federal, provincial, and municipal governments in Canada—a country with over 20 years of experience in asset management—to learn about their practices, including their use of the ISO 55000 standard. We also conducted a site visit to Canada to discuss and view examples of assets in these municipalities (see appendix I for more information on Canada's asset management practices). For more information on our scope and methodology, see appendix II.

We conducted this performance audit from August 2017 to November 2018 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

ISO 55000 defines asset management as “the coordinated activity of an organization to realize value from assets.”⁶ This approach includes, for example:

- developing an understanding of how each of an organization's assets contributes to its success;
- managing and investing in those assets in such a way as to maximize that success; and

⁶ISO, *ISO 55000 Asset Management—Overview Principles and Terminology* (Switzerland: 2014).

- fostering a culture of effective decision making through leadership support, policy development, and staff training.

While ISO defines an asset as any item, thing, or entity that has potential or actual value to an organization, in this report we focus on real property assets. Asset management can help federal agencies optimize limited funding and make decisions to better target their policy goals and objectives. See fig. 1 for an example of an asset management framework.

Figure 1: Example of an Asset Management Framework



Source: GAO analysis of leading practices. | GAO-19-57

Asset management as a distinct concept developed in the 1980s, and since that time, organizations around the world have published a number of standards and leading practices. These include:

- **Publicly Available Specification (PAS) 55:** The British Standards Institution published this standard in its final form in 2008. This standard focuses on the management of physical assets such as real property and describes leading asset management practices in areas

such as life cycle planning, risk management, cost avoidance, and collaborative decision-making. Additionally, the standard provides a checklist for organizations to assess the maturity of their asset management framework. Some public services, utilities, and oil and gas sectors in the United Kingdom and other countries have adopted this standard. The British Standards Institution formally withdrew this standard in 2015 after the publication of ISO 55000, but it remains in use as a reference for many organizations.

- **ISO 55000:** This standard, published in 2014, is a series of three documents, collectively referred to as “ISO 55000.”⁷ It is based on the earlier PAS 55 standard but with stated applicability to all types of assets as opposed to just the physical assets covered by PAS 55. Committees with members from more than 30 countries identified common asset management practices and developed this international consensus standard that, according to ISO, applies to the broadest possible range of assets, organizations, and cultures. Some public and private sector organizations from around the world including utilities, infrastructure management firms, cities, federal agencies, and others have adopted the standard for their real property assets. See appendix III for a summary of the key elements of the ISO 55000 standards.
- ***International Infrastructure Management Manual:*** Initially published in 2000, this manual became one of the first sets of internationally accepted asset management leading practices. The Institute of Public Works Engineering Australasia published the most recent edition in 2015.⁸ The current manual complements the ISO 55000 standards and includes case studies of how organizations in different sectors have approached asset management. It provides detailed information on how to create and implement an effective asset management framework, such as how to incorporate estimates of future demand for services. Various organizations, particularly in

⁷The first standard, known officially as ISO 55000, defines asset management and asset management terminology and provides context for the other two standards. The second standard, ISO 55001, defines the asset management requirements for organizations to follow in seven areas: context of the organization, leadership, planning, support, operation, performance evaluation, and improvement. These are the requirements against which organizations are measured when pursuing certification. The third standard, ISO 55002, provides basic guidelines for applying the requirements in ISO 55001 including how the requirements should be interpreted and applied within a specific sector or to particular asset types.

⁸The Institute of Public Works Engineering Australasia. *International Infrastructure Management Manual, 2015 Edition* (Sydney, Australia).

sectors that manage physical assets, have adopted the manual as a reference.

In the United States, within the federal government's executive branch, OMB and GSA are responsible for providing leadership in managing federal real property—one of the government's major assets. OMB is tasked with overseeing how federal agencies devise, implement, manage, and evaluate programs and policies. OMB has provided direction to federal agencies by issuing various government-wide policies, guidance, and memorandums related to asset management. For example:

- OMB's 2017 Capital Programming Guide⁹ outlines a capital-programming process, including how agencies should effectively and collectively manage a portfolio of capital assets and requirements for agencies strategic asset management plans;
- OMB's *Circular A-123*¹⁰ directs agencies to conduct enterprise risk management assessments to identify significant risks to agency goals and operations;
- OMB's Memorandum 18-21¹¹ expands the responsibilities of federal agencies' senior real property officers in leading and directing the agency's real property program.

GSA's Office of Government-wide Policy is generally responsible for identifying, evaluating, and promoting best practices to improve the efficiency of real property management processes. This office has provided guidance for federal agencies and published performance measures.

In 2004, the President issued Executive Order 13327 directing Chief Financial Officers Act (CFO Act) agencies¹² to designate a senior real property officer responsible for establishing an asset management-

⁹OMB's 2017 Capital Programming Guide, Supplement V 3.0 OMB Circular A-11, Planning, Budgeting, and Acquisition of Capital Assets.

¹⁰OMB, *Circular A-123, Management's Responsibility for Enterprise Risk Management and Internal Control*, (Washington DC: July 15, 2016).

¹¹OMB, *Designation and Responsibilities of Agency Senior Real Property Officers*, Memorandum No. 18-21 (Washington, D.C.: July 12, 2018).

¹²The Chief Financial Officers Act (CFO Act) established chief financial officers to oversee financial management activities at 23 agencies. The list now includes 24 agencies, often referred to collectively as CFO Act agencies. See 31 U.S.C. § 901(b).

planning process and developing a plan to carry out this process. Among other things, this plan was to describe the agency's process for:

- identifying and categorizing all real property managed by the agency,
- prioritizing actions needed to improve the operational and financial management of the agency's real property inventory,
- using life-cycle cost estimations for those actions, and
- identifying asset management goals and measuring progress towards those goals. The order also required agencies to manage their real property assets in a manner that supports the agency's asset management plan, goals, and strategic objectives.

In addition, Executive Order 13327 tasked GSA with providing policy oversight and guidance to inform federal agencies' real property management efforts and required that OMB review agencies' efforts in implementing their asset management plans and completing the other requirements specified in the executive order. The executive order also established the Federal Real Property Council (FRPC)—chaired by OMB and composed of senior management officials from CFO agencies—and called for the FRPC to develop guidance, collect best practices, and help federal agencies improve the management of real property assets.¹³ In response to this executive order, in 2004 the FRPC developed guidance describing guiding principles that agencies' asset management practices should align with, requirements for what agencies should include in their asset management plans, and a template for agencies to follow when compiling these plans. Specifically, the guidance stated that each real property asset's management plan should link the asset management framework to the agency's strategic goals and objectives, describe a process for periodically evaluating assets, and describe a process for continuously monitoring the agency's framework.

¹³Exec. Order No. 13327 also required the FRPC to work with GSA to establish and maintain a single, comprehensive database describing the nature, use, and extent of federal real property under the control and custody of the executive branch agencies. Exec. Order No. 13327, Federal Real Property Asset Management, 69 Fed. Reg. 5997 (Feb. 6, 2004). FRPC created the FRPP to meet this requirement. The FRPC was established in statute by the Federal Property Management Reform Act of 2016 (Pub. L. No. 114-318, 130 Stat. 1608) which kept the composition of the council the same and placed some additional responsibilities on the council such as establishing a real property management plan template.

More recent federal asset management initiatives have focused on efficiently managing and reducing federal agencies' real property holdings. For example, in 2012 OMB directed the 24 CFO Act agencies to maintain their civilian real-estate inventory at or below their then-current levels, a policy known as Freeze the Footprint.¹⁴ In 2015, OMB issued its *National Strategy for the Efficient Use of Real Property* and its accompanying *Reduce the Footprint* policy requiring the CFO Act agencies to set annual targets for reducing their portfolio of domestic office and warehouse space.¹⁵ Subsequently, the Federal Assets Sale and Transfer Act of 2016 established the Public Buildings Reform Board to identify opportunities for the federal government to reduce its inventory of civilian real property and reduce its costs. The act also requires the head of each executive agency to provide annually to GSA information describing the nature, use, and extent of the agency's real property assets.¹⁶ In addition, the Federal Property Management Reform Act of 2016 codified the Federal Real Property Council to, among other things, ensure efficient and effective real-property management while reducing costs to the federal government. The act requires executive branch agencies to annually submit to the Federal Real Property Council a report on all excess and underutilized real property in their inventory.¹⁷

¹⁴OMB, M-12-12 *Memorandum to the Heads of Executive Departments and Agencies* (Washington, D.C.: May 11, 2012) and OMB, *Implementation of OMB Memorandum M-12-12 Section 3: Freeze the Footprint*, Management Procedures Memorandum No. 2013-02 (Washington, D.C.: Mar. 14, 2013).

¹⁵OMB, *National Strategy for the Efficient Use of Real Property 2015-2020: Reducing the Federal Portfolio through Improved Space Utilization, Consolidation, and Disposal* (Washington, D.C.: Mar. 25, 2015) and OMB, *Implementation of OMB Memorandum M-12-12 Section 3: Reduce the Footprint*, Management Procedures Memorandum No. 2015-01 (Washington, D.C.: Mar. 25, 2015).

¹⁶Pub. L. No. 114-287, 130 Stat. 1463.

¹⁷Pub. L. No. 114-318, 130 Stat. 1608.

Effective Asset Management Frameworks Include Six Key Characteristics Reflected in Selected Agencies' Practices

Based on our review of the ISO 55000 standards, asset management literature, and interviews with experts, we identified six key characteristics of an effective asset management framework: (1) establishing formal policies and plans, (2) maximizing an asset portfolio's value, (3) maintaining leadership support, (4) using quality data, (5) promoting a collaborative organizational culture, and (6) evaluating and improving asset management practices (see fig. 2).¹⁸ See appendix II for a more detailed explanation of how we identified these key characteristics.

¹⁸We asked experts to identify the key characteristics of an asset management framework. Of the 22 expert responses that we received, 17 experts cited establishing formal policies and plans, 16 cited maximizing an asset portfolio's value, 14 cited maintaining leadership support, 13 cited using quality data, and 8 cited promoting a collaborative organizational culture. In separate questions, 6 out of the 22 experts also cited evaluating and improving asset management practices as a key characteristic. These characteristics were consistent with practices described in the ISO 55000 standards and were commonly mentioned in asset management studies and articles that we reviewed.

Figure 2: Key Characteristics of an Asset Management Framework

Characteristic	Description
 <p>Establishing formal policies and plans</p>	Organizations should have a clearly defined governance regime that includes a strategic asset management plan that ties to the organization’s mission and strategic objectives, defines the asset management scope, and defines the roles and responsibilities for each part of the organization.
 <p>Maximizing an asset portfolio’s value</p>	Organizations should develop an asset management policy to identify the value of their assets to achieve their mission and strategic objectives, and invest in those assets in such a way as to derive the greatest value from them.
 <p>Maintaining leadership support</p>	Organizational leadership should clearly articulate its support for asset management and provide the necessary resources for asset management to succeed.
 <p>Using quality data</p>	Organizations should collect, analyze, and verify accuracy of asset data, including the organization’s inventory of assets and data on each asset’s condition, age, maintenance cost, and criticality to the organization.
 <p>Promoting a collaborative organizational culture</p>	Organizations should promote a culture of information sharing and enterprise-wide decision-making regarding their assets.
 <p>Evaluating and improving asset management practices</p>	Organizations should evaluate the performance of their asset management system and implement necessary improvements.

