August 31, 2022

Honorable Members of the Los Angeles City Council
Los Angeles Board of Water and Power Commissioners

Re: Industrial, Economic and Administrative Survey of the Los Angeles Department of Water and Power

As required under City Charter Section 266(a), the Los Angeles City Controller, the Office of the Mayor, and the Los Angeles City Council shall regularly conduct an Industrial, Economic and Administrative (IEA) Survey of the Department of Water and Power (DWP) by an independent qualified organization.

Representatives from the Mayor's Office, City Council and Controller's Office (Joint Administrators) identified several objectives and focused heavily on risks and opportunities for improvement in the areas of sustainability, water and power infrastructure, information technology, cybersecurity and emergency management. The attached “IEA Survey of the Los Angeles Department of Water and Power” is the firm’s final report addressing these objectives.

The Joint Administrators will closely monitor DWP’s implementation of the recommendations included in this IEA Survey. The Joint Administrators also recognize the need to promote accountability and transparency at DWP given the recent challenges at the department. We will continue to work with DWP leadership and the department’s Inspector General to provide effective oversight and protect the integrity of DWP operations.

If you have any questions about the report, please contact Devang Panchal, Director of Auditing, at (213) 978-7388 or devang.panchal@lacity.org.

Sincerely,

RON GALPERIN	ERIC GARCETTI	NURY MARTINEZ
City Controller	Mayor	City Council President

cc: Honorable Michael Feuer, City Attorney
Andre Herndon, Chief of Staff, Office of the Mayor
Martin L. Adams, General Manager and Chief Engineer, LADWP
Sharon Tso, Chief Legislative Analyst
Matt Szabo, City Administrative Officer
Holly L. Wolcott, City Clerk

Industrial, Economic and Administrative Survey of the Los Angeles Department of Water and Power

RON GALPERIN
LA CONTROLLER

Guidehouse

Industrial, Economic and Administrative Survey of the Los Angeles Department of Water and Power

2022 Final Report

Prepared for:

The City of Los Angeles

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August 2022

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Executive Summary

The Los Angeles Department of Water and Power (LADWP, DWP, the Department) is one of the largest and most unique utilities in the U.S., serving approximately four million residents, with an asset footprint that includes over 7,300 miles of distribution mains across California and over 4,000 miles of overhead transmission circuits across five (5) states. The LADWP has a workforce of over 11,000 employees, who aim to achieve the Department's Mission to "support the growth and vitality of the City of Los Angeles, its residents, businesses, and the communities we serve, providing safe, reliable and cost-effective water and power in a customer-focused and environmentally responsible manner."[1]

As a major employer and driver of economic development in the City, as well as a key participant in meeting local and regional objectives related to clean energy and water conservation, the Department's success in executing its strategic vision is vital to the City's overall economic and policy agenda. However, like all utilities, the Department exists in an environment defined by significant and evolving challenges. These challenges are both external (present due to regulatory, political, or market forces outside the Department's immediate control) and internal (distinct to the Department given its current operations, institutional history, organizational culture, and relationship to key stakeholders). Prominent external challenges include:

- Increasingly aggressive sustainability targets and regulatory requirements (e.g., relating to the LA Green New Deal, LA100, and Operation NEXT) that shape priorities and decision-making in both the water and power systems.
- Climate change, including periods of sustained drought and increasing temperatures, which will only continue to impact the delivery of both water and power service.
- Increases in credible and significant physical and cyber security threats that could potentially undermine service delivery.
- Calls for improved customer service from ratepayers and other stakeholders, with the objective of enhancing the overall "customer experience."

Prominent internal challenges include:

- Aging infrastructure in both the water and power systems, which could have impacts on service reliability and long-term costs if not appropriately addressed.
- Significant capital programs necessary to address ongoing challenges related to regulatory change and aging infrastructure – many of which lack detailed implementation plans and will demand significant program management acumen.
- Vacancies or absent skillsets across the Department, particularly in areas requiring specific expertise (e.g., information technology, cybersecurity), and exacerbated by the massive ongoing and future infrastructure projects the Department plans to undertake.
- Meeting financial targets/metrics to ensure the Department's overall financial health, while designing competitive rates that satisfy capital and operating requirements.

In addition, as the Department moves forward with transformative efforts such as LA100 and Operation NEXT, it will be critical to consider social and environmental impacts to ensure equity in the distribution of burdens and benefits to LADWP customers and surrounding communities

[1] Briefing Book 2020-2021, Los Angeles Department of Water and Power, 2020.

throughout project planning and implementation. Further, recent Federal Bureau of Investigation (FBI) and Department of Justice (DOJ) indictments have undermined public trust and may impact the Department's ability to carry out its strategic objectives. These and other challenges introduce sources of risk to the Department's ability to achieve its vision and mission around reliability, sustainability, equity, customer service, and costs.

In the context of this environment, Guidehouse Inc. (Guidehouse) was retained by the Los Angeles City Controller, in coordination with City Council and the Mayor (Joint Administrators), to conduct the Industrial, Economic, and Administrative (IEA) Survey of the Department to assess the Department's planning and operations in specific focus areas across the Water, Power, and Joint Systems. Our findings and recommendations are summarized below.

Water System – Strategic Planning and Physical Infrastructure

Comprehensive long-term water supply and storage strategies are essential to adequately protect the City from long-term droughts, natural disasters, and climate change. In response to the growing variability in imported water and the increasing expense associated with imported water from the Metropolitan Water District (MWD), LADWP is committed to increasing the availability of local groundwater, recycled water, and stormwater; developing storage to address hydrologic variability; maintaining LA aqueduct reliability; and strengthening conservation and water use efficiency measures to ensure supplies meet local demand. The Water System has several ongoing and upcoming capital programs which plan to increase the local supply of water, including the Groundwater Replenishment Project and the Operation NEXT Water Supply Program, potentially executed in partnership with Los Angeles Sanitation and Environment (also referred to as the Public Works Bureau of Sanitation). These proposed programs will require significant planning, financial analysis, and augmentation of internal resources in order to meet local water development goals according to the timeline currently envisioned and to mitigate ratepayer impacts.

The Water System has also committed significant resources to tracking and mitigating water loss in the City's distribution system through the formation of the Water Loss Task Force and Action Plan. Water loss along the Los Angeles Aqueduct is also tracked, monitored via regular inspections, and taken into consideration when forecasting water supply from the Sierras; however, there are many factors such as evaporation and natural diversions that impact loss during transport and cannot be mitigated.

In the area of physical infrastructure, the Water System has improved its Asset Management strategy and planning documentation since the last Survey with an established Steering Committee that meets regularly and approved Policy, Strategy, and Asset Management Plans for each major asset type. However, the Asset Management program is still in an early stage of maturity, largely due to the lack of centralized and digitized asset data as well as a continuous comprehensive condition assessments program for assets other than mainline and trunk line. Resource constraints to gather, manage, and analyze this data is also a challenge. This limits the Department's ability to use the Asset Management Plans for capital planning and risk management purposes, including preventative maintenance and replacement project prioritization.

Review of the Water System's repair and replacement data by major asset class indicated that despite increasing replacement rates in recent years and maintaining a leak rate that is lower than the national average, many asset classes such as mainline and large valves have replacement cycles that extend far beyond their average useful life. Contracting vehicles, internal hiring, and technology optimization will all be critical to increasing replacement rates

and executing the Water System's 10-year capital plan, which is expected to increase significantly over the next decade.

Power System – Strategic Planning and Physical Infrastructure

The Power System is in the process of developing long-term strategic plans for achieving a 100 percent renewable portfolio to align with the City target of 100 percent renewables by 2035, as set forth in LA's Green New Deal and the National Renewable Energy Laboratory's (NREL) LA100 study. The upcoming 2022 Strategic Long-Term Resource Plan (SLTRP) will provide details on which aspects of the four pathways tested in the LA100 study will be targeted for immediate development. As the 2022 SLTRP is expected to be released in Fall 2022, there is no current comprehensive document or plan showing the generation mix pathway which LADWP expects to follow over the next 20 years. In the absence of such a document at the time of this report, Guidehouse reviewed a variety of available planning documents to assess how LADWP proposes to achieve the City's renewable energy goals, while addressing potential gaps and risks associated with the prospective pathways.

The Department contends with significant challenges as it plans for a transition to a 100 percent renewable resource portfolio. Key priorities include meeting growing electricity demand; establishing a diverse future mix of power generation resources; ensuring reliability and resiliency, including sufficient in-basin generation; adhering to environmental regulation and promoting environmental stewardship; and maintaining competitive rates for customers. Ensuring that the 2022 SLTRP balances these considerations will be critical to a successful transition and will provide important guidance as the Power System begins to develop detailed project plans.

Utilities, regulators, and other energy stakeholders face serious, often-conflicting challenges in delivering both clean and resilient electricity. Utilities must take proactive steps to ensure that the building blocks of critical infrastructure continue to be delivered, while significantly increasing renewable energy supply. In addition to conventional grid infrastructure upgrades, utilities across the country are encouraging customers to adopt distributed energy resources (DERs) that can provide resiliency during extreme weather and customer benefits during normal conditions, but that also introduces new grid challenges. The City of Los Angeles is at the forefront of these changes, accelerated by the policy goal to achieve 100 percent renewable energy by 2035. At the same time, LADWP has for years been grappling with system reliability and security due to aging infrastructure and, increasingly, climate change impacts such as wildfire threats. Significant capital investments for distribution and transmission grid enhancements are necessary to enable integration and transportation of the large amounts of renewable generation needed to meet the City's renewable energy targets.

In addition to strategic planning and physical infrastructure for the Water and Power systems, this report further examines enterprise security and emergency preparedness protocols, as well as the Department's use of outsourcing for Information Technology.

Joint System – Security & Emergency Preparedness

Emergency preparedness and security initiatives, including efforts to protect power and water supply from external threats such as bioterrorism and cyber warfare, are becoming increasingly critical considerations for utilities. The Department requires world class cyber and physical security to protect Water and Power System infrastructure. The number of significant security events is increasing across the utility sector, placing customer data, utility infrastructure, and

other elements of ongoing operations at-risk. The frequency and high-profile nature of these events emphasize the need for strong and responsive security practices at the Department.

The Department is handling persistent incoming threats and multiple emergencies could occur at once. In response to these risks, LADWP is committed to a robust cyber and physical security program and comprehensive emergency planning and preparedness. Recent achievements underscore the focus that LADWP is placing in these areas, including comprehensive security and emergency plans, increased threat monitoring capabilities, and leadership alignment around the importance of security and emergency preparedness. The Department continues to face challenges around coordination of plans across the enterprise as well as a continually evolving set of mandatory compliance requirements, evolving cyber threat landscape, and competing priorities.

Support and Administration – Information Technology

The Information Technology (IT) division oversees major projects with direct impacts across LADWP systems and activities. However, there is a lack of understanding within the Department of gaps in available skillsets. Clear understanding of the division's responsibilities and how these align with in-house capabilities are necessary to inform insourcing and outsourcing decisions. Establishing where skillset deficits exist through workload/workforce balancing analysis will enable the Department to make informed decisions on when to outsource to specialized consultants on an as-needed basis.

As LADWP pursues major capital projects such as Operation NEXT and LA100, it will be critical for the IT division to support these changes with appropriate staffing resources and technology infrastructure. These initiatives will require major digitization and automation of key Water and Power operations. These initiatives will require greater outside support, but LADWP can mitigate the impacts of hiring outside consultants by ensuring it is deploying outside assistance in the right areas and focusing on knowledge transfer to build up its own in-house staff.

Based on these conclusions, Guidehouse has developed the following recommendations for the areas of focus considered in the 2022 IEA Survey.

2022 Water System Recommendations
Strategic Planning
1. Continue to explore funding and financing options, assess the necessary augmentation of internal resources with outside professional services, and engage with stakeholders in order to realize and or adapt the Operation NEXT Water Supply Program to meet recycled water development goals according to the timeline currently envisioned and to mitigate ratepayer impacts.
2. Consider contingency scenarios for expanding system supply of groundwater, stormwater capture, and recycled water beyond the Operation NEXT Water Supply Program to mitigate risks of delay, including the feasibility of additional storage along the Los Angeles Aqueduct to reduce supply variability in dry years.
3. Invest additional resources towards the timely completion of maintenance on Los Angeles Aqueduct meters to improve the accuracy of water loss measurements and other physical infrastructure improvements to reduce water loss in transit.

Physical Infrastructure

4. Develop and implement an organizational plan to ensure sufficient resources are dedicated to build-out of the asset management program and to improve coordination across divisions.

5. Continue to pursue outside contracts to move asset management program forward (including technical support for improving data and optimizing systems and field support to conduct condition assessments).

6. Develop and document procedure for capturing institutional knowledge of retiring employees, especially as it relates to asset data and operational risk.

7. Conduct comprehensive condition assessments for vertical assets, including pump stations, regulator stations, tanks, reservoirs, groundwater wells and large valves. Data collected through these assessments is foundational to the Asset Management Plans (AMPs).

8. Confirm leadership consensus on the purpose of Maximo, ESRI Geographic Information Systems (GIS), and Water Information Network (WIN) as it relates to asset management. Invest resources in the optimization of Maximo and GIS (including adding more asset types in Maximo, better integration of vertical asset data in GIS and digitization of paper records), and the build-out of WIN to link these systems and other databases, to centralize and better utilize asset data.

9. Implement data improvement plans in the AMPs to allow for more actionable plans in the near-term, including the completion of comprehensive condition assessments to better assess risk and prioritize replacements by asset type. Once data confidence increases, integrate asset management framework (risk prioritization and lifecycle assessments) into existing processes for replacement and repair decision-making.

10. Document a preventative maintenance strategy, develop preventative maintenance analytics, and dedicate resources (budget and staff) to better incorporate proactive preventative maintenance into existing maintenance practices, including those based on condition-based maintenance practices (and incorporated into department-wide asset management programs).

11. Develop a formal condition-based maintenance program for the routine testing, repair, and replacement of aging valves and hydrants.

12. Develop hiring strategy and supporting budget for increasing Water System staff to support aggressive near-term infrastructure goals, including significant increases in mainline replacement and the need to better assess and address the condition of vertical assets.

13. Assess the benefits of developing an overarching asset management plan and systems jointly used by LADWP's Water and Power organizations. Develop processes and procedures that are consistently applied to Water and Power, including funding prioritization and allocation.

2022 Power System Recommendations

1. Develop a 2022 Strategic Long-Term Resource Plan (SLTRP) based on resource additions that provide the greatest flexibility and lowest risk for load growth forecasts over a range of electrification scenarios and outcomes. The preferred plan should be sufficiently flexible to allow the Department to adjust resource needs to align differences in load forecasts or EV adoption rates in order to minimize rate impacts associated with unanticipated changes to each scenario.

2. Ensure the 2022 SLTRP includes sufficient in-basin, spinning, fast-response generation to reliably meet customer electricity demand under normal and contingency conditions, including contingencies that may occur while transmission lines and substations are out of service due to upgrades or replacement. Vigorously pursue the extension of Scattergood repowering deadlines to 2029.

3. Complete studies to determine the magnitude and timing of distribution upgrades and voltage conversions for each of the growth scenarios evaluated in the 2022 SLTRP. Prepare a detailed project plan that outlines the specific projects, resources, and work tasks that LADWP will need to implement over the next five years, including costs.

4. Update the current 10-year transmission plan to align with the 2022 SLTRP, including adjustments to schedules for proposed upgrades based on changes in the timing and capacity of power resources outlined in the LA100 study.

5. Determine the level of internal and external crews and support resources needed to complete the work outlined in the 2022 SLTRP and associated transmission and distribution system enhancements and upgrades. Prepare a detailed plan that identifies work to be completed by internal and external crews, and a strategy to ensure sufficient resources are available to construct proposed facilities based on proposed schedules.

6. Prepare an Operational Technology (OT) plan that outlines required enhancements to the ongoing Distribution Management System upgrades to incorporate Distributed Energy Resource Management System functionality that can reliably integrate, manage, and control distributed resources for existing and upgraded facilities for the resource scenarios outlined in the 2022 SLTRP. The OT plan should incorporate Substation Automation and Real-Time monitoring systems that capture digitally connected smart devices, sensors and protection systems.

7. Assess the benefits of developing an overarching asset management plan and systems jointly used by LADWP's Water and Power organizations. Develop processes and procedures that are consistently applied to Water and Power, including funding prioritization and allocation.

8. Identify the additional facilities needed to accommodate conversion of LADWP's vehicle fleet, work crews, training facilities, and equipment storage associated with the build out of the power delivery system.

Wildfire Recommendations

9. Provide transparency to the Board and the public on decision-making processes in establishing new LADWP wildfire mitigation investments.

10. Continue to track metrics and trending risk drivers to inform future Wildfire Mitigation Plan updates.
11. Formalize the criteria for activation and notification protocols that address events before, during, and after an incident-based de-energization or loss of power supply because of a PSPS initiated by SCE.
12. Power System Reliability Program (PSRP) investments should account for incremental activities that align to the High Fire Threat District (HFTD) wildfire risk reduction in addition to resiliency initiatives.

2022 Security and Emergency Preparedness Recommendations

Physical & Cyber Security

1. Guidehouse recommends LADWP continue to focus on the following 2015 Recommendations:
   a) Security Services and the Director of Cybersecurity work together to complete the Corporate Security Plan to design and implement necessary physical and cyber security protective measures and controls for all LADWP Water and Power Facilities and Cyber Systems.
   b) Guidehouse recommends LADWP review the current cybersecurity strategy, perform any updates, then develop and implement the cybersecurity plan.
   c) Guidehouse recommends Security and Emergency Preparedness continue to work with the Information Technology (IT) division to test and implement the Business Continuity Management Plan (BCMP)/ Disaster Recovery (DR) plans and the Business Impact Analysis (BIA) process across all Water and Power System Facilities.
   d) Guidehouse recommends Security continue developing its risk assessment process and implement risk assessments and mitigation plans to identify and mitigate physical security threats and vulnerabilities across all Water and Power System facilities.
2. Guidehouse recommends Security continue developing its risk assessment staff and processes to implement prioritized risk assessments and mitigation plans for all LADWP Water and Power System Facilities.
3. Guidehouse recommends Security move forward with its underlying strategic plan for establishing a corporate security framework. Once approved, Guidehouse recommends Security develop a phased and prioritized project plan to implement the corporate security framework across all LADWP Water and Power System Facilities to close critical security gaps.
4. Guidehouse recommends LADWP conduct a complete review of technical employee retention practices to reduce employee attrition and turnover. This should not deter employee professional growth.

Emergency Preparedness

5. Guidehouse recommends Security and Emergency Preparedness remain focused on the 2015 Recommendation to develop continuity plans and a BIA by continuing to (a) prioritize critical facilities, (b) test and implement detailed continuity plans to update BIA risk assessments across all Water and Power System Facilities, and (c) ensure timely restoration plans are created and maintained for each identified critical facility.
6. Guidehouse recommends LADWP Office of Emergency Management (OEM) personnel coordinate with Security and IT to ensure the Disaster Recovery planning process is finalized and implemented across all LADWP critical infrastructure and Water and Power System facilities.
7. Guidehouse recommends LADWP assign specific members of the OEM and IT teams with the responsibility to move forward with the Enterprise Technology Advisory Services (ETAS) and fully develop and implement the BCMP and its BIA and BC/DR components.
8. Guidehouse recommends LADWP develop an overall LADWP emergency scenario to integrate all business unit emergency plans and evaluate the effectiveness of enterprise LADWP emergency planning and response practices.
9. Guidehouse recommends OEM obtain and maintain sufficient staff to accomplish its strategic goals, including the completion of BCMP/BIA and DR project development and implementation across all LADWP Water, Power, and Joint Systems.
10. Guidehouse recommends LADWP integrate the ETAS Operational Risk Assessment reports into its overall enterprise risk assessment and mitigation process.

2022 IT - Support and Administration Recommendations

1. Address serious staffing deficiencies and skill gaps. Conduct a workload/workforce balancing analysis to establish the necessary skillsets for ongoing and future IT projects and to validate IT employee skillsets and certifications. The outcome of this analysis should be a firm understanding of skillset deficits within the division.
2. Maintain a list of qualified consultant Subject Matter Experts (SMEs) that can fulfill identified skillset gaps and implement Service Level Agreements (SLA) where possible to provide technology specific SMEs for break/fix and/or compliance issues. These same consultants could provide augmentation for overdue technical housekeeping such as documentation management and updates or other low priority tasks.
3. Review the IT hiring process to determine where delays can be mitigated, potentially through proactive backfilling.
4. Establish an employee retention program to determine the divisions most affected by transient employees and develop methods or incentives to encourage employee retention, particularly in areas requiring unique skillsets.
5. Perform a cost analysis of fully loaded employee costs compared to temporary consultant labor, including the impact of turnover.

6. Establish documented processes for knowledge transfer as a critical component of any IT project, to bridge any gaps left by temporary consultants or transient staff.

In conclusion, the current environment poses significant challenges to all utilities – from increasingly aggressive sustainability objectives and regulatory requirements, to aging infrastructure and the threat of a significant security breach, and many more. Under these conditions, the most successful utilities are those that are proactive in planning for these factors with forward-looking strategies and program execution, and also are effective with dynamic responses to changing market and organizational conditions. The Department's high-level plans and ambitious objectives in the areas of strategic planning and physical infrastructure reflect a commitment to providing reliable future service delivery in this evolving landscape. Moving forward, the Department will need to match this impetus with detailed implementation plans and demonstrated ability to execute and report on those plans.

1. Introduction and Approach

1.1 Study Objectives

Every five years, Section 266 of the Los Angeles City Charter requires that the Los Angeles City Controller, in coordination with City Council and the Mayor (Joint Administrators), conduct the Industrial, Economic, and Administrative (IEA) Survey of the Los Angeles Department of Water and Power (LADWP, DWP, the Department). The goal of this survey is "to ascertain if the surveyed Department is operating in the most efficient and economical manner." For the 2022 Survey, the City Controller has retained Guidehouse Inc. (Guidehouse) to conduct this study.

The scope of the 2022 Survey is more targeted than the 2015 Survey, but the 2022 Survey continues to focus significantly on infrastructure. The 2015 Survey broadly reviewed infrastructure – both in terms of the core Power and Water Systems, as well as the areas of operations that facilitate the safe, reliable, and cost-effective delivery of service to customers. The 2022 Survey is even more focused, and seeks to examine elements of strategic planning, physical infrastructure, enterprise security and emergency preparedness, and Information Technology (IT) support and administration. Specifically, the Joint Administrators have identified the task areas reflected in Figure 1-1. This focus is driven by an understanding of the role of core infrastructure in achieving the primary goals of the Department, as well as aging infrastructure, long-term supply, and climate change challenges facing the Department.

Figure 1-1. 2022 IEA Survey Task Areas

Source: Guidehouse.

This report discusses the major findings and subsequent recommendations for each of the 2022 IEA Survey Task Areas across the Water System, the Power System, enterprise Security and Emergency Preparedness, and IT Support and Administration.

The focus areas for this IEA Survey for the Water System are:

- **Strategic Planning:** An assessment of whether the Water System's long-term water supply and storage strategies adequately protect the City from long-term droughts, natural disasters, and climate change. This focus area also considers a review of the Department's water loss programs and emergency preparedness, including efforts to protect the City's water supply from external threats.
- **Physical Infrastructure:** An assessment of the Water System's asset management program, including how the Department collects asset information, assesses risk, conducts preventative maintenance, prioritizes replacement projects, and coordinates with other entities. This focus area also considers replacement costs and the level of funding needed to support the program.

The focus areas for this IEA Survey for the Power System are:

- **Strategic Planning:** An assessment of whether the Power System's renewable energy grid resilience and supply diversification strategies adequately equip the city for implementation of LA100. This focus area also considers a review of LADWP's emergency preparedness, including efforts to protect the Power System from external threats.
- **Physical Infrastructure:** An assessment of the Power System Reliability Program (PSRP) and emerging system needs, including the impacts of LA100 and increasing electrification. This focus area also considers the Department's Wildfire Mitigation efforts.

The focus areas for this IEA survey for enterprise Security and Emergency Preparedness are:

- **Security:** An assessment of the Water and Power Systems' physical and cybersecurity protective measures and controls, including how the Department collects facility asset information, assesses risks and vulnerabilities, prioritizes critical facilities, and develops appropriate protective measures and mitigating controls to ensure the physical protection of Water and Power System facilities and the electronic protection of critical Water and Power operational cyber systems.
- **Emergency Preparedness:** An assessment of the Water and Power Systems' level of emergency preparedness, including efforts to protect the City's Water and Power Systems from external threats, and current status of business continuity and disaster recovery planning, testing, and implementation across the Department.

The focus area for this IEA survey for Support and Administration of IT activities that currently utilize consultants is:

- **Insourcing Challenges:** An assessment of the insourcing challenges for IT, based on the represented employee environment, challenges with existing vacancies, and challenges with transient employees. Current outsourcing to consultants is utilized when specific expertise is required that is not available at the Department. This focus area considers the benefits and complications of insourcing experts to minimize use of consultants.

Where relevant, this report also considers progress made against recommendations made in the 2015 IEA Survey in the focus areas noted above.

1.2 Approach

Information for this report was derived from several sources:

- Interviews with LADWP Water System, Power System, Security and Emergency Preparedness, and Information Technology staff, as well as executive leadership.
- Documents collected and reviewed across all areas of focus including reports, presentations, budgets, metrics, and other data.
- A literature review of California regulation and peer utility publications on relevant Water System and Power System topics.
- Guidehouse's experience with LADWP's prior reports and practices.

A full description of the interviews conducted can be found in Appendix A.

2. Water

2.1 Strategic Planning

The first focus area of the 2022 IEA Survey for the Water System is strategic planning. Specifically, the Survey assesses whether the Water System's long-term water supply and storage strategies adequately protect the City from long-term droughts, natural disasters, and climate change. This focus area also considers a review of the Department's water loss programs (including water loss in transport along the Los Angeles Aqueduct and water loss in the Metro area) and high-level review of LADWP's emergency preparedness as it relates to the Water System. (A more detailed review of the Department's enterprise emergency preparedness efforts is discussed in Section 4 – Security and Emergency Preparedness.)

To assess the Department's long-term water supply and storage strategies, Guidehouse primarily relied on the Department's 2020 Urban Water Management Plan (UWMP), which provides long-term resource planning to ensure that adequate water supplies are available to meet existing and future water demands over a 25-year planning horizon. The Department submits an UWMP to the Department of Water Resources (DWR) every five years in accordance with the Urban Water Management Planning Act. Guidehouse also interviewed Department staff and reviewed planning documents for specific sources of supply such as the Stormwater Capture Master Plan, annual recycled water reports, groundwater development plans, the program charter for Operation NEXT Water Supply Program (Operation NEXT), and the 2017 Water Conservation Potential Study.

2.1.1 Water Supply

Over the last six years, the City of Los Angeles and Mayor Eric Garcetti have put actionable climate goals at the forefront of city planning. The 2019 Los Angeles Green New Deal (also known as the Sustainable City pLAn) includes new water-focused goals for wastewater reclamation, local sourcing, and water use which can be seen in Table 2-1.[2,3]

Table 2-1. Select Local Water Targets from the LA Green New Deal

Local Water Targets
Recycle 100 percent of wastewater for beneficial reuse by 2035
Source 70 percent of water locally by 2035
Capture 150,000 acre-feet per year (AFY) of stormwater by 2035
Reduce per capita potable water use by 25 percent by 2035
Reduce LADWP's purchase of imported water by 50 percent by 2025

Source: 2019 Sustainable City pLAn

LADWP is working towards the targets laid out in the 2019 Sustainable City pLAn and has prioritized the development of long-term water supply and storage strategies to adequately protect the City from hydrologic variability, natural disasters, and climate change. The

[2] City of Los Angeles, *L.A.'s Green New Deal: 2019 Sustainable City pLAn*, 2019. **https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf**

[3] The 2019 L.A. Green New Deal is also known as the 2019 Sustainable City pLAn.

Department has been a major contributor to the study of future climate impacts on the City of Los Angeles, including impacts on historical water resources in the Eastern Sierra Nevada, ground and surface water reliability, and opportunities for increasing sources of climate resistant local water.

In 2020, LADWP worked with the University of California, Los Angeles to complete a Climate Study Update (unpublished but summarized in the 2020 UWMP) to analyze potential changes since the previous 2011 Climate Study was completed. Specifically, the study utilized a set of 20 Global Climate Models (GCMs) to model climate impacts in the Eastern Sierra Nevada region through the end of the 21st century. The results of the Study are similar to the 2011 Study and project long-term changes to temperature and precipitation. The results from the 2020 Climate Study provide inputs to the hydrologic runoff models to estimate changes in deliveries into the Los Angeles Aqueduct (LAA) system and assist in developing strategies for improved management of water supply. LADWP's supply forecast includes a 0.1652% decrease in LAA supply per year due to climate impacts.

Given imported water sources from the LAA as well as the State Water Project (SWP) and the Colorado River Aqueduct (supplied by Metropolitan Water District; MWD) currently supply more than 80% of LADWP's water needs, there is a need to mitigate the impacts of the increasing variability of imported supply availability. For example, significant changes in hydrological conditions and increased environmental restoration obligations have led to a decrease in water supply from the Owens Valley and Mono Basin of 50% of historic levels over the past 30 years. In addition, under hydrological conditions which impact MWD's supply sources, MWD may implement their Water Surplus & Drought Management actions and Water Shortage Contingency Plan to respond to shortages, which may cause LADWP to implement its Water Shortage Contingency Plan to address shortages from its supplemental water supplier, MWD.[4]

LADWP has already experienced several years of steady decreases in SWP allocation. 2022 started with an initial allocation of 0% from the SWP, down from 5% in 2021 and 20% in 2020. The Department put together a request to the State with other Member Agencies in MWD service area for "Health and Safety" water, but this significantly reduced allocation would have required aggressive local water use restrictions if the allocation was not changed due to improved climate conditions. As of March 2022, the SWP allocation to State Water Project Contractors, including MWD, was 5%, but it exposed the challenges that LADWP faces as it continues to provide reliable water service to its customers.

In response to the growing variability in imported water and the increasing expense associated with imported water from MWD, LADWP is committed to increasing the availability of local groundwater, recycled water, stormwater, and conservation measures to meet local demand. LADWP has already met the Mayor's Executive Order No. 5 to reduce per capita potable water use by 20% by 2017 and is on target to meet the Green New Deal's 2035 target of 25%.[5] Both climate-driven reliability concerns and the LA Green New Deal targets have led to LADWP creating a series of programs to support a more sustainable future water supply.