Source: GAO analysis of the ISO 55000 standards, asset management literature, and interviews with experts. | GAO-19-57

Each of the six federal agencies we reviewed had a real property asset management framework that included some of these key characteristics. However, agencies varied in how they performed activities in these areas. In addition, the scope and maturity level of the agencies’ asset management frameworks varied. For example, while some agencies’ asset management policies applied to large portions of their portfolios, other agencies’ policies applied to only certain portions of their

portfolios.¹⁹ In addition, two agencies—the Corps and Coast Guard—told us they were using the ISO 55000 standards. For example, according to Corps officials, the Corps is in the process of incorporating elements of the ISO 55000 standards into its frameworks. Coast Guard officials told us they were using the ISO 55000 standards as a benchmark to compare against their existing framework. According to OMB and GSA officials, some of the differences in agencies’ asset management frameworks can be attributed to differences such as agency mission needs and the types of assets that each manages. For example, the real property asset portfolios of the six agencies we reviewed differed substantially in the types, numbers, and total replacement values of the assets. See table 1 for more information on the agencies’ asset portfolios and fig. 3 for examples of agency assets and their primary uses.

¹⁹Specifically, the Corps’ current asset management framework applies to its Civil Works program, which covers assets in its navigation, flood risk management, and recreation portfolios, among others. In addition, the Coast Guard’s current real property asset management framework applies to its Civil Engineering program, which includes assets in its Shore Infrastructure portfolio.

Table 1: Summary of the Fiscal Year 2017 Real Property Asset Portfolios of Six Selected Federal Agencies

Agency	Total number of real property assets	Number of leased assets	Total asset replacement value	Most common primary asset uses (number)
General Services Administration	8,766	6,922	\$86.1 billion	<ul style="list-style-type: none"> Offices (4,744) Public facing facilities (1,461) Warehouses (570)
National Aeronautics and Space Administration	5,340	36	\$36.9 billion	<ul style="list-style-type: none"> Warehouses (787) Service facilities (696) Laboratories (686)
National Park Service	64,549	100	\$127.8 billion	<ul style="list-style-type: none"> Roads and bridges (10,504) Recreational structures (8,649) Parking structures (7,819)
U.S. Army Corps of Engineers ^a	143,059	334	\$273.4 billion	<ul style="list-style-type: none"> Flood control and navigation (130,748) Power development and distribution (7,004) Utility systems (1,320)
U.S. Coast Guard ^a	44,458	2,436	\$17.9 billion	<ul style="list-style-type: none"> Navigation and traffic aids (21,206) Other assets^b (4,770) Military facilities (2,422)
U.S. Forest Service	34,103	608	\$44.0 billion	<ul style="list-style-type: none"> Other assets^c (10,420) Recreational structures (10,009) Roads and bridges (3,946)

Source: GAO analysis of Federal Real Property Profile data. | GAO-19-57

Note: This table excludes real property assets identified as “disposed” in the Federal Real Property Profile (FRPP).

^aWe used FRPP data for consistency in this report. The U.S. Army Corps of Engineers and the U.S. Coast Guard noted differences in the data from their reporting systems. For more information, see appendix II.

^bOther U.S. Coast Guard assets include those that cannot be classified in other categories, such as communication sites and ship moorings.

^cOther U.S. Forest Service assets include those that cannot be classified in other categories, such as cabins and sheds.

Figure 3: Examples of Agency Assets



U.S. Coast Guard Shipyard, Curtis Bay, Maryland



U.S. Army Corps of Engineers, Washington Aqueduct, Washington, D.C.



General Services Administration warehouse, Washington, D.C.



National Aeronautics and Space Administration, Johnson Space Center Human Health and Performance Laboratory, Houston, Texas



King Gillette Ranch Visitor Center, National Park Service, Santa Monica Mountains National Recreation Area, Santa Monica, California



U.S. Forest Service road, El Yunque National Forest, Puerto Rico

Source: GAO, NASA, and Forest Service. | GAO-19-57

Below we discuss the six key characteristics of an effective asset management framework and how the six selected agencies performed asset management activities in these areas.

Establishing Formal Policies and Plans

Formal policies and plans can help agencies utilize their assets to support their missions and strategic objectives. According to literature we reviewed, developing a formal asset management plan can help agencies take a more strategic approach in their asset management decision making and identify key roles and responsibilities, resources required to implement their plans, potential implementation obstacles and strategies

for overcoming these obstacles.²⁰ In addition, several experts we interviewed stated that having an asset management plan that describes the overarching goals of the organization and how the organization's assets relate to those goals is an important element of an asset management framework. Each of the six agencies we reviewed had some documentation such as asset management plans, investment strategies, or technical orders that lay out how the agency conducts asset management activities. This documentation covered important areas such as collecting data, prioritizing assets, and making investment decisions, along with documentation detailing the roles and responsibilities of key officials, for example:

- In 2014, the Corps published a Program Management Plan for Civil Works Asset Management that laid out a vision, tenets, and objectives for asset management along with the roles and responsibilities of key officials. Corps officials told us that this document functions as a strategic asset management plan for the Corps' Civil Works asset portfolio, and the plan contains foundational principles such as how the Corps will assess risk and measure the performance of its framework.
- Since 2006, the Coast Guard Civil Engineering program has been developing a series of manuals, process guides, and technical orders that provide detailed procedures to support implementation of an overarching asset management model.²¹ Coast Guard officials told us this model will cover all of the Coast Guard's real property assets and reflect the agency's mission and objectives.²²

In addition, each of the six agencies we reviewed had developed a formal asset management plan in response to Executive Order 13327 from 2004. One agency had a plan that officials said reflected their current practices. Officials from the remaining five agencies told us that the

²⁰See for example, Transportation Research Board, *Asset and Infrastructure Management for Airports: Primer and Guidebook*, Report 69, (Washington D.C.: 2012); National Research Council. *Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities* (Washington D.C.: National Academies Press, 2012); and National Research Council. *Investments in Federal Facilities: Asset Management Strategies for the 21st Century* (Washington, D.C.: National Academies Press, 2004).

²¹ Coast Guard officials told us that in 2006 the Coast Guard began an effort to modernize its organizational structure, and in 2012 Coast Guard began to operate its current structure for real property asset management.

²²We currently have an ongoing review to assess Coast Guard shore infrastructure projects and expect to issue a report in early 2019.

practices contained within their original asset management plans had been superseded by later policy documents. For example:

- NASA officials told us the agency's 2008 Real Property Asset Management Plan no longer reflects NASA's overarching asset management framework. Officials said that NASA instead uses a series of policy documents, procedural requirements, and annual data calls to set out its framework.
- Park Service officials told us the agency's 2009 Asset Management Plan is still in place, though some of the practices in that document have been superseded by more recent policy documents including the Capital Investment Strategy.²³

Further, five of the agencies linked their asset management goals and objectives to their agency mission and strategic objectives in their asset management plans. For example, GSA's 2012 plan states that it supports GSA's overall mission and goals, as well as the mission of the Public Buildings Service, by organizing real property decision making and supporting the Public Buildings Service's objectives for owned assets.²⁴

Maximizing an Asset Portfolio's Value

Prioritizing investments can help agencies better target resources toward assets that will provide the greatest value to the agency in meeting its missions and strategic objectives. Each of the six agencies we reviewed has documentation describing a process for prioritizing asset investments. For example, each agency has documentation describing a scoring process for prioritizing projects based on specific criteria, such as the risks an asset poses to agency operations, asset condition, project cost, and project impact. Some agency officials told us that scoring projects in this manner provides an objective foundation for decision making that can lead to more consistent investment decisions and improved transparency. In addition, each of the six agencies have implemented, or are in the process of implementing, a centralized decision-making process for prioritizing high value projects and delegating approval for lower cost projects to local or regional offices. The agencies vary, however, in the types of projects for which they use centralized decision-making and the degree to which they use the project scores, for example:

²³The Park Service has used the *Capital Investment Strategy* since 2012 to evaluate and rank investment projects for funding.

²⁴The GSA Public Buildings Service acquires space on behalf of the federal government through new construction and leasing, and acts as a caretaker for federal properties.

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- NASA field centers are authorized to independently prioritize and approve certain projects with total costs under \$1 million. For larger projects, however, NASA field centers develop project scores based on a mission dependency index measuring the relative risk an asset poses to NASA's missions.²⁵ To prioritize and approve these larger projects, NASA headquarters staff consider projects submitted by centers using the mission dependency scores, asset conditions, and other factors such as flooding risk, and make funding decisions using NASA's available budget.
 - GSA categorizes each of its assets into tiers based on the asset's financial performance and capital investment needs.²⁶ Additionally, since 2017 GSA has been using an Asset Repositioning Tool, which uses more detailed data analysis to rank assets within each tier.²⁷ GSA uses these designations when prioritizing asset investments. For projects with projected costs below the prospectus level (approximately \$3.1 million in fiscal year 2018), GSA regions use each asset's tier and core designation to allocate funds across the region's asset portfolio.²⁸ For larger projects, the GSA Administrator and GSA's Public Buildings Service Commissioner and Deputy Commissioner are responsible for determining the priority level of projects.
 - The Corps is in the process of implementing a procedure that would base funding decisions for maintenance and repair projects on a

²⁵NASA calculates this score using a matrix of responses to two questions: how long NASA would be able to sustain its operations without the asset and how easily another asset could assume the asset's functions?

²⁶GSA refers to assets with high annual return on equity and low investment needs as "tier 1" assets, with lower-performing assets placed into lower tiers. GSA also designates as "core assets" those that the agency expects to remain in the inventory for more than 15 years, have a solid customer base, are in a stable real estate market, and have sustainable reinvestment needs.

²⁷In 2015 we recommended GSA review its tiering and core-asset analysis measures and update them to provide more precise measures of asset performance. GSA officials told us that they developed the Asset Repositioning Tool in response to this recommendation to build upon the tiering and core analysis measures. See GAO, *Federal Real Property: GSA Needs to Determine Its Progress toward Long-term Sustainability of Its Portfolio*, [GAO-15-609](#), (Washington D.C.: July 15, 2015).

²⁸Prospectus-level projects involve major work or acquisitions that are estimated to cost more than a statutorily prescribed amount, which GSA's Administrator is authorized to adjust annually. Projects that are expected to cost more than the prospectus-level threshold must be submitted to certain congressional committees for authorization. 40 U.S.C. § 3307.

portfolio-wide comparison of scores, with the goal of approving the projects that will reduce the greatest amount of risk. This differs from the Corps' previous system of allocating projects' funding to local divisions and districts based on historical amounts and staff judgement. To prioritize projects, the Corps calculates a score for each project based on an assessment of the asset's condition and the risk the asset poses to operations. For example, the Corps measures risk for a lock and dam component such as a gate (see fig. 5) based on the potential economic impact of failure to users (e.g., shipping companies that use the waterway). The Corps has a plan to implement this process by 2020, a plan that Corps officials told us they expect to complete on schedule.

Officials from these agencies told us that more centralized decision-making processes can provide improved standardization and clarity in the prioritization process, particularly for high value projects, and can help ensure that mission-critical projects receive funding. As an example, Coast Guard officials cited a project involving a permanent repair to a failed steam heating pipe at the Coast Guard Yard near Baltimore. They said that this failure left several key buildings, including the Coast Guard's primary ship-painting facility, with intermittent service and an inability to complete certain critical tasks. According to officials, the Coast Guard's centralized decision-making process scored this project as a high priority because of the importance of the facilities involved, the impact of the failure, and the fragility of the temporary pipe that runs on the surface amongst other equipment (see fig. 4).

Figure 4: Temporary Steam Heating Pipe Running through Dockside Equipment, U.S. Coast Guard Yard, Curtis Bay, MD



Source: GAO. | GAO-19-57

Maintaining Leadership Support

Leadership buy-in is important for organizational initiatives, and experts told us that management support is vital to implementing an asset management framework. However, officials from two of the six agencies told us that they have received varying levels of leadership support for asset management, for example:

- Corps officials told us that it can be a challenge to make senior leadership understand the value that improved asset management practices can provide to the agency, value that they said can affect the level of support the program gets.
- Forest Service officials told us that they have faced challenges obtaining the resources they need to develop their asset management program.

In addition, in 2015 the Coast Guard received a report it had commissioned to examine the level of alignment between its asset management framework and the ISO 55000 standards. This report concluded, among other things, that the Coast Guard has faced

challenges with strategic leadership related to asset management, including in balancing budgetary support for long-term initiatives—like developing an asset management framework—against short-term infrastructure investment needs and in communicating asset management policies.

Using Quality Data

Using quality information when making decisions about assets can help agencies ensure that they get the most value from their assets. Experts we spoke with cited data elements such as inventory information (e.g., asset age and location); condition information (e.g., how well the asset is performing); replacement value; and level of service (e.g., how the asset helps the agency meet its missions and strategic objectives) as important for maximizing an asset's value. Each of the six agencies collected inventory and condition data on their assets, and used this data to make decisions about its assets, for example:

- The Forest Service requires its units, such as national forests and grasslands, to inventory and verify 100 percent of their asset data over a 5-year cycle. It has developed a standardized process for units to collect specific types of data for this inventory, such as condition data and deferred maintenance. According to Forest Service officials, the data tracked in the system informs several investment decisions, such as decisions on decommissioning of assets.
- GSA developed the Building Assessment Tool Survey to assess the overall condition of its assets and what investments they need. GSA uses the data collected from the survey, conducted every 2 years, to calculate a Facility Condition Index, which is the asset's current needs divided by its replacement value.
- The Corps' 2017 policy for operational condition assessments lays out a methodology for assessing condition based on visible attributes and asset performance, such as the degree to which water is leaking around a lock gate (see fig. 5 for an example of what Corps officials described as a minor water leak). Under this policy, Corps officials assign a letter grade to the performance of each individual component within a Corps' asset. Corps officials told us that there are key differences between this system and the maintenance management system they used previously. For example, officials said the Corps is now able to more easily compare the condition of its assets across the portfolio, and grade the condition of more types of asset components, a process that Corps officials said gives them a more complete understanding of how their assets are performing.

Figure 5: U.S. Army Corps of Engineers, Brandon Road Lock and Dam, Joliet, IL



Closed lock gates with water leak in lower right-hand corner, Brandon Road Lock and Dam, Joliet, IL

Source: GAO. | GAO-19-57

Some agencies told us that they faced challenges related to collecting and maintaining asset data, for example,

- The Park Service uses data on the condition of its assets to calculate a facility condition index. Park Service officials told us that when they developed their asset management program in the early 2000's they had to change many of their existing data collection processes and train their staff to manage the new data.
- NASA field centers are required to assess assets and enter key asset data into NASA's database, but according to NASA Headquarters officials, they have faced challenges collecting data from some Centers. For example, NASA Centers are required to review and revalidate the mission dependency scores for each of their assets every 3 years, but Headquarters officials told us not all Centers have entered such scores on all assets.

Promoting a Collaborative Organizational Culture

Aligning staff activities toward effective asset management and communicating information across traditional agency boundaries can ensure that agencies make effective decisions about their assets. Officials from three of the agencies we reviewed told us that having staff embrace asset management is a key to successful implementation, for example,

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- Park Service officials told us they implemented an organizational change-management process and provided additional training to staff in key asset management areas such as data collection. Finally, they said that they tried to prevent asset management requirements from overwhelming the other tasks staff perform by, for example, considering staff time constraints when developing their data collection processes. Officials told us that they continue to streamline these processes to reduce field staff workload.
 - The Corps' *Program Management Plan* includes chapters on communications strategies and organizational change management to promote an asset management culture.

While these agency officials told us that obtaining leadership and staff buy-in is important for asset management implementation to be effective, officials from three of our six selected federal agencies cited managing organizational culture changes as an implementation challenge. For example, Corps officials told us that, prior to developing their framework, the different functional areas in the Civil Works Program were each responsible their own assets and were not sharing asset information across areas. As a result, the Corps struggled with getting staff to work together and coordinate on asset management activities. To help mitigate this issue, Corps officials told us they have assigned dedicated asset management staff to each regional district to facilitate communication at the local level between staff in different functional areas, and developed a community of practice to discuss maintenance issues including asset management.

Evaluating and Improving Asset Management practices

Continuously evaluating the performance of an agency's asset management framework and implementing needed changes can optimize the value the agency's assets provide. According to literature we reviewed, an asset management plan should be evaluated and continuously improved over time to ensure it still reflects the organization's goals.²⁹ Officials from each of the six agencies told us that they collect data to measure the performance of their asset management policies, and two agencies have continuous evaluation processes laid out in their asset management plans. For example:

²⁹ See for example, The Institute of Public Works Engineering Australasia, *International Infrastructure Management Manual*.

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- GSA's asset management plan describes the data GSA uses to track the performance of its framework, including information on operating costs, asset condition, asset utilization, operating income, and energy.
 - The Corps evaluates its program by conducting maturity assessments.³⁰ According to the Corps' 2014 *Program Management Plan*, these assessments measure the maturity level of its asset management program to review and identify gaps in achieving the asset management system's vision and objectives while efficiently using resources. Corps officials told us they self-assessed their own operations at the low end of the maturity scale, and they are using the results of the assessment to inform revisions to their *Program Management Plan*.

In addition, officials from five of the six agencies told us they are in the process of developing or implementing major changes to their asset management policies, including developing new policies for collecting data, measuring asset criticality, and prioritizing investments, for example:

- The Coast Guard has been developing its asset management model since 2006 and, as previously mentioned, is in the process of developing manuals, process guides, and technical orders to support this model.
- NASA officials told us that they are in the midst of developing new policies and guidance for asset management based on a recently completed business process assessment. Officials said that the new process under development would involve more centralized planning and management across NASA instead of the more center-based asset management program they currently use, along with improved data collection practices.
- Park Service is undertaking a program focused on improving the operation and maintenance of its real property portfolio.³¹ Officials told us that there are two major pieces to this effort, one to improve

³⁰Specifically, Corps officials stated that they use an asset management maturity-assessment tool from PASS 55 to measure the performance of its asset management program on an ongoing basis.

³¹In 2016, we recommended that the Park Service evaluate its Capital Investment Strategy to assess whether it was achieving its intended results. Park Service officials told us that they are conducting the Review Asset Management Program in response to this recommendation. GAO, *National Park Service: Process Exists for Prioritizing Asset Maintenance Decisions, but Evaluation Could Improve Efforts*, [GAO-17-136](#) (Washington, D.C.: Dec. 13, 2016).

efficiency of their data collection process by streamlining and consolidating systems to reduce the data collection and management burden on staff, and another to expand the Park Service's investment strategies to reflect the agency's top priorities and strengthen the role of the Developmental Advisory Board to ensure consistent application of investment goals.

Experts and Practitioners Said Implementing an Asset Management Framework Can Be Challenging but Also Provides Benefits

Experts and Practitioners Cited Managing Organizational Culture Changes and Capacity as Challenges to Implementing an Asset Management Framework

According to our interviews with asset management experts and practitioners whom we selected, organizations can face challenges implementing an asset management framework.³² The two challenges most frequently mentioned were managing both organizational culture changes and capacity challenges, such as lack of skills and knowledge of management practices.

Managing Organizational Culture Changes

Almost all the experts and over half of the practitioners we interviewed stated that managing the organizational culture changes that result from implementing a new asset management framework is a challenge.³³ For example, several experts and practitioners stated that an effective framework requires enterprise-wide policies to manage assets and that changing the organizational culture from one in which departments or

³²We interviewed 22 experts and 10 practitioners for a total of 32 experts and practitioners. Experts and practitioners only responded to questions that they had specific knowledge or expertise about, so our denominator varies by question.

³³Nineteen of the 21 experts and 5 out of the 8 practitioners who answered this question cited managing organizational culture changes as a challenge.

divisions are used to working independently to one that promotes interdepartmental coordination and information sharing can be challenging. Specifically, one expert representing a U.S. municipality told us that a key implementation challenge it faced was in setting up policies to promote more information sharing across the organization. This expert stated that previously the organization's data systems were not set up to share information across departments, leading to data silos that hindered coordination across the agency. Similarly, another expert stated that asset management is by nature a multidisciplinary practice, which crosses through many functional silos that are typically present in large organizations. These silos are necessary to allow for the required level of specialization, but if these silos do not communicate, inefficiencies and errors in asset management result. He stated that in these organizations, a key challenge in implementing an asset management framework is getting officials in these different departments to agree upon and transition to a common set of goals and direction for the framework.

Expert Opinion

“When asset management implementation fails, it is often because asset management staff and senior management are not in alignment.”

Source: GAO interviews with asset management experts.
| GAO-19-57

Several experts and practitioners stated that obtaining the leadership and staff buy-in that is critical for asset management implementation to be effective can be a challenge. For example, one expert representing an organization that had recently implemented a new asset management framework stated that it faced resistance from some of its staff. These employees had been working for the organization for a long time, had not been updating their skills over time and were resistant to having to learn a new process. In addition, it was difficult to convince staff previously invested in the old decision-making process to adjust to a new process. A study examining asset management practices of public agencies in New Zealand found that obtaining buy-in and support from leadership and staff was critical.³⁴ According to this study, for asset management to be successful, it has to become part of the organization's culture, and for that to happen, leadership needs to “buy-into” the process, the reason why it is important, and the value of its outputs.

Managing Capacity Challenges

Over half of the experts and all of the practitioners we interviewed cited capacity challenges to implementing an effective asset management

³⁴Audit New Zealand. *Asset management for public entities: Learning from local government examples* (April 2010).

framework, such as lack of skills, knowledge of management practices, asset data, and resources.³⁵

- Some experts and practitioners stated that implementing an effective framework might require skills and competencies that the organization may not currently have. For example, one expert stated that organizations might not have the in-house expertise needed to implement a risk management approach. Similarly, a practitioner representing an asset management firm that provides consulting services to municipalities noted that lack of in-house expertise could lead to the organization's over-reliance on consultants; such over-reliance, in turn, can result in the organization's not following through with the new asset management practices once the consultants finish their work.
- Several experts and practitioners also stated that some organizations struggle with collecting and managing data needed to conduct asset management. For example, one expert stated that an important first step to implementing an asset management framework is to develop comprehensive records of the organization's assets. However, according to this expert, it is difficult to actually collect and use good information about assets to deliver robust planning. The age of assets can compound this challenge because with older assets sometimes the original plans and specifications have been lost.
- Several experts and practitioners also mentioned lack of sufficient resources as an implementation challenge. Specifically, one expert noted that obtaining funding to support asset management activities is a challenge. This expert stated that it is more difficult to secure funding for improving components of an asset management framework, such as improving data collection processes, than it is to secure funding for tangible investments in new assets. As we previously discussed, some of the experts that we interviewed stated that evaluating and continually improving asset management practices is an important characteristic of an effective asset management framework.