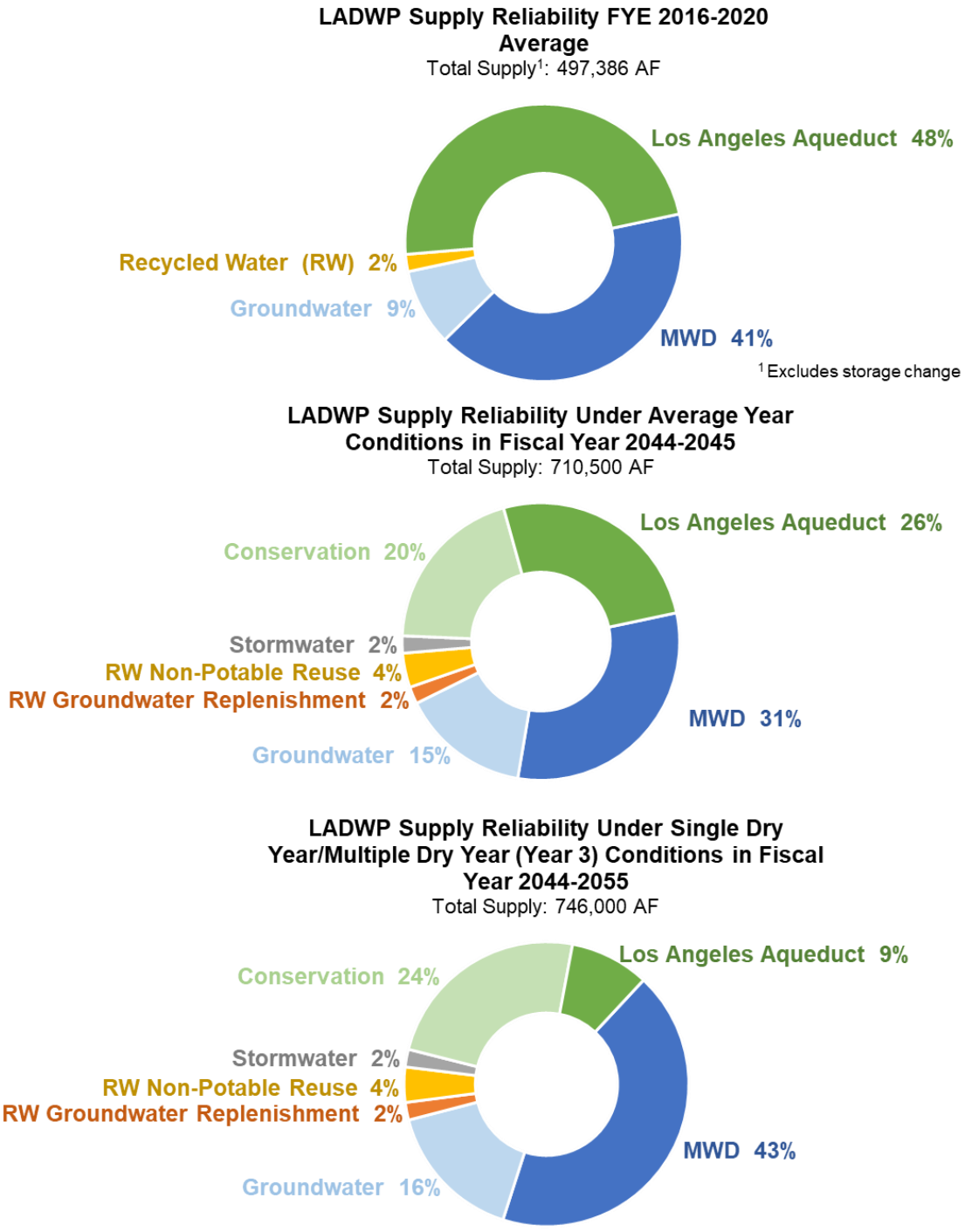
Figure 2-1 expands on the current and future water supply for Los Angeles based on average supply and projected supply (assuming average hydrology conditions). Specifically, LADWP plans to increase its current supply of groundwater, stormwater capture, and recycled water from 11% to 43-70% of its total supply. Figure 2-1 does not include water capacity from

[4] Los Angeles Department of Water and power, *Urban Water Management Plan,* 2020. **https://www.ladwp.com/cs/groups/ladwp/documents/pdf/mdaw/nzyy/~edisp/opladwpccb762836.pdf**

[5] City of Los Angeles, *L.A.'s Green New Deal: 2019 Sustainable City pLAn*, 2019. **https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf**

upcoming recycled water programs which will be critical to LADWP meeting the Sustainable City pLAn goal of 70% local water supply by 2035. LADWP has several upcoming recycled water programs which will increase local supply of water, including the Groundwater Replenishment Project and the Operation NEXT Water Supply Program (Operation NEXT). As noted in Figure 2-1, the inclusion of Operation NEXT, a long-term project aimed to maximize the available purified wastewater from the Hyperion Water Reclamation Plant using local groundwater basins and the Los Angeles Aqueduct Filtration Plant, significantly increases the Department's local water supplies. The following sections will review the strategic justifications for these projects and the climate drivers for increasing recycled water, groundwater storage, stormwater capture, and water conservation.

Figure 2-1. LADWP's Supply Reliability



Source: Los Angeles Department of Water and power, Urban Water Management Plan, 2020.

2.1.1.1 Recycled Water

Water supply derived from treated wastewater is considered hydrologically independent from climate impacts. Each unit of treated water which can be sent to recycled water customers or injected into groundwater storage projects represents additional capacity captured from the

original snowpack or rainfall delivered to the City. Additionally, the investment of capital funds into advanced water treatment facilities and delivery systems for recycled water is expected to offset the operating expense of expensive imported water from MWD, while providing a secure and climate resistant local water supply.

LADWP is working towards maximizing recycled water availability to meet expected demands through accelerated planning efforts in both the Harbor Area and Metro Area. There are twenty-five projects across both areas planned to increase recycled water usage by just over 17,000 AFY by Fiscal Year (FY) 30/31. Additionally, LADWP and LASAN are exploring new potential sources of recycled water to meet projected demands such as the Carson Water Reclamation Facility and the Joint Water Pollution Control Plant.

Over the past several years, multiple studies have looked at various scenarios on how to effectively use recycled water from LASAN's Hyperion Water Reclamation Plant to meet future water supply demands. To this end, LADWP has initiated Operation NEXT to deliver advanced treated recycled water from Hyperion Water Reclamation Plant (Hyperion WRP; Hyperion) to groundwater basins for indirect potable reuse.

The Operation NEXT Program's charter, enacted in July 2021, provides executives and managers within the Department with information necessary for them to evaluate and make decisions regarding roles and responsibilities, funding, scheduling, staffing resources, and other aspects for the successful implementation of the program. The Charter includes information regarding the scope, justification, and an estimated budget of $16 billion over 31 years, starting in 2021. At this time, no funding has been approved by the Board except for short-term planning investments and given the significant cost, this project will require significant financial analysis to determine financing options that will mitigate significant rate increases to customers.

In order to successfully deliver the Program, the Department will need to explore funding and financing options, assess the necessary augmentation of internal resources with outside professional services, and continue engagement with the various Program stakeholders, including LASAN, Water Replenishment District (WRD), MWD, and surrounding cities. Upcoming next steps in these pursuits include completing an Operation NEXT Master Plan to further define scope, financing, rate impacts, and other considerations. In addition, the Water Resources division is continuing to dedicate resources to the planning of Operation NEXT and working closely with the Water Engineering and Technical Services (WETS) division to begin engineering design activities.

Operation NEXT also relies heavily on a program partnership with LASAN to retrofit Hyperion with advanced treatment facilities. Hyperion currently treats approximately 288,000 acre-foot per year (AFY) and will require upgrades to produce Advanced Treated Recycled Water (ATRW). ATRW facilities use membrane bioreactors or equivalent, reverse osmosis, and advanced oxidation to produce high quality recycled water for use in Direct and Indirect Potable Reuse (DPR and IPR) programs. However, LADWP will require new regulation of DPR at the state level to capitalize on the entirety of Hyperion's recycled water capacity.

Given the timeline noted above, flows from the Hyperion facility are scheduled to be accommodated through DPR in 2046. While this timeline extends beyond the targets in the Green New Deal, this program represents a complex undertaking for the Department to significantly increase local water supply and mitigate the impacts of climate change. It will require a significant increase in budget, resources, contracting vehicles, and collaboration with other entities to complete. Accordingly, the output of the Operation NEXT Master Plan and

continued collaboration and analysis with internal and external stakeholders will be essential to determining the feasibility of the program.

During the 2015 IEA study, the idea was posed to combine the Water System with water functions across Los Angeles, encompassing the water-related responsibilities of the Los Angeles County Public Works Department and the City of Los Angeles Bureau of Sanitation. At the time, Guidehouse reviewed several upcoming initiatives. The combination of Sanitation, Water, and Waste Water was discussed in the 2015 report. The following analysis quoted below from the 2015 report remains applicable:

> *Independent management of these entities leads to operational redundancies, missed opportunities for water savings, and inflated costs for Los Angeles residents. However, with the current drought, new water regulations, and increased public awareness of California's water vulnerability, policy makers and the public are recognizing that these issues can no longer be addressed in isolation.*
>
> *Prior to 1992, the water system in San Antonio looked quite similar to that of Los Angeles… Since the [consolidation of water supply, sewage, and wastewater reuse agencies], San Antonio has been recognized nationally for its novel conservation efforts and proactive water management planning. It is the only U.S. city to reuse all three wastewater treatment process byproducts.*
>
> *Sacramento provides another example of a water system managed independently from the electric utility… With all aspects of the water cycle under its management, the Department of Utilities is reportedly able to streamline and enhance conservation efforts, manage regulatory compliance without redundancies, protect water rights and quality without oversight, prevent contamination of local creeks and rivers, and maintain adequate financial reserves to provide financing for long-term infrastructure improvements.*
>
> *The benefits of a collaborative approach could be further amplified by creating a single entity with the sole purpose of managing all aspects of the City's water, wastewater, stormwater, and flood protection services. However, this is a more dramatic step than suggested by previous work. It would require a large organizational and cultural change with significant impacts on the Water Organization. It would also require several City Charter changes, the full support of City leaders and Department management, and a larger process at the County level to include LACDPW. The ultimate design of an integrated water group demands a dedicated analysis of its own. Navigant recommends the City of Los Angeles initiate a study to provide this analysis.*

We note here that the Operation NEXT program aligns with a recurring theme emphasizing the need for collaboration amongst key stakeholder groups to manage all aspects of the water cycle in a coordinated fashion. Clearly, policy makers continue to recognize that water issues can no longer be addressed in isolation. This, combined with the long-term resource planning and collaboration necessary for a successful adoption of the Operation NEXT program, presents the optimal opportunity to discuss the unified management of the City's water infrastructure.

2.1.1.2 Stormwater Capture

Stormwater capture is another cost-effective way to increase local groundwater replenishment. Stormwater can be added to groundwater basins through centralized facilities such as spreading grounds, which capture larger runoff from impervious structures like roads, and

water-capture landscape at parks and other city properties. Stormwater can also be collected by decentralized facilities such as rain-barrels, tree wells, and vegetation swells. Stormwater captured in decentralized facilities typically do not enter local groundwater but are used locally to offset landscape water demand.

The 2015 Stormwater Capture Master Plan created milestones for stormwater capture potential in the LADWP service area along both conservative and aggressive pathways. In the same plan, LADWP laid out goals to nearly double stormwater capture from an annual average of 75,000 acre-feet (AF) by adding 68,000 to 114,000 acre-feet per year through a series of centralized facilities, such as the Tujunga Spreading Grounds, and distributed infiltration such as rain gardens and green street developments.

LADWP, in partnership with the Los Angeles County Flood Control District (LACFCD), also completed the Los Angeles Basin Study (LA Basin Study) in 2016. The Study highlighted future opportunities for the Department to increase stormwater capture and mitigate climate change by implementing widespread, low-impact development, enhancing or constructing new centralized facilities, and improving policies that could boost the region's existing stormwater capture potential.

LADWP's FY 20/21 target for stormwater capture capacity was 78,000 AF, which closely follows the conservative stormwater capture potential for 2020. The calculated potential included 64,000 AF of baseline incidental and centralized capture and 14,000 AF of new potential capture from centralized facilities and distributed infiltration. LADWP was on track to meet the target variance for the stormwater capture target in April 2021.

2.1.1.3 Groundwater Storage

LADWP is exploring storage development opportunities to help improve the management of the City's water supplies under hydrologic variability. In total, the City's groundwater withdrawal rights can potentially supply more than 110,000 AFY of groundwater. However, the true value of the groundwater basins includes over one million AF of available storage capacity which will serve as the cornerstone of the City's future supply reliability. New sources of recycled water or LAA water supply offset by more affordable water imports from the SWP during wet years can be directed towards recharging the San Fernando Basin which offers around 550,000 AF of storage capacity. This supply can then be used as-needed to supplement demand, or remain in the aquifer as storage for emergency use or other operational needs.

The Groundwater Replenishment Project will recharge the San Fernando Groundwater Basin with up to 30,000 AFY of recycled water produced by the Donald C. Tillman Water Reclamation Plant. Implementation of the Initial Phase and Ozone Demonstration Project is underway with spreading scheduled to begin in 2028. This initial phase will add 3,500 AFY of recycled water to the basin and additional wastewater will need to be sourced to support increased annual recharge. Operation NEXT also includes plans to convey ATRW from the Hyperion Water Reclamation Plant to the San Fernando Valley to replenish the San Fernando Groundwater Basin. This would be accomplished by a new trunk line to deliver water from Hyperion to a new well field northwest of the Tujunga Spreading Groups. The proposed well field infrastructure would include 18 injection wells for water storage and 12 extraction wells for future withdrawals.

LADWP is also looking to capture affordable non-SWP water that is conveyed through the SWP and other imported sources during years when water can be banked for future dry cycles or supplement typical sources. To facilitate water transfers, LADWP completed construction of the Antelope Valley-East Kern (AVEK) water agency's LADWP turnout (turnout) between LADWP's

First LAA and the East Branch of DWR's SWP located where the two aqueducts intersect in the Antelope Valley. The turnout provides LADWP with the ability to offset some of the LAA supplies being used to meet environmental obligations in the Mono Basin and Owens Valley and replace it with non-SWP water in order to meet the City's water demand.

LADWP is also evaluating the potential use of groundwater storage programs in the Owens Valley along the LAA, between South Haiwee Reservoir and LADWP's LAAFP during similar wet year circumstances in the Owens Valley. Additional storage through banking will help reduce the variability of imported water supply from Eastern Sierra and allow excess supply to be stored in wet years and recovered to meet demands during dry years.