Expert Opinion

"In a more practical sense, collecting data may be a big challenge for many organizations. Collecting data is one component of asset management and requires the measurement of many factors that may not have been measured before. It is difficult to collect these data and to combine and apply them in a way that is useful. This process can feel overwhelming to people within organizations."

Source: GAO interviews with asset management experts.
| GAO-19-57

Addressing Culture Change and Capacity Challenges

Experts and practitioners we interviewed identified potential strategies for addressing and overcoming implementation challenges, including strategies for managing culture change and capacity challenges such as

³⁵Twelve of the 21 experts and all 8 practitioners who answered this question stated that lack of capacity is a challenge.

lack of skills and resources. See table 2 for the strategies experts and practitioners identified.

Table 2: Examples of Strategies Experts and Practitioners Identified for Addressing Culture Change and Capacity Challenges to Implementing an Asset Management Framework

Culture change challenges	<ul style="list-style-type: none"> • Obtaining leadership buy-in: Ensuring that senior management and leadership are involved and supportive of the efforts can help mitigate organizational resistance to asset management implementation. • Maintaining ongoing communication with workforce: Maintaining ongoing communication with the workforce about the implementation process and what the organization is trying to achieve can help mitigate cultural change challenges and increase staff support. • Developing performance metrics: Identifying and tracking metrics that show how asset management activities align with organizational goals can help staff understand how their work supports the overall asset management strategy. • Providing training: Providing training to the workforce about how their work contributes to the framework can help overcome over challenges.
Capacity challenges	<ul style="list-style-type: none"> • Conducting a gap analysis: As an initial step, conducting a “gap analysis” which includes comparing the existing framework to standards or leading practices, can help inform the organization’s implementation process when resources and in-house expertise are limited • Using a phased approach to asset management implementation: Taking incremental steps to implementing the framework can help an organization manage the implementation process when resources and in-house expertise are limited.

Source: GAO analysis of comments from 22 experts and 10 practitioners. | GAO-19-57

We have previously reported on practices and implementation steps that can help agencies manage organizational change and transform their cultures to meet current and emerging needs, maximize performance, and ensure accountability.³⁶ Several of these practices—such as involving employees in the transformation effort, ensuring top leadership drives the transformation effort, and establishing a communication strategy—could address some of the potential change-management challenges that agencies might face when implementing an asset management framework. For example, in our prior work on organizational change we have noted that a successful transformation must involve employees and their representatives from the beginning to increase employees’ understanding and acceptance of organizational goals and objectives, help establish new networks and break down existing organizational silos, and gain their ownership for the changes that are

³⁶GAO, *Results-Oriented Cultures: Implementation Steps to Assist Mergers and Organizational Transformations*, [GAO-03-669](#) (Washington, D.C.: July 2, 2003).

occurring in the organization.³⁷ Some of the experts we interviewed who had implemented ISO 55000 stated that they involved employees in the transformation effort. For example, one expert representing an organization with recent success in implementing ISO 55000 stated that the managers at person's organization involved staff in the implementation process, which helped foster ownership of the new asset management program.

Experts and Practitioners Cited Improved Data and Other Benefits to Adopting an Asset Management Framework

Asset management experts and practitioners we interviewed cited a number of potential benefits to adopting an asset management framework that aligns with the six characteristics we identified, including: (1) improved data and information about assets, (2) better-informed decisions, and (3) financial benefits.

Improved Data and Information about Assets

About half of the experts and practitioners we interviewed stated that implementing an asset management framework that aligns with the six characteristics we identified previously and discussed can result in an organization's collecting more detailed and quality information about assets.³⁸ For example:

- One expert representing a U.S. municipality that had recently implemented a new asset management framework stated that it now collects and tracks more detailed asset data, including information about the condition and performance of its assets. According to this expert, this more detailed information provides asset managers with a better understanding of how much asset repairs actually cost in the long term, how long repairs take, and which assets are most critical to repair or replace. Additionally, they are in the process of integrating this data into the organization's capital-improvement project modeling, a step that in turn has allowed the asset managers to make better investment decisions. This expert also noted that collecting detailed data about the municipality's assets has enabled the asset managers to provide more information to the public and to decision-makers.
- Another expert we interviewed representing an organization that had recently adopted a new asset management framework stated that its

³⁷[GAO-03-669](#).

³⁸Nine of the 21 experts and 5 of the 7 practitioners cited improved information and data about assets as a benefit to implementing an asset management framework.

data have improved as a result. According to this expert, prior to implementing the program, the organization had a good inventory of its assets, but it was missing dynamic information about condition and performance. The managers made several changes to address this situation, including investing in information technology systems and infrastructure to collect and track condition data in real time. As a result, the organization is now able to track trends in asset performance failures and anticipate that over time it will predict future performance failures with this information.

Better-Informed Decisions

Most of the experts and all of the practitioners who responded to this question stated that another benefit of implementing an asset management framework is that it can help organizations make better-informed asset management decisions.³⁹ For example, some of these experts and practitioners stated that having a framework that includes improving interdepartmental coordination, collecting more detailed data, and having a strategic approach to asset management helps organizations make better-informed decisions about how to maintain and invest in their assets. In addition, about one-half of the experts stated such a framework can also help organizations better understand the risks the organization faces and make informed decisions about the organization's assets.⁴⁰ For example:

- One expert stated that a benefit to implementing an asset management framework that incorporates interdepartmental coordination is that everyone within the organization is working to achieve the same goals in both the short-term and long-term, which results in better decisions and better customer service. This expert worked with a foreign network operator to implement an asset management system that would support the company's goals for increasing its electric grid capacity. He found that for different assets, the company had adopted different asset strategies to deal with future demand growth, approaches that resulted in misaligned asset strategies. The differences in the individual asset strategies were identified and realigned. If these differences had not been recognized,

³⁹Fifteen out of 21 experts and all 7 of the practitioners who responded to this question cited better-informed decisions as a benefit to implementing an asset management framework.

⁴⁰Nine out of the 21 experts who responded to this question cited having the ability to better understand the risks the organization faces and make risk-informed decisions about the organization's assets as a benefit.

this lack of coordination could have resulted in inefficient decision-making and the loss of time and money.

- Another expert representing a U.S. municipality stated that by implementing an asset management framework, the municipality's program managers are now able to make better-informed asset management decisions and present information and proposals to the city council and budget committee. In addition, this detailed information has allowed managers to better assess the condition of their assets across the portfolio and to compare it to industry standards in the respective asset classes.

Financial Benefits

Over half of the experts and a third of the practitioners we interviewed stated that effective asset management practices can result in financial benefits to the organization, such as cost avoidance and better management of financial resources.⁴¹ For example,

- One expert stated that asset management can lead to a greater understanding of budget needs and better long-term capital and lifecycle investment planning. In addition, this expert stated overall that asset management improves clarity in terms of where funds are spent. This enhanced insight can then inform asset management decision-making to produce future cost savings.
- A practitioner representing a local municipality in Canada stated that since implementing an asset management framework, the municipality is now making better-informed decisions about maintenance and have identified and eliminated unneeded maintenance activities, steps that have resulted in cost savings. For example, by analyzing condition data, the municipality identified an optimal point in time for addressing maintenance issues on its roads and achieved a fivefold-to-tenfold cost reduction over previous repairs.

⁴¹Fifteen out of 21 experts and 3 of the 7 practitioners who responded to this question stated that effective asset management practices can result in financial benefits to the organization.

Government-Wide Asset Management Information Does Not Fully Reflect an Effective Asset Management Framework

Experts and Practitioners Cited ISO 55000 Standards as a Resource to Inform Agency Efforts

Experts and practitioners we interviewed most often cited the ISO 55000 standards as a useful resource that provided a solid foundation for an asset management framework and could inform federal agencies' asset management efforts.⁴² Specifically, these experts and practitioners stated that the standards are flexible and adaptable to different types of organizations regardless of size or organization mission, applicable to different types of assets, and internationally accepted and credible. About half of the experts we interviewed had used the standards, and some of these experts shared examples of how their organization's asset management approach improved by implementing ISO 55000. See, for example, the experience of Pacific Gas & Electric below.

⁴²Several experts and practitioners also cited the *International Infrastructure Management Manual*, and resources from the Institute for Asset Management as useful guidance to implementing an asset management framework. See Institute of Asset Management, *Asset Management—an Anatomy*, Version 3 (Bristol, U.K.: December 2015) and Institute of Asset Management, *Asset Management Maturity Scale and Guidance*, Version 1.1 (Bristol, U.K.: 2016).

Pacific Gas and Electric's (PG&E) experience with International Organization for Standardization (ISO) 55001 standard:

In 2014 and 2017, PG&E, a public utility company in California, attained Publicly Available Specification (PAS) 55 and ISO 55001 certification and recertification for its natural gas operations. Its physical assets include gas transmission and distribution pipelines, pressure regulator stations, gas storage facilities, and meters. According to PG&E, a key benefit from implementing the standards is that PG&E has developed a consistent strategy for managing its natural gas operations assets. This, according to PG&E, has enabled the utility to develop a framework for program managers from different parts of the organization, such as finance, operations, engineering and planning, to collaborate more effectively and work together towards one strategic goal rather than competing with one another for funding. According to PG&E, this new structure allows the program managers to prioritize investment decisions across their asset portfolio to align with corporate objectives.

Source: GAO interview with PG&E officials. | GAO-19-57

Officials from five of the six agencies we interviewed stated that they were familiar with the ISO 55000 standards, and officials from the Corps stated that they use selected practices from ISO 55000. Corps officials stated that using the standard has provided several benefits to their organization. For example, they stated that using the standard has informed their budget process and has helped them make better-informed decisions about critical reinvestment. In addition, it has allowed them to develop a consistent approach to managing all of their physical assets across different lines of business.

However, officials from four agencies raised some concerns about using these standards. These included concerns about upfront costs and resources needed to implement the standards and their applicability to the federal government given the size, scope, and uniqueness of agencies' assets, and the diverse missions of each agency. For example, officials from one selected agency stated that in their view, the standards are better suited for private organizations because federal agencies have federal requirements they need to meet, such as those for disposition of real property, which may affect their asset management decision making. We have previously reported on challenges federal agencies face with disposing of assets in part due to legal requirements agencies must follow.⁴³

⁴³See GAO, *Federal Building Management: Building Disposal Authorities Provide Varying Degrees of Flexibility and Opportunities for Use*, [GAO-17-123](#) (Washington, D.C.: Dec. 8, 2016); GAO, *Federal Real Property: The Government Faces Challenges to Disposing of Unneeded Buildings*, [GAO-11-370T](#) (Washington, D.C.: Feb. 10, 2011); and GAO *Federal Real Property: National Strategy and Better Data Needed to Improve Management of Excess and Underutilized Property*, [GAO-12-645](#) (Washington, D.C.: June 20, 2012).