2.1.1.4 Water Conservation

Conservation is a foundational component of LADWP's water resource planning efforts and will continue to be central to the City's water conservation and efficiency goals over the long term. According to the Department's 2020 Urban Water Management Plan, LADWP is pursuing multiple strategies to achieve and maintain water use reductions, including:

- Technology investments;
- Rebates and incentives promoting installation of water-efficient fixtures and appliances;
- Expansion and enforcement of prohibited water uses, and reductions in total customer water use through updated City Ordinances and pending State legislation;
- Extension of education and outreach efforts at the local and regional level; and
- Rate design that incentivizes conservation.[6]

The Department completed a Water Conservation Potential Study in 2017 to better understand water savings potential by customer class and water fixture type. The Study found that total potential water savings are approximately 140,000 AFY by 2035 for the Maximum Cost-Effective Conservation Potential, which is defined as conservation potential that is achievable and cost-effective. The Study found that landscape irrigation has the most potential for conservation savings for single and multi-family customers and that cooling towers followed by toilets have the most potential for commercial and industrial customers. Economic assessments of the potential confirmed that all individual rebates were cost-effective compared to projected increases in MWD's treated water rate.[7] LADWP also determined that there will be enough remaining conservation potential to help meet the 2025 and 2035 per capita water use reduction goals set by the City. This Study is being used by the Department to plan future conservation programs to obtain additional water savings.

These water conservation strategies also allow LADWP to respond to growing variability in imported water and drought conditions such as those being experienced in 2022. LADWP customers will soon experience limits on outdoor watering as the Department intends to enter Phase 3 of the City's Emergency Water Conservation Ordinance.

[6] Los Angeles Department of Water and power, *Urban Water Management Plan,* 2020. **https://www.ladwp.com/cs/groups/ladwp/documents/pdf/mdaw/nzyy/~edisp/opladwpccb762836.pdf**

[7] Los Angeles Department of Water and Power, *Water Conservation Potential Study*, September 2017. **https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB620807&RevisionSelectionMethod=LatestReleased**

2.1.2 Water Loss

Tracking and mitigating water loss is an important component of the Department's effort to maximize the use of its water supply, limit non-revenue water, and maintain a reliable system. For the purpose of the Survey, we have assessed the Department's water loss in two areas: water lost in transport from Northern California and the Owens Valley (along the LAA) and water lost in the City's distribution system.

Guidehouse reviewed the Department's documented plans and reporting on water loss in the City's distribution system and found that the Department has made significant investments over the last decade to mitigate water loss over time. This effort was initiated in 2013 when LADWP first completed a Water Loss Audit and Component Analysis Study, which included a full-scale assessment of LADWP's databases and tracking efforts, as well as a pilot project that performed leak detection and analyzed pressure and leakage in three service zones within the distribution system. Upon the completion of the Study, LADWP established a Water Loss Task Force in 2014, consisting of over 100 LADWP staff to work on addressing the recommendations from the Study. These recommendations were converted into actionable plans in the Water Loss Task Force Action Plan (Action Plan), which now serves as a guide that coincides with LADWP's ongoing pipe replacement plan to maintain infrastructure reliability.

Examples of actions taken by the Task Force include installing over 100 pressure monitoring devices targeting the leakiest zones, completing automated leak reporting pilots, piloting acoustic leak detection technologies, establishing small meter accuracy testing and replacement programs, and testing of supply meters at the LAAFP. The Task Force also has plans to implement system-wide pressure monitoring, pilot new leak detection technologies, establish a testing program for large meters, and develop a methodology for estimating theft due to tampering and bypassing.

LADWP is also required to submit validated water loss audits annually to DWR under SB 555. The audit must be conducted using the methods from American Water Works Association's (AWWA's) most recent Water Audits and Loss Control Programs Manual (M36) and water audit software.[8] Water losses are broken down into two categories: apparent losses and real losses. Apparent losses include meter inaccuracies and theft. Real losses include piping distribution system leakage. As shown in Table 2-2 below, the Department estimates that approximately 8.4% of total water supplied is non-revenue water based on the five-year average.[9] Importantly, real losses and total non-revenue losses have declined over the last three years. In the Urban Water Management Plan, the Department is projecting to reduce non-revenue water to account for 7.1% of water supplied by 2045 and meet performance standards defined under SB 555 (Table 2-3).

[8] Los Angeles Department of Water and Power, *2020 UWMP Guidebook – Appendix L: Water Loss Audit Regulations*, 2020. **https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Urban-Water-Management-Plans/Final-2020-UWMP-Guidebook/Appendix-L---UWMP-2020.pdf**

[9] Non-revenue water includes apparent losses, real losses, and unbilled authorized consumption, and unbilled unmetered consumption.

Table 2-2. Historical Non-Revenue Water for LADWP

Fiscal Year Ending	Total Potable Water Supplied (AF)	Unbilled Metered and Unbilled Unmetered Volume (AF)	Apparent Loss Volume (AF)	Real Loss Volume (AF)	Non-Revenue Water Volume (AF)	Non-Revenue Water Percentage (%)
2016	480,393	600	9,744	27,514	37,858	7.9%
2017	482,113	2,744	8,870	30,432	42,046	8.7%
2018	512,338	8,201	8,612	33,036	49,849	9.7%
2019	480,754	4,312	6,630	28,341	39,283	8.2%
2020	477,950	5,606	4,594	24,216	34,416	7.2%
5-Year Average	486,710	4,293	7,690	28,708	40,690	8.4%

Source: LADWP 2020 UWMP

Table 2-3. Projected Non-Revenue Water (NRW) Used in LADWP Demand Model

Year	Projected NRW (%) of total demand
2025	8.0
2030	7.7
2035	7.6
2040	7.3
2045	7.1

Source: LADWP 2020 UWMP

2.1.2.1 Water Loss in Transportation

Because State reporting requirements for water loss only consider water in the LADWP Metro Service Area, LADWP does not report water lost along the Department managed and maintained LAA. However, the Department does consider historical data on water loss (including losses due to evaporation and infiltration as well as leaks) in its water supply simulation model for the LAA (LAA Simulation Model or LAASM). The LAA can be divided into three sections as it pertains to water loss potential. Upstream of the Aqueduct Intake, the aqueduct system is effectively the Owens River. Transit loss varies in this section based on the changing evapotranspiration rates and potential seepage into the river's banks. This water loss is calculated and incorporated into LAASM, but water loss in this section is typically beyond LADWP's control as it is due to natural features of the system.

In the second section of the LAA, downstream of the Aqueduct Intake, but upstream of Haiwee, transit loss occurs if water leaks through the embankment wall or due to evaporation or other climate conditions. LAA operators perform routine checks of this asset and will visually see leaks long before there is a noticeable trend in the database. The third section, south of Haiwee, would experience water loss for the same reason as the second section and leaks are identified before they get big enough to register as a noticeable increase in transit loss. The Haiwee to Los Angeles Transit Loss (HLTL) is calculated for the covered portion of the two aqueducts along with flows into Fairmont and Bouquet Reservoirs. HLTL has averaged approximately 7,600 AF annually over the last 20 years. HLTL as a percentage of total AF delivered to Los

Angeles averaged 3% for the same time period. This is a reasonable water loss percentage given the transport of water from the Sierras to the City, and trends do not indicate any significant variation due to anything other than natural factors such as evaporation, rainfall, drought conditions, and soil absorption.

LAA Operations uses measuring instruments at Haiwee outflow and along the LAA to help calculate water loss; however, these meters require frequent recalibration. The Power System has meters at its generating facilities along the LAA that provide daily values that are used to compare against the Water System meters. Significant variances between these two reads drive the need for recalibration. More reliable calibration maintenance on the LAA meters would help improve the accuracy of estimates for water loss in transit, but as of now, crews for those tasks are based out of Los Angeles and are not always available.

The Department also has a robust operation and maintenance program for the LAA, which includes significant investments to harden and replace portions of the Aqueduct system. For example, the Department is replacing portions of the concrete sidewall lining and rehabilitating the covered conduit sections that are decaying. The Department is targeting to replace 3 miles of concrete channel per year and 15,000 feet of top cover per year. The Department has made progress on these goals despite delays due to the pandemic and the need to maintain service. These activities will further strengthen the LAA and mitigate water loss.

2.1.3 Emergency Preparedness

It is critical that the Department have robust plans and procedures in place to identify and respond to emergency situations. A detailed review of these plans and procedures is provided in Section 4 - Security and Emergency Preparedness; however, a brief summary as it relates specifically to the Water System is provided below. The Water System has emergency response and continuity of operations plans in place and has proven to be effective in responding to emergency leaks and breaks. Specifically, the Water System has an Emergency Response Plan (ERP) that establishes lines of authority and organizational relationships at the System level to identify how action will be coordinated in response to emergencies. Certain divisions such as Water Distribution, Water Operations, and WETS also have ERPs that further outline specific responsibilities during an emergency. In addition to the Water Distribution Division ERP, Emergency Action Plans (EAPs) are created for critical infrastructure elements, including dams and aqueducts. Each EAP identifies potential emergency conditions and response processes for the element, roles and responsibilities for emergency response, preparedness activities, and inundation maps where appropriate.

To increase the resiliency of the Water System in the event of an earthquake, the Department developed a performance-based seismic design (PBSD) in 2019 to establish design requirements for enhancing vulnerable assets and performance objectives for acceptable service losses and recovery times in the event of an earthquake. The Water System is now evaluating capital improvement projects to ensure they meet the performance criteria in the PBSD. Example projects include utilizing Earthquake Resistant Pipe to develop the Department's Seismic Resilient Pipe and Transmission Network, developing interties between the LAA and the State Water Project, and seismic improvements of dams such as the Tinemaha Dam, North Haiwee Dam, and South Haiwee Dam.

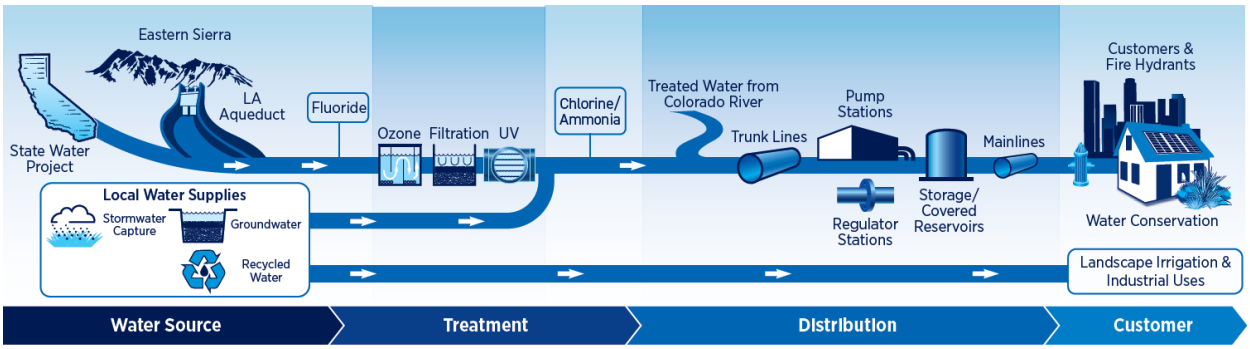
The Department has already installed over 18 miles of trunk line and 23 miles of mainline with Earthquake Resistant Pipe. Virtually all of the Department's future trunk line projects will be constructed using Earthquake Resistant Pipe and the Department is planning to install 10 miles of Earthquake Resistant Pipe for mainlines over the next three years. These Earthquake Resistant mainline replacements will represent less than 10% of total mainline replacement

goals by mile. System resilience will increase incrementally as the pipeline network is improved, but seismic vulnerability will remain a concern until the target performance objectives are fully achieved over next several decades and possibly up to about 100 years.

2.2 Physical Infrastructure

The second focus area of the 2022 IEA Survey for the Water System is physical infrastructure. The Department manages and maintains over 300 miles of Los Angeles Aqueduct (LAA) tunnels, 115 storage tanks and reservoirs, distribution lines measuring more than 7,300 miles in length, 85 pump stations, 329 pressure regulator and relief stations, and more than 735,000 service connections. Figure 2-2 provides an illustration of the Department's water supply system.

Figure 2-2. Illustration of LADWP's Water Supply System



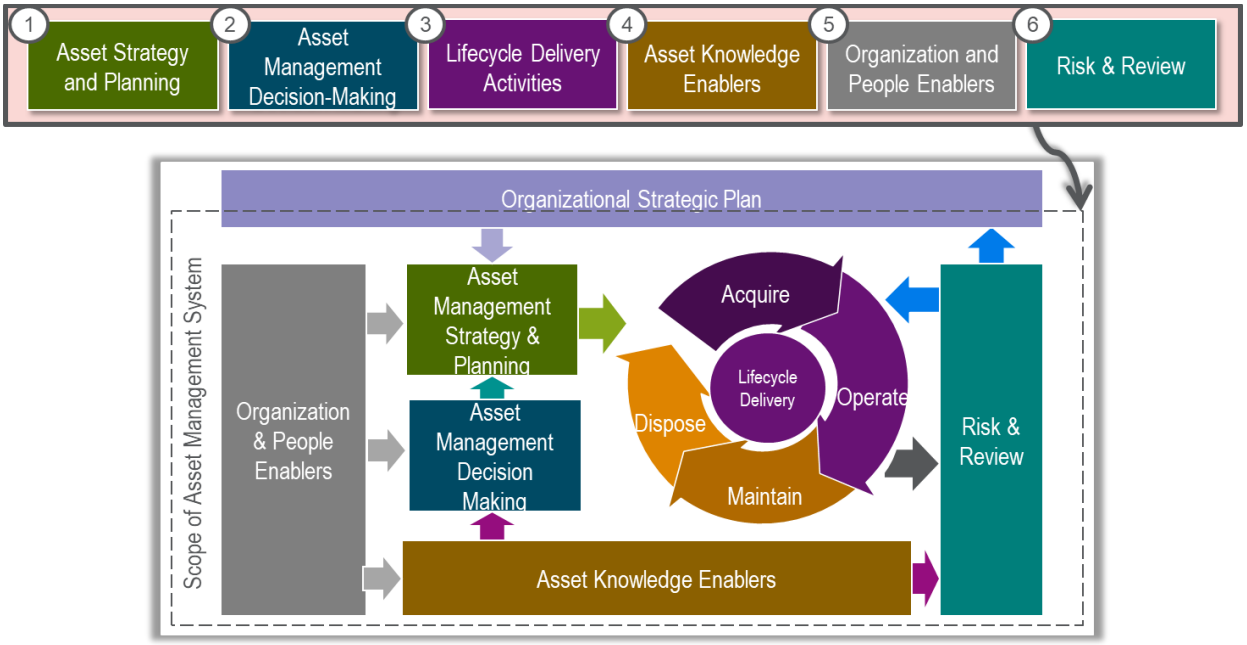
Source: LADWP Briefing Book 2020-21.

Specifically, this Survey assesses the Water System's asset management program, including how the Department collects asset information, assesses risk, conducts preventative maintenance, prioritizes replacement projects, and coordinates with other entities. This focus area also considers the Water System's current infrastructure replacement costs and the level of funding needed to support the program in the future.

2.2.1 Asset Management Program

The goal of an asset management program is to systematically manage assets in a manner that will result in the lowest cost of ownership, while maximizing the effectiveness of the assets. To assess the Water System's asset management program, Guidehouse leveraged its Asset Management Diagnostic Tool, which is based on the International Standards Organization (ISO) 55000, 55001, and 55002 standards, the Global Forum on Maintenance and Asset Management (GFMAM), and our asset management experience. This tool evaluates an organization's asset management function against six asset management groups: (1) asset strategy and planning, (2) asset management decision making, (3) life cycle delivery activities, (4) asset knowledge enablers, (5) organization and people, and (6) risk & review. Figure 2-3 provides an overview of these asset management groups.