Several experts and officials from one practitioner organization we interviewed stated that they thought that federal agencies across the government could implement the ISO 55000 standard. The experts stated that key benefits of implementing the standard would be that it would result in a more consistent asset management approach and help federal agencies better manage resources. For example, one expert stated that a key benefit of implementing the standard would be to drive federal agencies to be better stewards of their resources by better utilizing mission assets. In addition, some experts and practitioners also stated that federal agencies do not need to implement the full standard or seek certification to achieve results; agencies can decide which practices in the standard are most relevant to their organization and implement those practices. The ISO technical committee that produced the ISO 55000 standards is drafting a new standard on asset management in the public sector. According to ISO, this standard, expected to be published in December 2019, will provide guidance to any public entity at the federal, state, or local level including more detailed information on how to implement an asset management framework.

Government-Wide Asset Management Information Lacks Many Elements of an Effective Asset Management Framework

While OMB has issued government-wide requirements and guidance to federal agencies related to asset management, this guidance does not present a comprehensive approach to asset management because it does not fully align with standards and key characteristics, nor does it provide a clearinghouse of information on best practices for federal real property management to agencies as required by Executive Order 13327.

As mentioned earlier, OMB has issued various government-wide policies, guidance, and memorandums related to federal asset management. For example, in response to Executive Order 13327 in 2004, the FRPC—chaired by OMB—developed guiding principles for agencies' asset management practices and for developing a real property asset management plan. Specifically, the guidance stated that each real property asset management plan should, among other things:

- link the agency's asset management framework to the agency's strategic goals and objectives,
- describe a process for periodically evaluating assets, and
- describe a process for continuously monitoring the agency's framework.

In addition, OMB's *Circular A-11* describes requirements for the agency capital planning process, such as prioritizing assets to support agency priorities and objectives, while OMB's *Circular A-123* describes risk management requirements for agencies, and OMB's Memorandum 18-21 describes requirements for an agency's senior real property officers, such as coordinating real property planning and budget formulation. Further, the Federal Assets Sale and Transfer Act and the Federal Property Management Reform Act—both of 2016—collectively contain provisions related to asset management including establishing procedures for agencies to follow when disposing of real property assets and requiring agencies to submit data on leases to the FRPC.

Taken as a whole, the OMB guidance lacks many of the elements called for by the ISO 55000 standards and the key characteristics we identified. For example, the guidance:

- covers several different areas of asset management but does not direct agencies to develop a comprehensive approach to asset management that incorporates strategic planning, capital planning, and operations, as recommended by the ISO 55000 standards and the key characteristics we identified.
- directs agencies to continuously monitor their asset management frameworks and identify performance measures but does not direct agencies to use the results to improve their asset management frameworks in areas such as overall governance, decision making, and data collection, as called for in ISO 55000 standards and the key characteristics we identified.
- directs agencies to have a senior official in charge of coordinating the real property management activities of the various parts of the organization but does not direct agencies to demonstrate leadership commitment to asset management or to define asset management roles and responsibilities for each element of the agency, as called for in ISO 55000 standards and the key characteristics we identified.
- directs agencies to ensure that their real property management practices enhance their decision making, but does not direct agencies to actively promote a culture of information sharing or ensure that the agencies' decisions are made on an enterprise-wide basis, as called for in ISO 55000 standards and the key characteristics we identified.
- directs agencies to identify asset management goals and enhance decision making, but does not direct agencies to establish the scope of their asset management frameworks by, for example, determining

how the agency should group or organize the management of its different types of assets, as called for in ISO 55000 standards.

Moreover, OMB staff told us that while the executive order's requirements for federal agencies to develop an asset management plan and related processes remain in effect, OMB's real property management focus has shifted to the *National Strategy for the Efficient Use of Real Property* and its accompanying *Reduce the Footprint* initiatives issued in 2015. These initiatives emphasize efficiently managing and using space, rather than overall asset management. OMB staff said that they view asset management as a tactical activity, separate from broader strategic and capital planning efforts, where agencies make operational-level policies to support their real property portfolio. However, this approach to asset management differs from ISO's definition of asset management, which encompasses both the capital-planning and asset management levels of OMB's policy model. Under the *Reduce the Footprint* initiative, federal agencies are required to submit annual Real Property Efficiency plans that specify their overall strategic and tactical approach to managing real property, provide a rationale for and justify their optimum portfolio, and direct the identification and execution of real property disposals, efficiency improvements, and cost-savings measures. As a result, according to OMB staff, they no longer require agencies to develop a comprehensive asset management plan.

We recognize that reducing, and more efficiently managing government-owned and leased space are important goals. However, effective asset management is a more comprehensive objective that seeks to best leverage assets to meet agencies missions and strategic objectives. For example, some agencies have high-value real property assets that are not building space, such as those at the Corps and the Park Service. See table 2 for examples of these types of assets at the six selected agencies in our review. For example, the Corps has over 700 dams—the age and criticality of which require the Corps to conduct regular maintenance and, in some cases, major repairs to assure continued safe operation. In 2015, the Corps estimated the cost of fixing all of its dams that need repair at \$24 billion.⁴⁴ Similarly, in 2016, we reported that the Park Service's deferred maintenance for its assets averaged about \$11.3 billion from fiscal year 2009 through fiscal year 2015 and that in each of those years, deferred maintenance for paved roads made up the largest share of the

⁴⁴GAO, *Army Corps of Engineers: Actions Needed to Improve Cost Sharing for Dam Safety Repairs* [GAO-16-106](#) (Washington, D.C.: Dec. 10, 2015).

agency's deferred maintenance—about 44 percent.⁴⁵ Assets classified as paved roads in the Park Service's database include bridges, tunnels, paved parking areas, and paved roadways. For these and other agencies with similar portfolios, the agencies' Real Property Efficiency plans are not relevant to managing the bulk of their assets, and the guidance primarily focused on buildings and office space is of limited use. In addition, without specific information to help all federal agencies evaluate their current practices and develop more comprehensive asset management approaches, federal agencies may not have the knowledge needed to maximize the value of their limited resources.

In addition, while Executive Order 13327 requires the FRPC to provide a clearinghouse of information on best practices for federal real property management, this information is currently lacking from existing guidance or other available sources. GSA officials and OMB staff stated they do not currently have plans to compile this information. Because of this, existing guidance falls short of what an effective asset management framework might include. GSA officials told us that while certain agencies have shared information on asset management at meetings of the FRPC, the council does not take minutes or make this information readily available to agencies outside of the meetings. Given OMB's shift in focus, OMB staff said that they did not plan to update their guidance. However, *Standards for Internal Control in the Federal Government* state that communicating information, such as leading practices, is vital for agencies to achieve their objectives.⁴⁶

Further, government-wide information in some cases is not available, such as information on practices federal agencies have successfully used to conduct asset management. There is merit to having key information on successful agency practices readily accessible for federal agencies to use. For example, officials from three of the six agencies we spoke with said information on best practices for asset management would be helpful to them in developing their agencies asset management frameworks. Such information could include practices that are described in ISO 55000 and that federal agencies have successfully used to improve asset management. For example, one agency official stated that it would be useful to have a compilation of asset management practices that federal

⁴⁵[GAO-17-136](#).

⁴⁶See GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

agencies use to determine if any of those practices might be applicable to an agency. Similarly, an official from another agency stated that the agency is currently evaluating opportunities to improve its asset management program and that the agency would be interested in learning more about asset management processes across the federal government in order to inform the agency's asset management efforts. Without information such as these officials described, federal agencies lack access to practices geared to them on how to develop an asset management plan and other asset management practices.

Conclusion

Federal agencies collectively hold billions of dollars in real property assets—ranging from buildings, warehouses, and roads to structures including beacons, locks, and dams—and are charged with managing these assets. The effective management of all of an agency's real property assets plays an important role in its ability to execute its mission now and into the future. However, because existing federal asset management guidance does not fully reflect standards and the key characteristics, such as, directing agencies to develop a comprehensive approach to asset management that incorporates strategic planning, capital planning, and operations, federal agencies may not have the knowledge needed to maximize the value of their limited resources. In addition, because there is no central clearinghouse of information to support agencies' asset management efforts, as required by Executive Order 13327, agencies may not know how best to implement asset management activities, including using quality data to inform decisions and prioritize investments. A reliable central source of information on current effective asset management practices could support agencies in making progress in their asset management efforts, helping them more efficiently fulfill their missions and avoid unnecessarily expending resources. Further, sharing experiences across the government could assist agencies' efforts to adopt, assess, and tailor an asset management approach appropriate to their needs and to support efforts to more strategically manage their real property portfolios.

Recommendation

We are making the following recommendation to OMB:

The Director of OMB should take steps to improve existing information on federal asset management to reflect leading practices such as those described in ISO 55000 and the key characteristics we identified and make it readily available to federal agencies. These steps could include updating asset management guidance and developing a clearinghouse of

information on asset management practices and successful agency experiences. (Recommendation 1)

Agency Comments

We provided a draft of this report for review to the Office of Management and Budget, the General Services Administration, the National Aeronautics and Space Administration, and the Departments of Agriculture, Defense, Homeland Security, and the Interior.

The Forest Service within the Department of Agriculture agreed with our findings and noted that GAO's key characteristics for effective asset management will help the Forest Service manage their assets and resources effectively. Further, the Forest Service stated that asset management leading practices are critical in measuring efficiencies and meeting strategic goals for its diverse and large portfolio. The Forest Service's written comments are reproduced in appendix IV. The Departments of Homeland Security and the Interior, and the General Services Administration provided technical comments, which we incorporated as appropriate. The Office of Management and Budget, the Department of Defense, and the National Aeronautics and Space Administration had no comments on the draft report.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of the Departments of Agriculture, Defense, Homeland Security, and the Interior; the Administrators of the General Services Administration and National Aeronautics and Space Administration; and the Director of the Office of Management and Budget. 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 concerning this report, please contact me at (202) 512-2834 or rectanusl@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 V.



Lori Rectanus
Director, Physical Infrastructure

Appendix I: Asset Management in Canada

As of 2016, public entities in Canada owned about \$800 billion worth of infrastructure assets including roads, bridges, buildings, waste and storm water facilities, and public transportation assets.¹ Municipalities owned the majority of these assets, around 60 percent, with provincial and federal entities owning around 38 percent and 2 percent respectively.²

Asset Management Policy and Support

Federal Asset Management Policies

The federal government of Canada owns or leases approximately 20,000 properties containing about 37,000 buildings with about 300 million square feet of floor space. In the fiscal year that ended in 2016, the federal government spent around \$7.5 billion on managing its real property portfolio, of which about 80 percent went to operating expenditures and about 20 percent went to capital investments such as acquisitions and renovations. This portfolio is managed and controlled by 64 federal agencies, departments, and “Crown corporations” with primary uses including post offices, military facilities, government offices, employee housing, and navigation facilities such as lights.³ The Treasury Board of Canada, supported by the Treasury Board Secretariat, provides policy direction to agencies and departments for their real property assets along with approving certain larger projects, acquisitions, and disposals. The Treasury Board of Canada Secretariat is currently conducting a portfolio-wide review of the federal government’s real property management in order to develop a road map for the most efficient and effective model for federal real property asset management. Treasury Board Secretariat officials told us that they have preliminarily found that the federal government does not have a government-wide asset management strategy and faces challenges related to the availability of current and consistent asset condition data.

¹All dollar amounts in this section are in U.S. Dollars.

²Her majesty the Queen in Right of Canada, as represented by the Minister of the Office of Infrastructure of Canada, *Investing in Canada — Canada’s Long-Term Infrastructure Plan*. (Ottawa, Ontario: April 2018). While in this section we refer to Canadian public sector entities as owning or managing real property assets, all public real property in Canada is officially owned by Her Majesty the Queen in Right of Canada. Public sector entities are officially known as custodians of this real property in a practice known as Crown ownership.

³“Crown corporations” are companies wholly owned by the Canadian Government.

Federal and Provincial Support
for Municipal Asset
Management

Municipalities own and manage most of Canada's public infrastructure, and in recent years, municipal governments have been leaders in developing and implementing asset management frameworks. By the early 2000's several large cities including Hamilton, Calgary, and Edmonton began developing frameworks to reduce costs and improve the management of certain types of municipal assets such as those related to water distribution and treatment. More recently, the federal government and several provincial governments have promoted asset management for municipalities in a variety of ways including by awarding grants and attaching requirements to infrastructure funding. Some of these programs have focused on small municipalities that make up the large majority of the total but may face particular challenges in obtaining the resources to develop and implement an asset management framework.

The federal government provides infrastructure funding to municipalities through several programs, including the Federal Gas Tax Fund. This fund provides around \$1.5 billion in funding to municipalities each year for projects such as water treatment, roads and bridges, broadband connectivity, airports, and public transit, and does not require yearly reauthorization. Each of Canada's municipalities receives funding through this program by formula, and funds are routed through the provinces, which can attach their own requirements. In the 2014 set of agreements between the federal government and the provinces, provinces were required to institute asset management requirements for municipalities to receive gas tax funds, and each of the provinces developed separate requirements for municipalities under its jurisdiction. These requirements took several forms. For example, Ontario required each municipality to develop an asset management plan by the end of 2016 while Nova Scotia has withheld a small portion of its total provincial gas tax allocation to use toward developing a province-wide asset management framework for municipalities to use.

The federal government also provides funding to municipalities for asset management. Through the Municipal Asset Management Program, administered by the Federation of Canadian Municipalities (FCM),⁴ Infrastructure Canada made available \$38 million over 5 years for

⁴The Federation of Canadian Municipalities (FCM) is a non-governmental organization that advocates on behalf of Canadian municipalities including by representing municipalities in negotiations with the federal government and operating programs that support municipalities using federal funds

Canadian municipalities and partnering not-for-profit organizations to improve municipal asset management practices.⁵ The maximum grant amount for municipalities is \$38,000. Eligible activities under this program include assessing asset condition, collecting data on asset costs, implementing asset management policies, training staff, and purchasing software. FCM officials told us that, as of March 2018, they had received 253 grant applications and that, of the grants they had disbursed so far, around:

- 25 percent of grantees used the funds for data projects,
- 15 percent to develop asset management plans,
- 2 percent for staff training,
- 4 percent for asset management system operations, and
- 60 percent for some combination of these purposes.

Canadian provinces have also taken several actions to improve asset management practices at the municipal level by establishing requirements for municipalities in their jurisdiction or by providing funding programs. For example, in 2017, Ontario issued an asset management planning regulation, which requires municipalities to develop a strategic asset management policy by July 1, 2019, and then develop progressively more detailed asset management planning documents in later years.⁶ In addition to this regulation, in 2014, Ontario also introduced a funding program for small and rural municipalities to provide long-term, formula and application-based funding for these municipalities to develop and repair their infrastructure. Under the program, municipalities are required to have an asset management plan as a condition of receiving funding. In addition, municipalities can use formula-based program funds for certain asset management activities including purchasing software, staff training, or direct staff activity related to asset management. In 2016,

⁵Partnering not-for-profit organizations deliver training and other asset management capacity-building support for municipalities.

⁶Specifically, municipalities will be required to prepare a strategic asset management policy by July 1, 2019; have an asset management plan for its core municipal infrastructure such as water and wastewater assets, roads, bridges, and culverts by July 1, 2021, and for all other municipal infrastructure assets by July 1, 2023; and by July 1, 2024 every asset management plan must include information about the levels of service that the municipality proposes to provide in each of the asset categories for each of the following 10 years.

Ontario announced plans to increase the funding available per year from about \$75 million to about \$150 million in 2019.

Experiences with Implementing Asset Management Frameworks

Selected Federal Asset Management Experiences

Much of the federal government's real property is managed by a federal department known as Public Services and Procurement Canada (PSPC) whose nationwide portfolio includes around 350 owned buildings and an additional 1,200 building leases. PSPC uses a portfolio-wide asset management framework, which begins with developing national portfolio strategies and plans every 5 years. Staff in each of PSPC's five regional offices then use these plans to develop regional and community-based portfolio strategies and plans, which then inform annual management plans for each PSPC asset. To determine how to best allocate funds across its portfolio of assets, PSPC places each of its assets into one of four tiers based on three major criteria: (1) the asset's strategic importance to PSPC's portfolio as measured by criteria such as the asset's location and design, (2) the asset's operating and functional performance such as cost per unit area, and (3) the asset's condition based on a metric called the Liability Condition Index, which measures the risk an asset poses to continuing operations and occupant safety. Using this method, PSPC designates its highest tier assets as those that have excellent financial performance, that have non-financial attributes that support PSPC's objectives, and that are not expected to need major capital investments in the next 5 years. The lowest tier assets have poor performance and are in need of either major investments or disposal in the next 5 to 10 years.

PSPC officials told us that they are in the midst of making major changes to their asset management framework, including by moving to a component-based system of accounting where they will treat each asset as 12 components, including 11 for the building such as roofs or heating and air conditioning systems, and 1 for tenant equipment. Additionally, PSPC plans to move to more modern enterprise systems to eliminate paper records and improve the quality of the data they use to make budgeting decisions. Officials said that they consider the ISO 55000 requirements when evaluating their asset management framework, but they also use other best practices from the private sector that they said better suit their needs by providing more detailed information on how to

Selected Municipal Asset Management Experiences

develop and implement the various elements of an asset management framework.

Over the past 20 years, several Canadian municipalities have developed detailed asset management frameworks to improve management efficiency and cost-effectiveness as well as to obtain improved levels of service from municipal infrastructure. In the late 1990's, the City of Hamilton, Ontario, began developing an asset management framework for its core municipal infrastructure assets, and in 2001, the city established an office dedicated to asset management within its public works department, which produced its most recent municipal asset management plan for public works in 2014. This plan sets a strategic vision and goals for the asset management program, which are designed to align with the city's overall strategic plan, capital and operating budgets, master plan, and other business documents, and describes how the city's asset management activities will support the objectives laid out in those documents. Additionally, the asset management plan provides an overview of the current state of Hamilton's infrastructure assets in four categories: drinking water supply, wastewater management, storm water management, and roads and bridges. The plan states the total value of the assets in each category and, the condition of those assets and has an indicator of the recent trends in the condition of those assets. The plan also defines the levels of service Hamilton aims to provide in each of the four main asset categories and sets goals for each category such as safety, reliability, regulatory compliance, and customer service. Next, the plan defines an asset management strategy for the city, which includes taking an inventory of assets, measuring asset condition, assessing risk, measuring the performance of the asset management framework, making coordinated citywide decisions, and planning for capital investments. Finally, the document contains a plan for managing each of the four main asset categories over their entire life cycles.

Hamilton officials stressed the importance of collecting and using quality data when deciding where and when to allocate resources. They told us that the data they have collected under their asset management framework have allowed them to make better-informed investment decisions, and have provided them with the information necessary to make business cases for investment and to better defend their decisions when they solicit funding from the City Council. For example, officials described how the city assesses the condition of its road network and uses the results to prioritize investment in its assets. To assess the condition of each road, the city uses a 100-point scale where, for example, above 60 indicates the road is only in need of preventative

maintenance and 20 or less indicates the road is in need of total reconstruction. Officials said that a total reconstruction could cost ten times as much as a minor rehabilitation and that the window of time between when a road needs only a minor rehabilitation and a full reconstruction is only around 10 years. Because of this, Hamilton officials said that it is important to conduct rehabilitation on roads and other infrastructure assets before they deteriorate to the point where they either fail or are in need of a full rehabilitation. For example, Hamilton undertook a major re-lining project for a storm sewer that was in danger of complete collapse, as shown in fig. 6. Officials told us this project would preserve storm sewer service at significantly lower cost than waiting for the structure to fail or completely rebuilding it, either of which would have been cost prohibitive. Additionally, Hamilton officials noted that they do not need all of their assets to be at a 100 rating and that their asset management framework directs them to allow some assets to deteriorate to a certain extent while rehabilitating others by making investment decisions on a system-wide service basis, as opposed to an individual project basis.

Figure 6: Damage to the Mountain Trunk Storm Sewer, City of Hamilton, Ontario, Canada



Source: GAO. | GAO-19-57

The City of Calgary, Alberta, began developing its asset management framework in the early 2000's, first focusing on the Calgary's municipal water-management assets because they are expensive to maintain and are only funded from water utility customer bills, as opposed to tax revenue. City officials told us that the primary impetus for initially exploring asset management was to be able to maintain levels of service as the city rapidly expanded in both population and physical size; this expansion forced Calgary to make major investments in the water system. Since that time, Calgary has expanded its asset management framework to include nearly all of its assets, including its software,

bridges, public recreation facilities, and even its trees. Between 2008 and 2010, the Calgary took steps to align its asset management to its business processes, steps that culminated with the development of the city's first citywide asset management policy in 2010.

Calgary officials told us that between 2004 and 2008 they worked to align their initial asset management framework with the British Standards Institution Publicly Available Specification 55 (PAS 55). After this experience, officials from Calgary participated in the development of the ISO 55000 standards and provided the Standards Committee information about tactics for asset management such as policy development and business strategy. When the ISO 55000 standards were officially published in 2014, the city began working on aligning their asset management framework with the new standards, a process that led to a new framework including a strategic asset management plan, which city officials published in 2016. Calgary officials said that aligning their asset management framework with the ISO 55000 standards has given them support from the city's top management and has improved their relationship with the various bodies that audit the city's operations because it gives them a common language to use when describing management processes. Calgary officials told us that the ISO 55000 standards are credible internationally recognized best practices and that in practice they are a good guide for developing an asset management framework. However, Calgary is not planning on certifying its operations to the ISO 55000 standard because officials told us that they are not required to be certified; certification is expensive and needs to be repeated; and they are unsure of what additional value certification to the standards would provide.

The City of Ottawa, Ontario, began developing its asset management framework in 2001. Since that time, the city's asset management framework has gone through several versions, the most recent of which it developed beginning in 2012 based on PAS 55. Ottawa officials told us that implementing their asset management framework has allowed them to collect better information about their assets and improve their long-term financial-infrastructure-planning process. While Ottawa officials developed and implemented an asset management framework, they have a number of ongoing initiatives to further develop some areas of the framework. For example, officials said that they consider determining the levels of service to be provided by each asset class the most difficult aspect of asset management, especially for those assets that do not necessarily provide a measureable service. Ottawa officials are working on ways to better measure the services each of their assets provides and

the levels of risk that each asset poses to these service levels. Officials said that accurately measuring service and risk levels is critical for their financial planning and will allow them to improve how they prioritize funding and ensure that funds are spent on priority assets. See fig. 7 for an example of an asset officials said was intended to improve levels of service for Ottawa's pedestrian multi-use pathways. Another ongoing initiative is an updated report card for the condition of the city's assets, which officials said they use to transparently communicate to stakeholders the current state of their infrastructure.