Figure 2-3. Guidehouse Asset Management Diagnostic Tool



Source: Guidehouse.

Guidehouse (formerly Navigant) used this tool in the 2015 Survey and found that the Department performed relatively well in asset management decision-making and life cycle delivery activities. Specifically, the Water System had created an Asset Management group in Water Engineering and Technical Services (WETS), drafted several asset management plans for critical asset classes, and conducted asset management training for managers. The tool also identified opportunities for significant improvement in the areas of asset strategy & planning, asset knowledge enablers, organization and people enablers, and risk & review. In these areas, Guidehouse found that the Water System did not have a stated asset management strategy and risk assessment framework or a centralized asset management database, and that some asset classes lacked formal asset management plans and comprehensive condition assessments.

Guidehouse re-evaluated the Water System's progress in these six asset management areas as part of this Survey. Our findings are described in detail below.

2.2.1.1 Asset Strategy and Planning

There are three types of planning documents that are critical to the development and implementation of an asset management program: (1) Asset Management Policy, (2) Asset Management Strategy (also referred to as a Strategic Asset Management Plan or SAMP by ISO 55000), and (3) Asset Management Plans. Figure 2-4 from the Water System's Asset Management Strategy highlights the hierarchy of these documents, and each document is discussed in more detail below.

Figure 2-4. Asset Management Planning Hierarchy

Source: LADWP Water System Strategic Asset Management Plan, January 2020.

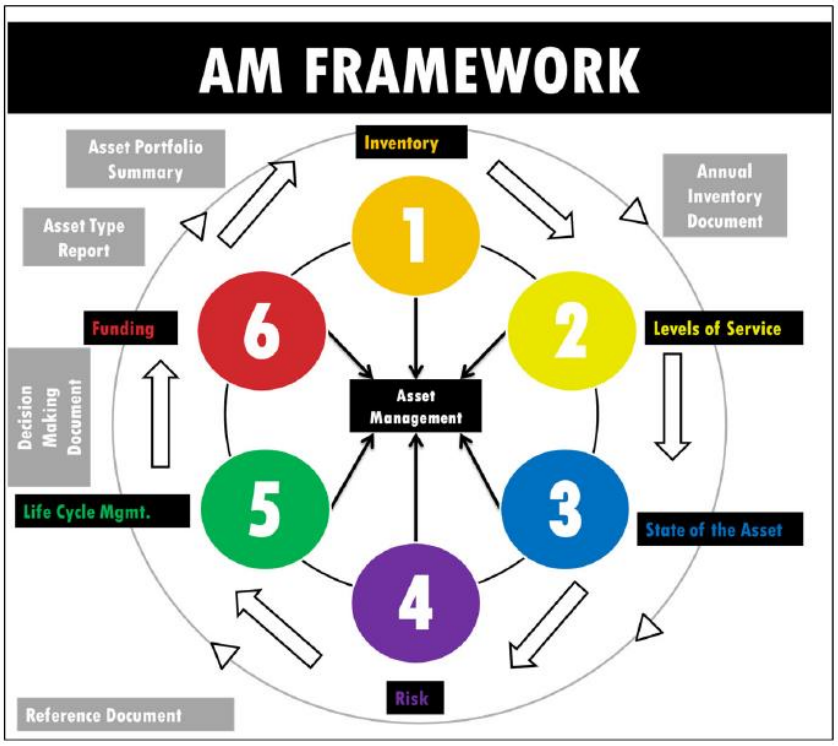
- An **Asset Management Policy** sets the "big picture" for the Asset Management program and serves a guiding document for the Water System to make decisions as it relates to asset management. The Policy aligns with the Water System's broader organizational plan and identifies the underlying principles that the Water System intends to follow to implement the program. This includes a vision statement, objectives, roles and responsibilities, and governance structure that will oversee the execution of the Asset Management program. The Policy should be approved at the executive level and should be widely communicated to the organization.
- An **Asset Management Strategy** defines the scope of the Asset Management program and how the Water System plans to manage its assets. The Strategy includes asset type definitions, strategic levels of service, an asset management framework, a risk assessment framework, a capital planning framework, objectives and performance targets, and a continuous improvement process. The Strategy should have direct linkages to the Asset Management Policy as well as the Water System and LADWP's broader strategic plans.
- The third document is an **Asset Management Plan** for each asset type as defined in the Asset Management Strategy. These plans define asset-specific objectives, levels of service, data sources, current state assessment (based on condition, performance, utilization, etc.), risk assessment, life cycle management plan, budget forecasting plan, and improvement plans. Each of these documents should be reviewed and updated periodically to ensure they remain effective and consistent. In addition, Asset Management Plans should be communicated to relevant stakeholders, including staff across the Divisions, to ensure that asset-specific objectives and results are understood and can be incorporated into their obligations such as capital planning and maintenance.

The Water System has made progress in this area since the 2015 Survey. As noted above, the 2015 Survey recommended that the Water System develop an Asset Management Policy and Strategy, complete its draft Asset Management Plans, and develop plans for additional asset types. Since 2015, the Water System formed an Asset Management Steering Committee (AMSC), led by the Senior Assistant General Manager (SAGM) of the Water System and consisting of directors from all Water System Divisions as well as select staff, to oversee the

development and implementation of the program. The AMSC meets monthly and is noted by the Division leads as being an effective governance structure for the program.

The AMSC developed and approved an AMSC Charter in 2016 that is being used as the Asset Management Policy for the program. The Charter is a comprehensive document that describes the AMSC's objectives, roles and responsibilities (including Action Teams dedicated to developing Asset Management Plans for each asset type), decision-making authority, meeting frequency, and program framework. The six-step Asset Management framework adopted by the Water system is shown in Figure 2-5.

Figure 2-5. Asset Management Framework



Source: LADWP Water System Strategic Asset Management Plan, January 2020.

In 2018, the Water System finalized initial Asset Management Plans (AMPs) for its 11 defined asset types:

- Aqueduct
- Distribution Mainlines
- Facilities
- Groundwater Wells
- Large Valves
- Pump Stations
- Regulator Stations
- Reservoirs
- Tanks
- Treatment Facilities
- Trunk lines

The finalization of initial Asset Management Plans and the development of additional plans for asset types that were recommended in the 2015 IEA Survey reflects significant improvement over the last five years. Each Asset Management Plan, developed by the Action Teams defined in the AMSC Charter, follows the framework outline shown in Figure 2-5. However, the data confidence maturity in most of these Plans is rated fair to poor due lack of data availability and comprehensive condition assessments, and most Plans cite data challenges for lack of

completeness in steps 2 through 6 of the framework (i.e., defining levels of service, assessing the current state, assessing risk, prioritizing assets, and developing a funding plan). As a result, these Plans are not currently used for project and expenditure planning. While the drafting of the framework in these plans is an important first step for the Water System's asset management program, significant work is still needed in this area to develop plans that provide information for effective decision-making in asset repair and replacement. Notably, each Plan does include recommendations for improvement in future iterations.

Most recently, the Water System developed its initial Strategic Asset Management Plan (SAMP) in January 2020. The SAMP ties the Water System's organizational objectives to its Asset Management objectives and provides a path forward for developing Asset Management Plans, levels of service, risk assessment and capital planning frameworks, and a process for continuous improvement. The SAMP also includes the Water System's Strategic Levels of Service, which consider key service objectives, strategic goals, and high-level performance measures for Water System assets. Similar to the Asset Management Plans, the SAMP provides a solid framework for fleshing out the Water System's asset management program; however, many aspects of the SAMP, including the risk assessment methodology and capital planning framework have yet to be defined and will be included in the next version of the document.

The SAMP also includes a roadmap for maturing the asset management program between 2021 to 2023. However, staff noted that the Water System has not progressed on the roadmap as much as desired because of resource constraints and plans to restructure the program. The execution of this roadmap is critical to enhancing the usefulness of the plans described above. Data gathering, cleaning, and consolidation is a critical first step and is discussed more in Section 2.2.1.4 – Asset Knowledge Enablers.

2.2.1.2 Asset Management Decision-Making

The Water System appears to have robust processes in place for the management of linear asset replacements. The initial prioritization of mainlines and trunk lines are done using the desktop models developed and run by the Water Engineering and Technical Services Division (WETS) Asset Management Group (AMG) to prioritize assets based on age, leaks, condition, material, and other factors. The decision to replace or repair mainlines is made by the Water Distribution Division using the WETS AM desktop model results and other factors, and mainline replacements are completed in-house by the Water Distribution Division. The decision to replace or repair trunk lines is made by WETS Planning using the AMG desktop model results and input from the Water Operation Division. Trunk line replacements are constructed by either the in-house Trunk Line Construction Group or outsourced to contractors. All trunk line replacement projects are planned and designed in-house. The design and construction of the trunk line replacement projects are managed by the WETS Project Management Office (PMO). As discussed in more detail in Section 2.2.2 – Current Infrastructure Replacement Plans, the Department plans to significantly ramp up its mainline and trunk line replacements over the next five years to bring its replacement cycle closer to the average lifecycle of 100 years for these assets. The ability to outsource a portion of these replacements will be critical to achieving these replacement goals, and the Department has faced significant challenges in executing contracting vehicles for support in this area. This is a critical path item that needs to be addressed in the near-term.

The decision to repair or replace vertical assets such as pump stations, regulator stations, and treatment facilities is primarily led by Water Operations with engineering and technical support from WETS. When a vertical asset requires a major overhaul or replacement (typically over $1

million), the PMO in WETS manages the design and construction of the project through its Capital Improvement Program (CIP). The CIP prioritizes projects based on several criteria, including project status, regulatory requirements, water supply needs, impact on water quality, O&M needs, and availability of outside funding. Each criterion is weighted, and a score is calculated for each project. This scoring is completed on an annual basis to prioritize CIP projects. The PMO is supported by well-functioning project management processes to execute projects based on clear roles and responsibilities. As stated in the SAMP, the Water System should incorporate the risk assessment methodology for the asset management program into this process once complete.

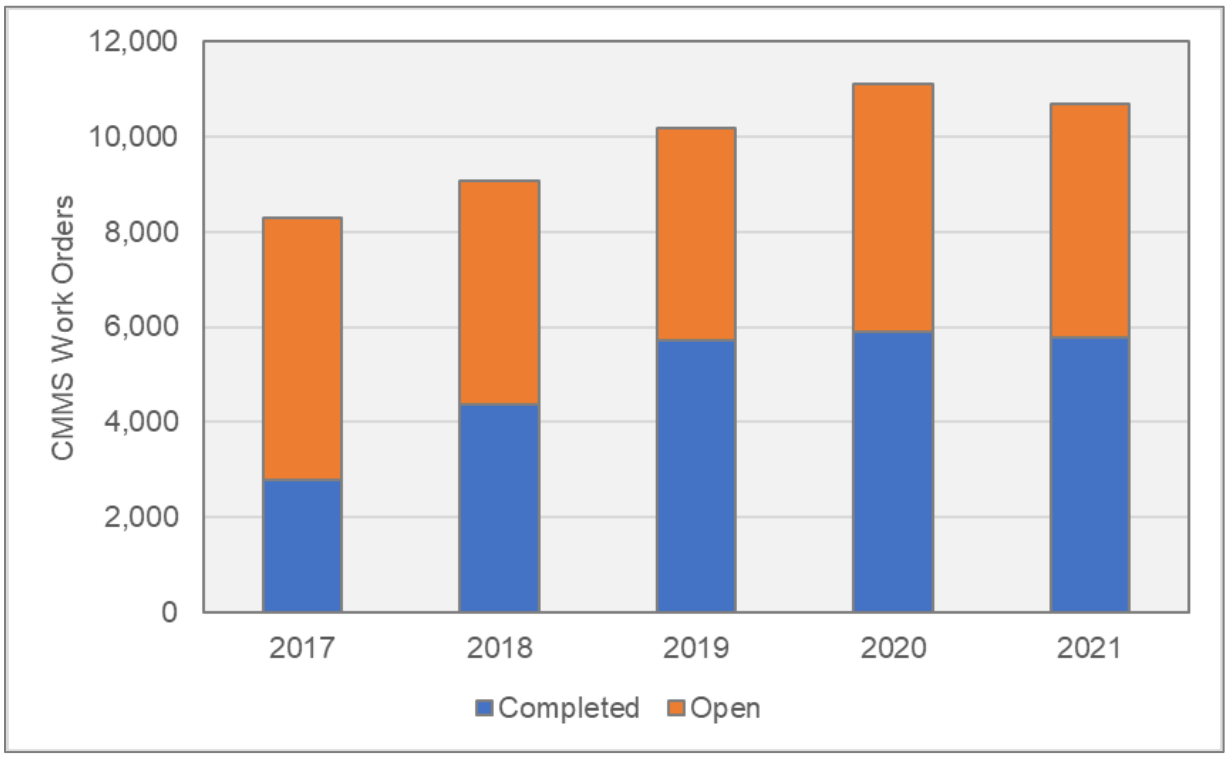
Maintenance work is primarily driven by short-term operational priorities rather than preventative maintenance and data analytics. There is also currently little connectivity between the Water System's asset management program and its maintenance strategy. Operational outcomes from this disconnected and reactive maintenance strategy mean that more asset replacements are done based on infrastructure failures rather than those that have reached the end of their prescribed lifecycle. This may increase the time it takes to reduce the length of replacement cycles for various equipment.

However, this could change over time as the Department builds out the data and analytics to execute the framework for its asset management program and coordination between WETS, Water Distribution, and Water Operations improves. The Department is also working on improving the prioritization of preventative maintenance for critical assets by prioritizing those work orders in Maximo and installing sensors at specific facilities, such as critical pump stations, to provide additional data to operators and help them make decisions regarding the prioritization of preventative maintenance work. In addition, as noted in the 2015 IEA Survey, there is no overarching written policy and business processes governing the repair, maintenance, and replacement of the Water System's asset classes. The planning and execution of these tasks is largely dependent on institutional knowledge.

2.2.1.3 Lifecycle Delivery

The Water System has many processes in place to monitor, maintain, and replace its assets. For example, the Water System has processes in place to prioritize the maintenance of its assets in its Computer Maintenance Management System (CMMS) based on a work order scoring of 1 to 4 with 4 being the highest priority corrective-maintenance jobs, and to schedule that maintenance across field staff in Operations based on priority, geography, and staff availability. Figure 2-6 provides an overview of the Water System's maintenance work orders by year and shows that the Department has improved its work order completion percentage over time despite an overall increase in number of work orders generated. The Water System also reports that Priority 4 work orders account for approximately 3-6% of total work orders in CMMS with that percentage declining over the last three years as the Department prioritizes closing these critical maintenance jobs.

Figure 2-6. CMMS Maintenance Work Orders



Source: LADWP CMMS.

Another aspect of lifecycle delivery is the Water System's ability to respond to emergencies such as asset failures. The Water System has emergency response plans in place and has proven to be very effective in responding to emergency leaks and breaks. Department staff noted that the Water System has created an emergency response group with staff dedicated to emergency planning and training. The Water System has also improved its Supervisory Control and Data Acquisition (SCADA) system and its communication assets such as smartphones, tablets, laptops and SAT phones, which further enhances the Department's ability to monitor and coordinate responses during an emergency.