Figure 7: Flora Footbridge, Ottawa, Ontario Canada



Source: City of Ottawa. | GAO-19-57

Appendix II: Objectives, Scope, and Methodology

This report discusses: (1) key characteristics of an effective asset management framework, and how selected federal agencies' frameworks reflect these characteristics; (2) views of selected asset management experts and practitioners on challenges and benefits to implementing an asset management framework; and (3) whether government-wide asset management guidance and information reflect standards and key characteristics of an effective asset management framework.

To obtain information for all three objectives, we reviewed relevant literature, including academic and industry literature on asset management, publications describing asset management leading practices, and the ISO 55000 and related standards. We selected the ISO 55000 standards because they are international consensus standards on asset management practices. We also reviewed laws governing federal real-property asset management, Office of Management and Budget's (OMB) guidance and prior GAO reports describing agencies' real-property management and efforts to more efficiently manage their real property portfolios.

In addition, to address all three objectives, we collected information from and interviewed a judgmental sample of 22 experts to obtain their perspectives on various asset management issues. To identify possible experts to interview, we first worked to identify relevant literature published in the topic area. Specifically we searched in October 2017 for scholarly and industry trade articles and other publications that examined effective asset management practices. We limited our search to studies and articles published from January 2014 through January 2017. From this search, we screened and identified studies and articles for relevance to our report and selected those that discussed asset management practices and the ISO 55000 standards. In addition, we conducted preliminary interviews with selected asset management practitioners, who included representatives from public and private organizations knowledgeable about asset management practices, to learn about key asset management issues and obtain recommendations about experts in this field. Through these methods, we identified a total of 82 possible candidates to interview.

To ensure a diversity of perspectives, we used the following criteria to assess and select a sample from this group: type and depth of an expert's experience, affiliations with asset management trade associations, experience with government asset management practices, relevance of

published work to our topic, and recommendations from other entities.¹ We selected a total of 22 experts representing academia, private industries, foreign private and public entities, and entities that have implemented ISO 55000.² See table 3 for a list of experts whom we interviewed. Their views on asset management practices are not generalizable to those of all experts; however, we were able to secure the participation of a diverse, highly qualified group of experts and believe their views provide a balanced and informed perspective on the topics discussed.

Table 3: Names and Affiliations of Experts Interviewed

Experts	Affiliation
Mike Aimone, P.E.	Senior Fellow, Asset Leadership Network. Former Director for Business Information & Systems, Office of the Assistant Secretary of Defense for Energy, Installations & Environment, Department of Defense, Washington DC.
Admiral Thad W. Allen (ret.)	Senior Executive Advisor, Booz Allen Hamilton. Former Commandant of the U.S. Coast Guard.
Kerry A. Brown	Professor of Employment and Industry, School of Business and Law at Edith Cowan University and Program Leader for the Governance and Organisational Planning Program of the Asset Institute.
Richard Culbertson	Owner of Culbertson Asset Management. United States Delegate to the ISO Standards Committee on Asset Management (ISO Technical Committee 251). Founding member and Senior Fellow of the Asset Leadership Network. Former Senior Manager of Asset Management, Lockheed Martin.
Peter Davies	Specialist Audit and Assurance Services Director, Audit New Zealand.
Mark DeClercq, P.E.	President, Applied Asset Management Consultants, Inc. Adjunct professor at Western Michigan University. Former Civil Engineer for the City of Grand Rapids, Michigan.

¹To select our final list of experts to interview, we developed a “total depth of experience” score by assigning a 1 or 0 for each of the following: affiliation with an asset management trade organization, published relevant work on the topic, work experience of 5 years or more years in asset management, national recognition, and experience with government asset management practices. A GAO Analyst calculated a total depth of experience score for each expert, and a second GAO Analyst reviewed the scoring. The two Analysts met to discuss any differences in scoring and to reach a final consensus. We organized the experts by their area of expertise and ranked them by their depth of experience score. Generally, we selected experts with the highest depth of experience score to interview. However, in some cases, we selected an expert with a lower score if there was a notable reason for speaking with that expert, such as if the expert worked for an organization that had recently implemented ISO 55000 or could speak to how ISO 55000 is used in other countries.

²We initially selected and contacted 23 experts to interview. Of these experts, five declined or did not respond to our interview requests, or were eliminated because we did not have correct contact information for them. We replaced these experts with four additional experts.

Appendix II: Objectives, Scope, and Methodology

Experts	Affiliation
Jack Dempsey, P.E.	Director, Definitive Logic. Product Improvement Work Group Convener, ISO Technical Committee 251. Member and Delegate US Technical Advisory Group to ISO Technical Committee 251. Senior Fellow, Asset Leadership Network.
Keith Hamer	Global Vice President of Asset Management and Engineering, Sodexo Global Services.
Robert Lewis	Principal Asset Management for Government, Contractor to Australian Department of Defense, Capability Acquisition and Sustainment Group. Technical Expert Asset Management Systems, Joint Accreditation System, Australia and New Zealand. Subject Matter Expert Asset Management Systems, ISO Technical Committee 251 (55001).
Chris Lloyd	Chairman of Competence Assurance Solutions Ltd. (CAS). Member of the Faculty of the Institute of Asset Management (IAM).
Cameron Oskvig, P.E.	Director of Federal Facilities Council and Director of the Board on Infrastructure and the Constructed Environment (BICE), The National Academies of Sciences, Engineering, and Medicine.
Val Rogers	Principal, Asset Management Specialist, Gas Operations – Distribution Integrity Management at the Pacific Gas & Electric Company.
Martin Richardson	Director, Audit Services, Audit New Zealand.
Richard Ruitenbun, PhD	Asset Management advisor at the Asset Strategy Department of the Netherlands Railways. Consultant at Samoa Asset Management and author in the field of asset management.
Michael Salvato	Vice President, Infrastructure Advisory Services. Former Director and Program Executive for Enterprise Information and Asset Management, New York State Metropolitan Transportation Authority (MTA).
Mary Saunders	Vice President, Government Relations and Public Policy, American National Standards Institute (ANSI). Former Associate Director for Management Resources, National Institute of Standards and Technology (NIST).
Jasper Schavemaker	Senior Advisor, Rijkswaterstaat, The Netherlands Ministry of Infrastructure and Water Management.
Andrew Sharp	Infrastructure Specialist, Asset Management Consulting Limited (AMCL). Consultant on a number of asset management development and transformation projects for clients such as National Grid, Network Rail, Gas Networks Ireland, and Transport for London.
Thomas Smith	Fellow of the Institute of Asset Management (IAM) and Director of the IAM-USA. United States Delegate to the ISO Standards Committee on Asset Management (ISO Technical Committee 251). Author and lecturer in the field of asset management. University of Wisconsin-Madison Emeritus.
Robert Valenzuela, PE	Director for Public Works for the City of Sugar Land, Texas. President Elect for the Texas Public Works Association - SE Branch. Member of the American Public Works Association—Engineering & Technology Committee. Serves on the American Water Works Association, Asset Management Committee and Water Loss Committee.
Claudia van Breugel-Parisius	Senior Advisor Quality and Asset management system storm surge barriers, Rijkswaterstaat, The Netherlands Ministry of Infrastructure and Water Management.
Steve Walker	Executive Director, Audit New Zealand.
John Woodhouse	CEO, The Woodhouse Partnership Ltd (TWPL). Founder, fellow and Chairman of the Panel of Experts for the IAM. Author in the field of asset management.
Steve Wyton	Manager of Corporate Project & Asset Management, City of Calgary. Founding member and past Chair of the Canadian Network of Asset Managers. Vice Chair of the Canadian Advisory Committee creating an ISO standard for asset management, Chair of the Board of Examiners for the IAM as well as a Fellow of the IAM.

Source: GAO. | GAO-19-57

Note: Peter Davies, Martin Richardson, and Steve Walker all represent Audit New Zealand and were interviewed together. As a result, we considered their responses as a single expert interview response. Audit New Zealand is a business unit of the New Zealand Controller and Auditor-General.

We interviewed the selected 22 experts between January 2018 and February 2018 and used a semi-structured interview format with open-ended questions for those interviews. We identified the topics that each of the experts would be able to respond to, based on the individual's area of expertise and each responded to questions in the semi-structured interview guide in the areas in which they had specific knowledge. During these interviews, we asked for experts' views on key characteristics of an effective asset management system, opportunities for improving federal agencies' asset management approaches, experiences with using ISO 55000, and their views on the applicability of ISO 55000 to the federal government. After conducting these semi-structured interviews, we conducted a content analysis of the interview data. To conduct this analysis, we organized the responses by interview question, and then one GAO analyst reviewed all of the interview responses to questions and identified recurring themes. Using the identified themes, the analyst then developed categories for coding the interview responses and independently coded the responses for each question. To ensure the accuracy of our content analysis, a second GAO analyst reviewed the first analyst's coding of the interview responses, and then the two analysts reconciled any discrepancies.

To identify key characteristics of an effective asset management framework and how selected federal agencies' frameworks reflect these characteristics, we obtained and analyzed the ISO 55000 standards, which include leading practices, and asset management literature, and we analyzed information collected from our interviews with experts. We synthesized information from these sources to identify six commonly mentioned characteristics.³ We then selected six bureau-level and independent agencies as case studies and compared these agencies' asset management frameworks to the six key characteristics that we identified. Because the agencies are not required to follow the key characteristics we identified, we did not evaluate the extent to which

³We asked experts to identify the key characteristics of an asset management framework. Of the responses that we received, 17 out of the 22 experts cited establishing formal policies and plans, 16 out of the 22 experts cited maximizing an asset portfolio's value, 14 out of the 22 experts cited maintaining leadership support, 13 out of the 22 experts cited using quality data, and 8 out of the 22 experts cited promoting a collaborative organizational culture. In separate questions, 6 out of the 22 experts also cited evaluating and improving asset management practices as a key characteristic. These characteristics were consistent with practices described in the ISO 55000 standards and were also commonly mentioned as leading practices in asset management studies and articles that we reviewed.

agencies' efforts met these characteristics. Instead, we provide this information as illustrative examples of how the agencies' asset management practices reflect these characteristics.

We used a variety of criteria to select these agencies, such as: whether the agency was among the agencies that had the largest real property portfolio; replacement value and total square footage of the portfolio; extent to which the bureau or independent agency had a notable asset management program as described by recommendations from practitioners we interviewed; and whether the agency was implementing the ISO 55000 standards.⁴ In order to ensure that we had a diversity of experiences and expertise from across the federal government, we limited our selection to independent agencies and one bureau-level entity from each cabinet department. Based on these factors, we selected: (1) U.S. Coast Guard (Coast Guard); (2) U.S. Army Corps of Engineers (Corps); (3) General Service Administration (GSA); (4) National Aeronautics and Space Administration (NASA); (5) National Parks Service (Park Service); and (6) United States Forest Service (Forest Service). While our case-study agencies are not generalizable to all Chief Financial Officers Act (CFO) agencies, they provide a range of examples of agencies' experiences with implementing asset management practices.⁵

We reviewed documents and interviewed officials from each of the six selected agencies to learn about the agency's practices, its experiences with the ISO 55000 standards, and challenges it has faced in conducting asset management. In addition, we analyzed fiscal year 2017 Federal Real Property Profile (FRPP) data, as managed by GSA, to obtain information about each agency's portfolio, such as the number of real property assets and total asset-replacement value, and to obtain examples of the types of buildings and structures owned by the six selected agencies. The Corps and Coast Guard noted small differences between our analysis of the FRPP data and the data from their reporting systems. For example, the Corps reported having 139,744 real property

⁴We used the FRPP data to assess the size of the agencies portfolio. Specifically, we used a variety of FRPP data fields including operating costs, size, replacement value, repair needs, and asset condition.