In terms of capital replacement, the Water System has the Planning Section managing the planning, PMO and other Water System groups managing the design and construction of Trunk Lines and vertical assets. Planning and Project Managers work closely with Water Operations to ensure that the replaced assets meet operating needs. The Water System also has a CIP Management team that tracks key metrics for the CIP projects, including project budgets and schedules, and prepares various monthly, quarterly, and annual reports for CIP tracking and management. However, there is little connectivity between the Asset Management Plans that have been created for the vertical assets and the implementation of the Water System's existing practices to manage the lifecycle of its vertical assets.

2.2.1.4 Asset Knowledge Enablers

As noted in the Water System's SAMP, many of the Asset Management Plans are based on fair to poor data quality due to difficulty in collecting, centralizing, and digitizing asset data. The WETS Asset Management Group (AMG) has made an effort to consolidate asset data in centralized data folders on the Asset Management network; however, in many cases, the data is not comprehensive enough to inform a formal risk-based assessment. The Asset Management

Plans also recommend steps to improve data quality, and the execution of these steps is critical to making the Plans practical and useful to the Water System's capital and maintenance programs in the future. The current sources of data and plans to improve their usability for asset management purposes are discussed below.

The Water System relies on two primary systems to store asset data: Maximo and ESRI Geographic Information System (GIS). Maximo is currently used to track inventory, manage work orders, and track costs for certain assets such as pump stations and regulator stations. In general, there have been major challenges associated with fully moving the Department's assets into Maximo. While Maximo could be used to more comprehensively store and process asset data for use by the Asset Management program, that functionality has not been built out. The 2020 SAMP notes that the Water System is in the process of selecting a consultant to expand and optimize the use of Maximo; however, there appears to be a lack of consensus in the use of Maximo for asset management purposes and a delay in onboarding a consultant for this work.

ESRI GIS contains digital maps of the Water System's assets as well as some unmapped assets that do not have positioning data. Part of updating this database requires the digitization of paper records from field crews such as water system maps, pipe location reports, and leak reports that provide critical information such as the location, intersection, pipe material, size, length, and condition of assets installed. It is important to note that the process of digitizing and verifying paper records from the Water Distribution crews creates at least a six-month lag in the availability of information in GIS. GIS is primarily used to store and pull information on linear assets such as mainline and trunk line. The Water System's GIS group (WaterGIS) also maintains a leak database and a Mainline Replacement (MLR) system, which tracks hours and budget for mainline replacement projects.

While these two systems contain a significant amount of the Water System's asset data, there are also paper reports, legacy databases and other ad-hoc databases that are used throughout the organization for specific needs or specific asset information. Examples include:

- Responsibility Cost Accounting System (RCAS), which tracks certain O&M and capital costs for work orders.
- e-Respond, which is used to capture leaks reported by customers.
- Construction Productivity System (CPS), which is maintained by Water Distribution and tracks leaks, crew responses, and crew productivity.
- FileNet, which is a database that archives the Water System's engineering design drawings (also referred to as Water System Drawing Index).
- Microsoft Access, which is used to maintain databases on regulator stations, pump stations and linear assets.
- Paper books such as the "Reg. Book", which is maintained by Water Operations and includes asset information on regulator stations.

Other databases are updated on an ad-hoc basis and efforts to centralize this data and share it across divisions has been challenging. However, the Water System is working on developing a Water Information Network (WIN) to combine information from various data sources (including Maximo, GIS, and other databases) and provide a single access point for planning and engineering analytics. The first phase of developing WIN was initiated in May 2018 and the 2020 SAMP notes that the Water System is in the process of choosing a consultant to set up the system. However, interviews with staff indicated that the Water System has not been able to

get a contracting vehicle in place to outsource this work and there are no internal staff dedicated to WIN full-time. Consequently, progress on advancing WIN has been slow despite leadership support for the initiative.

In October 2021, the Water System completed a consultant's Digital Utility Maturity Assessment (DUMA), which assessed its digital maturity in 8 functional areas including asset management, operations & maintenance, and capital planning & delivery. The assessment found that these three areas ranked the lowest across all the functional areas with scores between 3 and 4 on a 10-point scale for maturity. In general, the responses provided by Water System staff for the assessment survey highlight many of the challenges noted above, including that Maximo and GIS are not used comprehensively for setting maintenance and replacement strategies. Historical project data is also not routinely used to plan future projects because it is not centrally compiled and analyzed. Lastly, the assessment noted that WIN has made progress but needs additional resources so that it can be used for centralized data analytics to support the asset management program.

The findings noted above highlight the need to continue to invest resources in collecting, digitizing, cleaning, and centralizing the Water System's asset data. This is a critical first step to creating actionable Asset Management Plans that inform asset maintenance and replacement. Once this database is in place and staff are trained to analyze the data, the Water System can implement its risk assessment and capital planning frameworks, and ultimately be more proactive and strategic in its asset management practices.

2.2.1.5 Organization and People Management

Asset maintenance, repair, and replacement work is conducted across three divisions: WETS, Water Operations, and Water Distribution. The WETS division is responsible for the planning, design, and project management of asset replacement projects. The Water Distribution Division is primarily responsible for the design, construction, replacement, repair, and maintenance of the distribution system assets, and the Water Operations Division is responsible for the operation and maintenance of the transmission system including the vertical assets and the Los Angeles Aqueduct assets.

The Asset Management team in WETS has seen fluctuations in resources over the last decade as the asset management program has evolved. At one point, the team had 12 staff; however, the group has recently been reduced to five staff. This reduction in staff has made it challenging to progress the AMPs. The Asset Management team in WETS is currently working with Water Operations to improve the coordination across divisions and develop an effective organizational structure to better implement a formal asset management program.

Despite the smaller team size, the formation of the AMSC and supporting Action Teams demonstrates leadership support of the development of the program. Leadership should continue to drive the implementation of this function to maintain momentum gained in recent years. In addition, the Water System has had success in utilizing an as-needed contract with outside resources to support technical writing and provide subject matter expertise in the build-out of the asset management program. However, efforts to put another as-needed contract in place have been stalled. The Water System should continue to pursue another contracting vehicle and leverage outside resources to expedite program development, especially as the next cycle of reviewing, updating, and enhancing the AMPs is underway.

As noted in the 2015 IEA Survey, it is also important that the Asset Management team, as well as the Water Operations and Water Distribution Divisions, focus on capturing the knowledge of

staff that are retiring. This knowledge transfer will be critical to compiling a comprehensive set of asset data and is especially important as more than 30% of the Water System staff was eligible for retirement as of 2020 based on a 2020 AWWA Benchmarking Study. The Water Distribution Division has a robust training system that the Water Operations Division is looking to emulate, and it has included this investment in upcoming budgets.

2.2.1.6 Risk and Review

In the 2015 IEA Survey, one of the key recommendations was for the Water System to adopt a formal asset management framework to assess risk and make planning decisions in a more standardized way. The Department has made progress in this area by adopting the ISO 55000 framework and developing the initial planning documents described above. Specifically, each AMP has a chapter on current state (including condition), risk, and lifecycle assessment based on the Water System's adopted asset management framework in Figure 2-5. In general, the risk and condition analyses described in the AMPs for vertical assets are not currently used to inform capital planning and maintenance strategies. However, the AMPs do lay out improvement plans to improve data quality, conduct comprehensive condition assessments, and incorporate the results into future planning efforts. The status of these efforts is discussed in more detail below.

In recent years, the Water System has made progress in building out the Asset Management framework for certain vertical assets. The Asset Management framework was tested on a pilot of tank assets in September 2019 and guidelines were developed to implement the framework for other assets. Ultimately, Asset Management analysis was conducted using the piloted approach for the following asset types: Groundwater Wells, Regulator and Relief Stations, Reservoirs, and Tanks. Specifically, condition assessment manuals with a standardized scoring framework were drafted for tanks, regulator stations, filter plants, and pump stations. However, due to limited resources, comprehensive condition assessments were not ultimately conducted. Currently, the Asset Management group pivoted to conducting condition assessments of its most at-risk assets, which includes 22 pump stations, 40 regulator and relief stations, and 20 tanks. These at-risk assets were primarily identified by the Water Operations division, and this prioritization will be used until more comprehensive condition assessments can be conducted.

The majority of large valves were last exercised in 2009 to determine their condition. According to the large valve AMP, the Department recently reinstituted a program to exercise its large valves to determine their operability. The Department hopes to use the data from this program to update the AMP once complete.

Desktop model analyses for mainlines and trunk lines have been developed and improved since 2010. These models include mainline and trunk line information based on age, material, soil resistivity, pressure, and condition, which is primarily based on leak data. This information is used by staff to provide a letter grade A through F to score the condition of linear assets (Mainlines and Trunk Lines). The Water System then prioritizes the linear asset replacement projects based on the letter grades, risk of service disruption, and coordination with the Bureau of Street Services' paving schedule.

As discussed above, one of the most important inputs to assessing asset risk is data, and comprehensive condition assessments are critical to collecting sufficient data to standardize risk assessments. Interviews with staff noted the importance of these assessments and the type of effort required to complete them. Under the ongoing Capital Risk Based Analysis, the WETS AMG is currently leading the effort to coordinate condition assessment for 22 Pump Stations, 42 Regulation Stations, and 20 Tanks. The condition assessments are performed by WETS

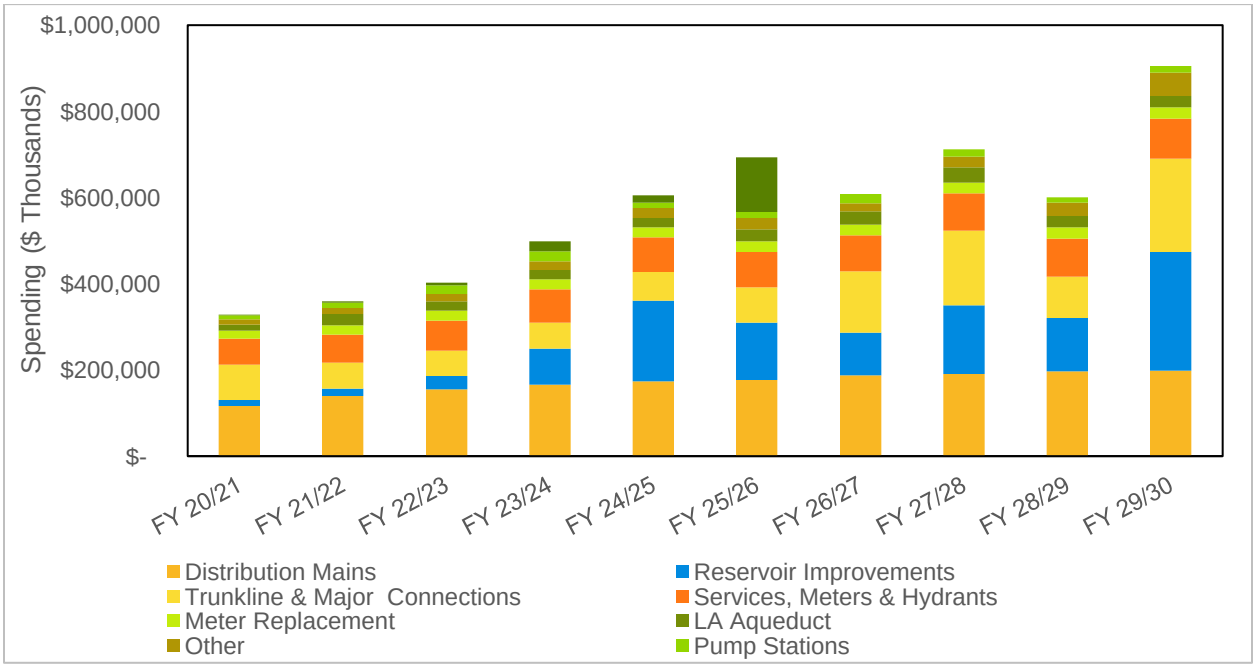
Design Teams and Corrosion Control Group with the support of the Water Operation Repair and Construction Group (R&C). In the meantime, the WETS AMG is communicating with the Water Operation Division to evaluate the feasibility of incorporating the condition assessments as a part of the ongoing preventive maintenance assessments performed by R&C for various assets.

2.2.2 Current Infrastructure Replacement Plans

2.2.2.1 Capital Spending Plan

LADWP's current 10-year Capital Budget for the Water System includes a 276% increase in Infrastructure Reliability-categorized spending from $327 million in FY20/21 to more than $900 million in FY29/30. Infrastructure Reliability accounted for 42% of Water System spending in FY20/21 and under the current budget, will account for 49% in FY29/30. The Water System budget also includes significant increases in Water Supply/Water Resources spending as Operation NEXT and other water supply projects (discussed above in Section 2.1.1 – Water Supply) ramp up over this period. It is important to note that these are high-level planning estimates beyond the next few years, but these figures do highlight the Water System's plan to significantly increase investment in Infrastructure Reliability over the next decade. These increases in spending are unprecedented and will require a significant increase in staff, contracting vehicles, and financing mechanisms. The Department has historically struggled with quickly ramping up resources, including hiring and contracting. Accordingly, the Department needs to explore options to enhance hiring and contracting to meet these aggressive spending targets.

Figure 2-7. 10-Year Infrastructure Reliability Budget



Source: LADWP Water System 10-Year Capital Budget.

Specific asset budgets include steady increases in funding for distribution mainlines and water meters through FY29/30, which aligns with the increase in annual replacement goals for these asset types to hit replacement cycles closer to their average lifecycle. Trunk lines have been budgeted for a 173% increase in spending from FY24/25 ($82 million) to FY25/26 ($142 million). Major projects in the budget include the Granada Trunk Line Replacement to replace existing

pipe built in 1955, the Rinaldi Trunk Line-MWD Lease Extension, Roscoe Trunk Line Replacement which includes two relief stations, and City Trunk Line North-Unit 1, one of the Water System's earthquake resistant ductile iron pipe installations. Trunk line improvements are estimated to reach $217 million in FY29/30, with an additional $46 million budgeted for the Tinemaha Dam replacement, accounting for 30% of the total Infrastructure Reliability budget for that year.

The Water System was on track to meet spending goals for fixed asset replacements for FY 2021 in April 2021, having spent within 10% of their target at that time. This metric includes mainline replacement, trunk line replacement, pump stations, regulator stations, tanks, and other facilities. This was an improvement over FY19/20 in which the Department only spent 84% of its budget for fixed assets replacement. LADWP rate metrics for FY19/20 and FY20/21, both years in which the Department underspent mainline replacement budgets and did not achieve annual replacement goals, cited limitations in field work staffing due to COVID-19 restrictions. Rate metric reports have also mentioned planned hiring for mainline crews to reach the increasing annual replacement rates for the last four fiscal years. While the rate metrics for water meter replacements has typically fallen within the acceptable variance in the last four years, most reports mention that delays in staff hiring continue to hinder achievement of the annual replacement goals.

2.2.2.2 Current and Future Repair and Replacement Rates

Guidehouse reviewed the Water System's repair and replacement data by major asset class to compare the current and planned replacement rates to average lifecycles and to examine alternative replacement scenarios. LADWP provided a list of asset types with associated Asset Life Cycles in years and current and future replacement cycles, which can be seen in Table 2-4. The Department also provided annual replacement actuals from FY15/16-20/21 and replacement goals for FY21/22-25/26.

Table 2-4. Asset Life Cycles, Current (FY 2021) and Future Replacement Cycles (FY 2026) for Various Asset Types

Asset Type		Asset Life Cycle (years)	Current Replacement Cycle FY 20/21 (years)	Future Replacement Cycle FY 25/26 (years)
Pumps		40	24	28
Regulator and Relief Stations		50 and 20, respectively	47	41
Regulator Vault Header		-	134	134
Water Storage Tanks		60 to 100	-	-
Pipelines	Mainlines (up to 20-inch diameter)	90-110	226	138
	Trunk Lines (greater than 20-inch diameter)	60-120	181	187
Large Valves		68	591	591
Meters (Small)		30	24	21

Source: LADWP Data

Replacements are done proactively every year for regulator station valves (retrofits), regulator station headers, mainlines, trunk lines, large valves, and small meters. For assets that do not currently have a replacement cycle below the asset life cycle provided by the Department, Guidehouse calculated the necessary annual replacement goal necessary to achieve a

replacement rate at or below the asset life cycle. These calculated annual replacement goals are discussed along with details of asset age from the Asset Management Plans in this section.

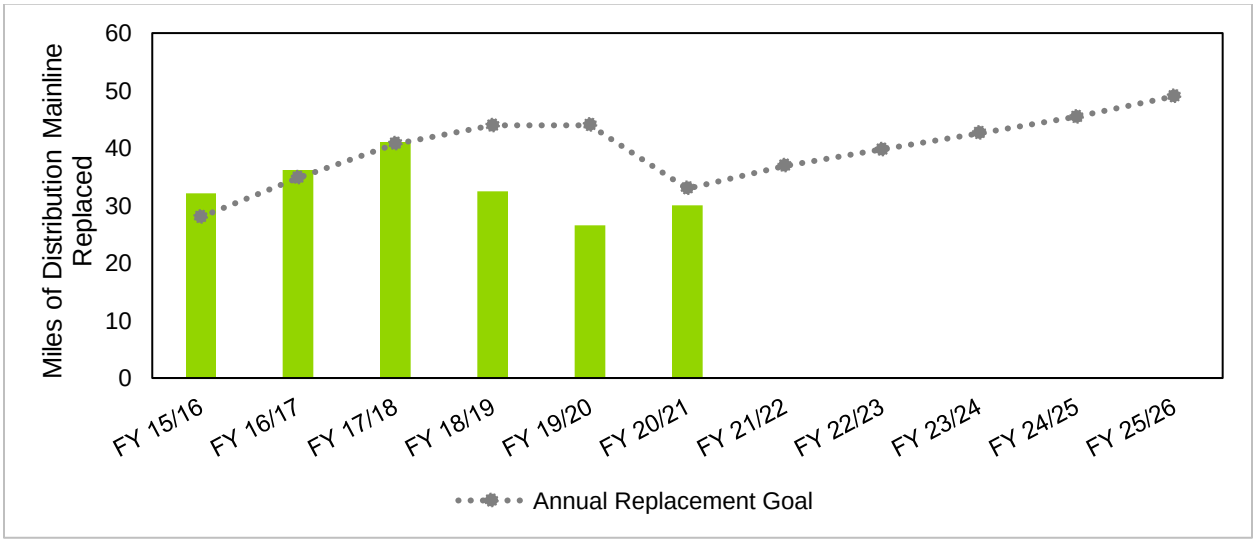
The Department's WETS and Water Operations Divisions work collaboratively to replace and maintain aging vertical assets such as pump stations and regulator stations. In addition to the pumps and motors replaced when the piece of equipment fails, twelve pumps and motors are replaced proactively every year. Pump stations are outfitted with extra equipment so that Operations are not disrupted when these pieces fail. This annual replacement target yields a replacement cycle that is lower than the average life of the asset. The Department also upgrades pump station control systems, with a goal of one upgrade per year for FY 21/22 through FY 25/26. Regulator stations are retrofitted due to age of valves, leaks, and corroded or pitted piping. The Department retrofitted six stations on average from FY 15/16 to FY 20/21 and has a goal of eight retrofits annually for the next five years. This will result in a Replacement Cycle of 41 years by FY 25/26, which is in line with the average lifecycle of the asset.

The Department's Water Distribution Division is dedicated to the replacement of aging mainline. The Department's condition assessment model indicates that approximately 6% of mainline is ranked as an "F" and 36% is ranked as a "D" in terms of condition. 7.9% of LADWP's distribution mainlines (approx. 536 miles) are greater than 100 years old. The expected lifespan of different pipe materials varies, but the largest portions of the mainlines above 100 years old are cast iron (life exp. 80-100 years), steel (90-100 years), and asbestos concrete (50-100 years).

The Water Distribution Division Five Year Action Plan notes that incremental increases to mainline replacement will ultimately result in a 150-year replacement cycle. While the Water System has faced challenges in hitting its annual replacement goals over the last three years, efforts are focused on allocating limited resources to areas with the highest leak density. Mainline replacement goals will need to be at least 45 miles per year to maintain a 150-year Replacement Cycle, although this does not take into account new distribution mainlines. As mentioned above, mainline replacement is currently completed entirely in-house, and the Department will need to consider an improved outsourcing strategy to hit the replacement targets noted above.

LADWP's replacement rate also lags behind the national average for pipeline. The 2019 Drinking Water Report Card from the American Society of Civil Engineers reported water utilities were replacing between 1% and 4.8% of their pipelines per year on average, a replacement rate that matches the lifecycle of the pipes. In comparison, LADWP replaced 0.44% of its mainline pipeline system in FY 2020/21 down from a high of 0.6% in FY 2017/18. It is important to note that despite not meeting aggressive replacement targets in recent years, the Water System's leak rate continues to be well below the national industry average of 25 leaks per 100 miles.

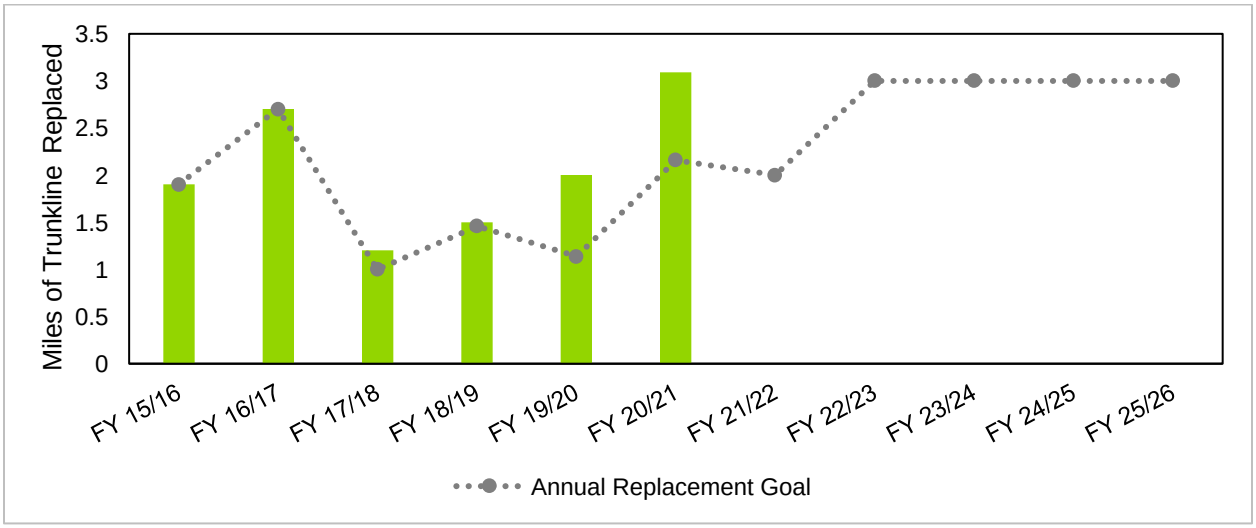
Figure 2-8. Mainline Replacement Actuals and Annual Replacement Goals FY15/16-25/26



Source: LADWP Data

Trunk line replacement goals have steadily increased over the last three years and currently aim to reach 3 miles of annual replacement in FY 2022/23 and subsequent years as seen in Figure 2-9. The Department successfully installed 3 miles of trunk lines in FY 2020/21, surpassing a goal of 2.2 miles, but this was partially due to a reduced traffic presence due to stay at home orders in response to the COVID-19 pandemic. Fluctuations in staffing and union contract delays has delayed trunk line installations in previous years, although the Department has met or surpassed its replacement goals for the last six years.

Figure 2-9. Trunk Line Replacement Actuals and Annual Replacement Goal FY 15/16-25/26



Source: LADWP Data

The Department's condition assessment of trunk line is much better than mainline, with less than 1% with ratings of "D" and "F" in terms of condition. The trunk line AMP includes an age profile which indicated that in 2018 more than 50% of trunk line segments are more than 65 years of age and 11% of trunk lines are more than 100 years. This means that 280 miles of the

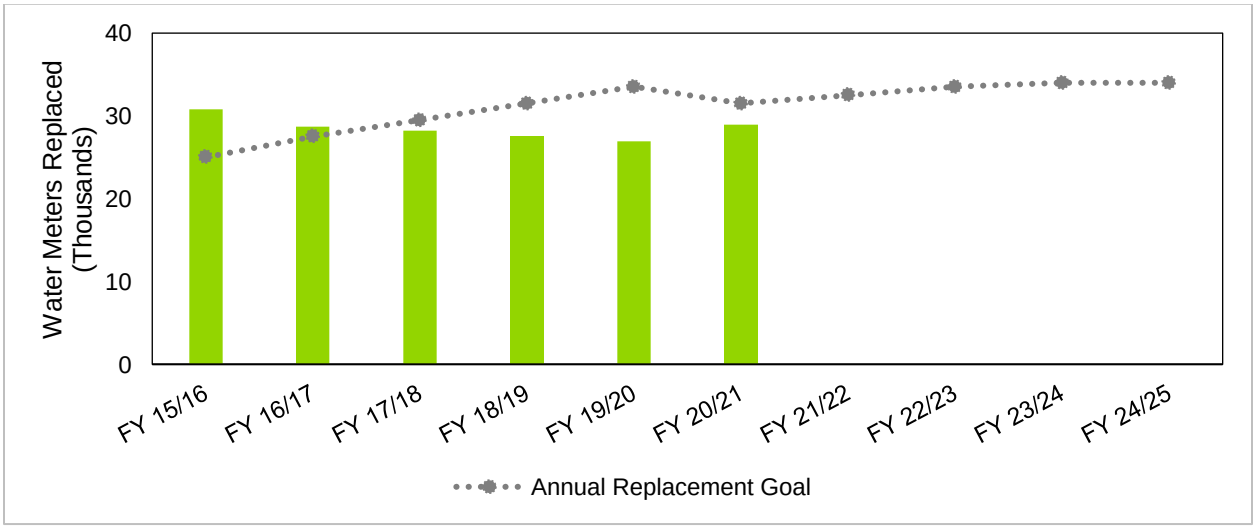
Department's trunk lines are in the end-of-life range for the asset class (60-120 years). The current Replacement Cycle in FY 20/21 was 181 years, and even with an increase in trunk line replacement, the expected future Replacement Cycle is 187 years. 4-5 miles of trunk lines would need to be replaced each year to lower the Replacement Cycle to 120 years or less.

The 2015 IEA Survey recommended that large valve replacement should be increased from five valves per year to reduce the current Replacement Cycle. The Department continues to replace five large valves per year, working through a list of approximately 22 prioritized valves awaiting replacement. The Water Distribution Division typically replaces an additional two to five valves each year during the planned replacement of trunklines. Improved tracking of these replacements, which are currently managed across two or more teams, will help improve understanding of this asset's management strategy.

The 2018 Large Valve AMP includes an asset inventory of valve types, sizes, and ages. In 2018, 17% of large valves were estimated to be older than 70 years. 284 large valves were inventoried with an installation date of 1900 but were excluded from the age analysis because it was assumed that the installation date was improperly documented, and a full conditional assessment could not be completed. If the 284 large valves were included in the age distribution, approximately 26% of large valves would have been over the age of 70 in 2018. An average Asset Life Cycle of 68 years was calculated based on recorded data from 2014 to 2018 of large valves that were replaced. The data included a total of 26 valves, ranging from 18 to 106 years old.

LADWP has just over 700,000 small meters with an expected life span of 20 years. Figure 2-10 shows that while the Department has steadily increased the annual replacement goal for water meters, it has not met the goal since FY 16/17. If the Department can achieve an annual replacement rate of 34,000 meters per year by FY 24/25, its small meter Replacement Cycle will approach 21 years. However, as more service connections are added, the Department will need to adjust its annual replacement goal to match.

Figure 2-10. Meter Replacement Actuals and Annual Replacement Goal (FY 15/16-24/25)



Source: LADWP Data

Several other asset types have less specific replacement cycles depending on various factors and characteristics of the asset. Capital improvements for storage tanks are identified during

their routine cleanings and inspections and generally have a lifespan of 60-100 years. Reservoir floating covers are replaced every 20 to 30 years, depending on their condition.

2.3 Water System Conclusions and Recommendations

From its assessment of LADWP's water infrastructure as outlined in its asset management plans, capital spending plans, Urban Water Management Plan, internal and external studies, and other documentation, Guidehouse concludes the following:

1. The Department has a comprehensive long-term water supply strategy that considers the impacts of climate change and includes significant investments over the next 20 years to increase local water supply through Operation NEXT, groundwater storage, stormwater capture, and conservation. These investments will reduce reliance on imported water (specifically purchased water from MWD and increasingly variable water from LAA) and increase the resiliency of the Department's water supply.
2. The Department has committed significant resources to tracking and mitigating water loss in the City's distribution system through the formation of the Water Loss Task Force and Action Plan. Water loss along the LAA is also tracked, monitored via regular inspections, and taken into consideration when forecasting water supply from the Sierras; however, there are many factors such as evaporation and natural diversions that impact loss during transport but cannot be mitigated.
3. The Water System has improved its Asset Management strategy and planning documentation since the last Survey with an established Steering Committee that meets regularly and approved Policy, Strategy, and Asset Management Plans for each major asset type.
4. The Asset Management program is still in an early stage of maturity, largely due to the lack of centralized and digitized asset data as well as comprehensive condition assessments for assets other than mainline and trunk line. Resource constraints to gather, manage, and analyze this data is also a challenge. This limits the Department's ability to use the Asset Management Plans for capital planning and risk management purposes.
5. The Water System has a well-functioning PMO to execute large capital projects, which will be critical as it seeks to increase replacement rates and construct large, complex programs such as Operation Next. However, outsourcing continues to be a major challenge both for asset replacements as well as engineering and technical support.
6. Despite increasing replacement rates in recent years, many asset classes have replacement cycles that extend far beyond their average useful life. This is most evident for distribution mainlines and large valves.

Based on these conclusions, Guidehouse has developed the recommendations noted below for the continued improvement of the Water System's strategic planning and physical infrastructure investments.

2022 Water System Recommendations
Strategic Planning

1. Continue to explore funding and financing options, assess the necessary augmentation of internal resources with outside professional services, and engage with stakeholders in order to realize and or adapt the Operation NEXT Water Supply Program to meet recycled water development goals according to the timeline currently envisioned and to mitigate ratepayer impacts.

2. Consider contingency scenarios for expanding system supply of groundwater, stormwater capture, and recycled water beyond the Operation NEXT Water Supply Program to mitigate risks of delay, including the feasibility of additional storage along the Los Angeles Aqueduct to reduce supply variability in dry years.