⁵The Chief Financial Officers (CFO) Act of 1990 (Pub. L. No. 101-576, 104 Stat. 2838 (1990)) established chief financial officers to, among other things, oversee financial management activities at 23 agencies. The list now includes 24 agencies, which are often referred to collectively as CFO Act agencies. See 31 U.S.C. § 901(b).

assets as of August 2018 with an estimated asset replacement value \$273.4 billion as of September 2017. In addition, the Coast Guard reported 44,226 real property assets with an estimated asset replacement value of \$17.6 billion as of September 2017. To ensure consistency, and because these differences were small, we relied on FRPP data rather than data from these agencies' reporting systems.

We conducted a data reliability assessment of the FRPP data by reviewing documentation, interviewing GSA officials, and verifying data with officials from our selected agencies, and concluded the data were reliable for the purposes of our reporting objectives. We also visited four locations from our case study agencies to discuss and view examples of how our selected case-study agencies are conducting asset management. Specifically, we visited the Park Service's Santa Monica, CA, Mountains National Recreation Area; the Coast Guard's Baltimore Shipyard in Curtis Bay, MD; the Corps' Washington Aqueduct in Washington, D.C.; and the Brandon Road Lock and Dam in Joliet, IL. We selected these locations based on several factors including geographic and agency diversity, costs to travel to location, recommendations from officials at our case study agencies, and extent to which the location provided illustrative examples of how federal agencies are managing their assets.

To determine the 32 experts' and practitioners' views on challenges and benefits to implementing an asset management framework, we analyzed information collected from our interviews with the 22 experts previously mentioned. We also reviewed documents from and interviewed asset management practitioners from 10 additional organizations familiar with asset management practices and the ISO 55000 standards. The 10 organizations included representatives from private industry, one federal agency and local municipalities in Canada. We selected these additional 10 organizations by reviewing published materials related to asset management and referrals from our preliminary interviews. We interviewed the 32 experts and practitioners about their views on challenges and benefits to conducting asset management, ISO 55000, and illustrative examples of practices in other countries. The information gathered from our interviews with experts and practitioners is not generalizable but is useful in illustrating a range of views on asset management issues. See table 4 for a list of organizations we interviewed.

Table 4: Asset Management Organizations Interviewed

Category	Organizations
Federal	Federal Transit Administration
Private industry	Asset Leadership Network
	GE Digital
Canadian practitioners	Public Sector Digest
	Public Works Department, City of Hamilton
	Federation of Canadian Municipalities
	Planning, Infrastructure and Economic Development Department , City of Ottawa
	Public Services and Procurement Canada
	Treasury Board of Canada Secretariat
	Province of Ontario, Ministry of Infrastructure

Source: GAO. | GAO-19-57

To assess whether government-wide guidance and information on asset management reflect standards and key characteristics of an effective asset management framework, we reviewed current federal guidance and evaluated the extent to which this guidance incorporates practices described in the ISO 55000 standards and the six key characteristics of an effective asset management framework that we identified. Specifically, we reviewed the Federal Real Property Council’s (FRPC’s) 2004 *Guidance for Improved Asset Management*, OMB’s, *National Strategy for the Efficient Use of Real Property 2015-2020: Reducing the Federal Portfolio through Improved Space Utilization, Consolidation, and Disposal* and OMB’s *Implementation of OMB Memorandum M-12-12 Section 3: Reduce the Footprint, Management Procedures Memorandum No. 2015-01*. We also reviewed other OMB guidance, such as OMB’s 2017 *Capital Programming Guide*,⁶ OMB’s *Circular A-123*,⁷ OMB’s *Memorandum 18-21*⁸ and other guidance. In addition, we reviewed asset management requirements in the Federal Real Property Management Act of 2016 and in the Federal Assets Sale Transfer Act of 2016. We interviewed OMB

⁶OMB’s 2017 *Capital Programming Guide, Supplement V 3.0 OMB Circular A-11, Planning, Budgeting, and Acquisition of Capital Assets*.

⁷OMB *Circular A-123, Management’s Responsibility for Enterprise Risk Management and Internal Control*, (Washington DC: July 15, 2016).

⁸OMB, *Designation and Responsibilities of Agency Senior Real Property Officers*, Memorandum No. 18-21 (Washington, D.C.: July 12, 2018).

and GSA officials about their role in supporting federal agencies' asset management efforts. In addition, we obtained information from our interviews with the 32 asset management experts and practitioners about practices that could be applicable to the federal government and opportunities to improve federal agencies' asset management approaches.

Lastly, we obtained documents and, as previously discussed, interviewed representatives from private organizations, federal agencies, and local municipalities in Canada—a country with over 20 years of experience in conducting asset management—to learn about their asset management practices, including their use of the ISO 55000 standard. We also conducted a site visit to Canada to learn more about their practices and to view examples of assets in local municipalities. See appendix I for more information on Canada's asset management practices.

We conducted this performance audit from August 2017 to November 2018 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.

Appendix III: Key Elements of the International Organization for Standardization (ISO) 55000 Standards

Table 5: GAO Summary of Key Elements of the International Organization for Standardization (ISO) 55000 Standards

ISO 55000 Section	Key elements
Establishing context of the organization	<ul style="list-style-type: none"> • Align the organization’s asset management system to its organizational objectives given the organization’s purpose, needs, and requirements • Ensure that the organization’s asset management strategy and criteria for asset management decision making address external and internal stakeholder requirements and expectations • Determine the scope of the asset management system, considering, among other things, the organization’s objectives, asset portfolio, and structure • Establish, implement, maintain, and continually improve an asset management system, including a strategic asset management plan that documents how the system supports organizational objectives
Promoting leadership	<ul style="list-style-type: none"> • Demonstrate leadership commitment to the asset management system • Establish an asset management policy to guide the organization’s management strategy, set asset management objectives and govern asset management activities including a commitment to satisfy applicable requirements and continually improve the asset management system • Ensure that the responsibilities and authorities for asset management are assigned and communicated within the organization
Developing support	<ul style="list-style-type: none"> • Identify and determine strategies for addressing risks and opportunities related to the organization’s assets and the asset management system’s ability to achieve the organizational objectives • Develop asset management objectives while considering organizational objectives and requirements the organization faces from stakeholders, laws and regulations, and financial constraints • Integrate achieving asset management objectives into other organizational-planning activities including finances, human resources, and other support functions • Develop a strategic asset management plan that documents how the organization plans to achieve its asset management objectives including its method and criteria for decision making and prioritization, and the processes to be employed to management assets
Operations	<ul style="list-style-type: none"> • Determine and provide for the resources needed to establish, implement, maintain, and continually improve the asset management system • Identify the skills necessary for the different personnel roles in the asset management system and ensure that the persons used in those roles have the appropriate competencies, education, training, and experience • Implement strategies and establish requirements to ensure and evaluate that employees are aware of the asset management policy and the contribution of their work activities to the asset management system’s success • Determine the need for internal and external communication relevant to the asset management system in order to enable effective decision making and stakeholder engagement • Determine information and data requirements needed to support effective asset management including quality, attribute, collection, analysis, and evaluation requirements • Document and control information required to ensure the effectiveness of the asset management system and compliance with applicable laws, regulations and policies governing the organization and its asset management system • Plan, implement and control the processes needed to implement its asset management system • Monitor performance of the asset management system including anticipating changes in performance and mitigating adverse effects

**Appendix III: Key Elements of the International
Organization for Standardization (ISO) 55000
Standards**

ISO 55000 Section	Key elements
	<ul style="list-style-type: none"> • Manage risks associated with outsourcing activities related to the asset management system including determining, evaluating and establishing governance over outsourced activities
Performance evaluation	<ul style="list-style-type: none"> • Determine what aspects of the asset management system need to be monitored and measured, determine how this monitoring and measurement will take place, and report on the performance of the asset management system • Establish an internal audit program to conduct audits at planned intervals to determine compliance of the asset management system with the organization’s own requirements and the ISO standard • Establish management reviews, at planned intervals, of the organization’s asset management system to ensure its continuing suitability, adequacy and effectiveness
Improvement	<ul style="list-style-type: none"> • Establish processes to identify non-conformities within the asset management system, identify root-causes, and implement remedies or corrective actions based on evaluation of these non-conformities • Establish processes using results of internal audits and management reviews to proactively identify failures in the asset management system and evaluate the need for preventative action • Continually improve the suitability, adequacy and effectiveness of the organization’s assets, asset management strategy, and asset management system

Source: GAO analysis of ISO 55000 standards. | GAO-19-57

Note: As discussed previously in this report, the ISO 55000 standards are made up of three documents collectively referred to as “ISO 55000.” In this table we summarized the requirements against which organizations are measured when pursuing certification, which are contained within the document officially known as ISO 55001.

Appendix IV: Comments from the Department of Agriculture



Forest Service

Washington Office

1400 Independence Avenue, SW
Washington, D.C. 20250

File Code: 1420; 6400
Date: OCT 04 2018

Amelia Shachoy
Assistant Director, Physical Infrastructure
U.S. Government Accounting Office
441 G. Street NW
Washington, DC 20548

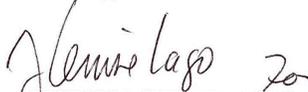
Dear Ms. Shachoy,

The U.S. Department of Agriculture's, Forest Service appreciates the opportunity to participate in the GAO No. GAO-19-57 Review of Federal Asset Management Practices (Job Code 102243). The Forest Service agrees with the findings in the GAO draft report.

GAO's key characteristics for effective management framework will help the Forest Service manage our assets and resources effectively. Asset management leading practices are critical in measuring efficiencies and meeting our strategic goals for the Forest Service's diverse and large portfolio. We can assess utilization, operations and maintenance costs, energy performance, priority projects, as well as plan for capital investment needs. The Forest Service will continue to improve our management practices to optimize our portfolio.

Thank you for including the Forest Service in your case study. If you have any further questions please contact Antoine Dixon, Chief Financial Officer, at 202-205-0429 or aldixon@fs.fed.us.

Sincerely,


VICTORIA CHRISTIANSEN
Interim Chief



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Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Lori Rectanus, (202) 512-2834 or rectanusl@gao.gov

Acknowledgments

In addition to the contact named above, Amelia Shachoy, Assistant Director; Maria Mercado, Analyst-in-Charge; Sarah Arnett; Melissa Bodeau; Leia Dickerson; Alex Fedell; Geoffrey Hamilton; Terence Lam; Malika Rice; Kelly Rubin; and Tasha Straszewski made key contributions to this report.

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