3. Invest additional resources towards the timely completion of maintenance on Los Angeles Aqueduct meters to improve the accuracy of water loss measurements and other physical infrastructure improvements to reduce water loss in transit.

Physical Infrastructure

4. Develop and implement an organizational plan to ensure sufficient resources are dedicated to build-out of the asset management program and to improve coordination across divisions.

5. Continue to pursue outside contracts to move asset management program forward (including technical support for improving data and optimizing systems and field support to conduct condition assessments).

6. Develop and document procedure for capturing institutional knowledge of retiring employees, especially as it relates to asset data and operational risk.

7. Conduct comprehensive condition assessments for vertical assets, including pump stations, regulator stations, tanks, reservoirs, groundwater wells and large valves. Data collected through these assessments is foundational to the Asset Management Plans (AMPs).

8. Confirm leadership consensus on the purpose of Maximo, ESRI Geographic Information Systems (GIS), and Water Information Network (WIN) as it relates to asset management. Invest resources in the optimization of Maximo and GIS (including adding more asset types in Maximo, better integration of vertical asset data in GIS and digitization of paper records), and the build-out of WIN to link these systems and other databases, to centralize and better utilize asset data.

9. Implement data improvement plans in the AMPs to allow for more actionable plans in the near-term, including the completion of comprehensive condition assessments to better assess risk and prioritize replacements by asset type. Once data confidence increases, integrate asset management framework (risk prioritization and lifecycle assessments) into existing processes for replacement and repair decision-making.

10. Document a preventative maintenance strategy, develop preventative maintenance analytics, and dedicate resources (budget and staff) to better incorporate proactive preventative maintenance into existing maintenance practices, including those based on condition-based maintenance practices (and incorporated into department-wide asset management programs).

11. Develop a formal condition-based maintenance program for the routine testing, repair, and replacement of aging valves and hydrants.

12. Develop hiring strategy and supporting budget for increasing Water System staff to support aggressive near-term infrastructure goals, including significant increases in mainline replacement and the need to better assess and address the condition of vertical assets.

13. Assess the benefits of developing an overarching asset management plan and systems jointly used by LADWP's Water and Power organizations. Develop processes and procedures that are consistently applied to Water and Power, including funding prioritization and allocation.

3. Power

3.1 Strategic Planning

As first set forth in L.A.'s Green New Deal and California SB 100, LADWP is on an accelerated path to procure 100 percent carbon-free electricity. The accelerated path is driven by climate change impacts and the associated desire by the City and the state of California to reduce carbon emissions, both within the transportation sector and from power generation facilities. The Los Angeles 100 Percent Renewable Energy Study (LA100) published in March 2021 by the National Renewables Energy Laboratory (NREL) examines pathways to reliable, 100 percent renewable electricity for Los Angeles and will inform LADWP's next Strategic Long-Term Resource Plan (SLTRP). The 2022 SLTRP, with plans through 2050, is expected to be released in the Fall of 2022.

In February 2019, while awaiting results from NREL's LA100 study to guide their 2022 SLTRP, LADWP initiated Clean Grid LA as an interim analysis designed to bridge the gap between the current state of the grid and 100 percent clean energy goals. Clean Grid LA focuses on accelerating to 80 percent renewable energy by 2030 by adding 3 gigawatts (GW) of new renewables, completing 10 critical transmission projects over 10 years, transforming in-basin generation from thermal generation to hydrogen generation and retrofitting Haynes to comply with Once Through Cooling (OTC) regulations, building 1 GW of energy storage by 2030 and deploying a total of 1.5 GW of distributed generation, along with promoting electric vehicle adoption.[10]

The efforts to replace in-basin OTC natural gas generation stations (Scattergood, Haynes, and Harbor) with resources that align with long-term 100 percent clean energy goals is in response to requirements under the Federal Clean Water Act, administered by the California State Water Resources Control Board (SWRCB). LADWP commissioned a technical study to identify and evaluate alternatives to repowering, such as removing the OTC process but continuing gas-fired power generation. The study examined the effects of different resource scenarios on the Power System, evaluating which alternatives would meet system reliability and resource adequacy requirements.

In the context of this environment, Guidehouse evaluates long-term planning for and progress towards the 100 percent renewable portfolio via a review of available documents and interviews with LADWP management and staff responsible for resource supply and power delivery. As the 2022 SLTRP is expected to be released in Fall 2022, there is no current comprehensive document or plan showing the generation mix pathway which LADWP expects to follow over the next 20 years. In the absence of such a document at the time of this report, Guidehouse reviewed a variety of available planning documents to assess how LADWP proposes to achieve the City's renewable energy goals, while addressing potential gaps and risks associated with the prospective pathways. The future mix of power generation resources is a critical consideration for balancing key objectives related to reliability supply, while ensuring environmental stewardship and meeting LADWP's mission to provide competitive rates. Guidehouse recognizes key challenges that LADWP faces as it transitions to a 100 percent renewable resource portfolio and offers specific recommendations for ensuring the reliability and resiliency of the power generation and delivery system.

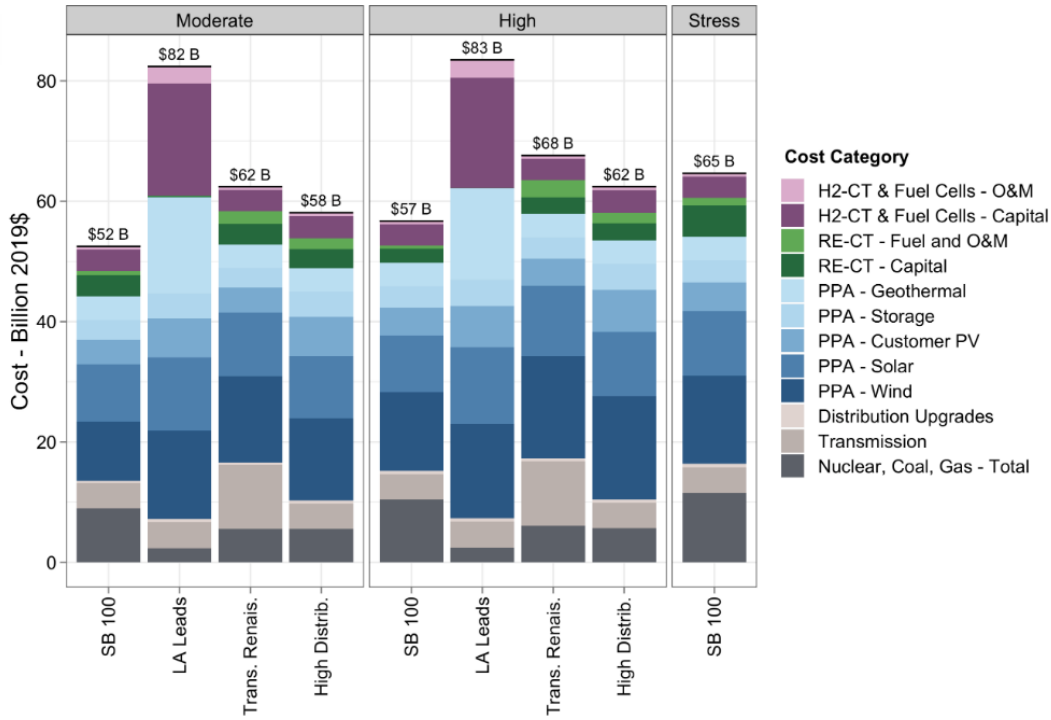
[10] Clean Grid LA Plan Update/Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

3.1.1 LADWP's Power Supply Resources and Clean Energy Targets

LADWP continues to take significant steps to decarbonize its power generation portfolio through various clean energy initiatives, including eliminating coal-fired generation, expanding renewable energy, developing energy storage systems, investing in distributed energy resources such as solar photovoltaics (PV), and encouraging a switch to electric vehicles. These strategies have significantly reduced GHG emissions and are the building blocks for the City of Los Angeles' clean energy future.

Currently, more than one-third of LADWP's power supply is from renewable solar, wind, and geothermal energy sources. The transition to additional clean energy sources will increase dramatically over the next decade based on LADWP's Clean Grid LA Plan and the City of Los Angeles' 100 percent renewables target. Over their multi-year LA100 analysis, NREL performed integrated modeling activities "to identify where, when, how much, and what types of infrastructure and operational changes would achieve reliable electricity at least cost, taking into consideration factors such as renewable energy policies and requirements, technological advancement, fuel prices, and electricity demand projections."[11] The LA100 study presented four potentially feasible pathways to achieve the City's goal of 100% clean energy by 2045 (or before), with variations based on three electricity demand scenarios (moderate, high, and stress). Figure 3-1 illustrates cumulative costs of LA100 for each of the four pathways under the three different electricity demand scenarios, with program costs ranging from $52 billion to $82 billion.

Figure 3-1. Cumulative Costs through 2045 for LA100 Modeled Scenarios



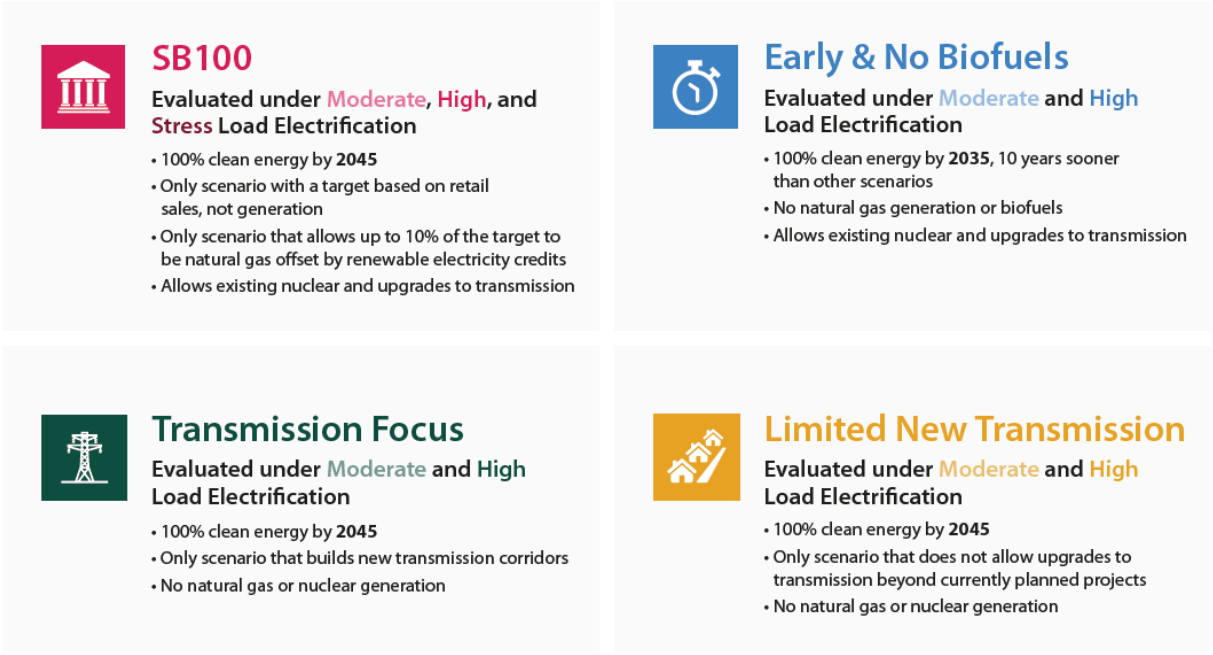
Source: NREL LA100 Renewable Energy Study Briefing for LADWP Board of Commissioners, Jan. 2021

[11] National Renewable Energy Lab, *LA100 - Executive Summary*, **https://www.nrel.gov/docs/fy21osti/79444-ES.pdf.**

3.1.1.1 LA100 Pathways

Three of the four LA100 pathways are structured to meet the City's 100 percent renewable energy target by 2045. The more aggressive pathway, "Early and No Biofuels", seeks to meet this goal by 2035. Figure 3-2 highlights the resources, delivery options and electrification scenarios considered in each pathway. Only the SB100 Pathway allows for continued use of natural gas as a fuel source, with renewable energy credits applied as an offset to meet the 100 percent renewable energy target.

Figure 3-2. LA100 Pathways



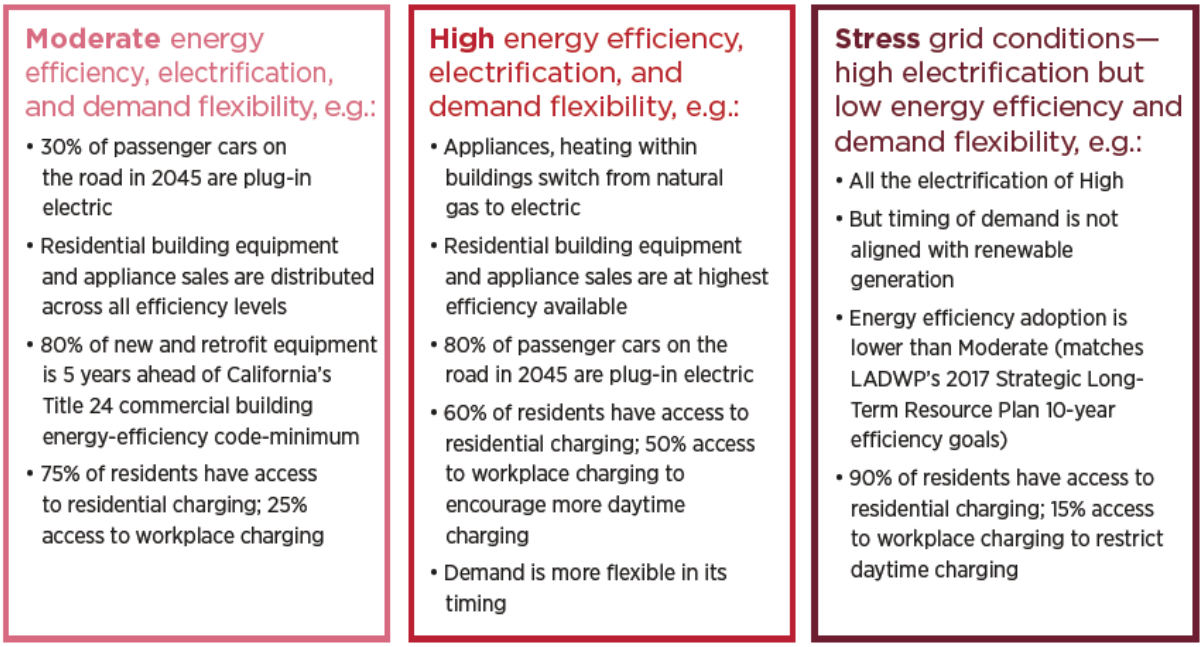
Source: NREL LA100 Renewable Energy Study, March 2021

NREL advises that the LA100 study is not intended to set forth specific plans or outcomes, nor to provide recommendations, but to leave decisions on plan implementation to LADWP with input from the Los Angeles community. Additionally, the report does not address rate impacts or trade-offs associated with electrification initiatives.

3.1.1.2 Electricity Demand

In developing the four pathways to 100 percent renewable energy, the LA100 study considered three potential scenarios for future electricity demand, varying according to differences in transportation electrification, energy efficiency adoption, and demand flexibility. Figure 3-3 presents the three futures that were used to inform the results of NREL's technical, economic, and environmental assessment of each pathway. The "Stress" forecast results in the highest growth in electricity demand and renewable resource supply requirements.

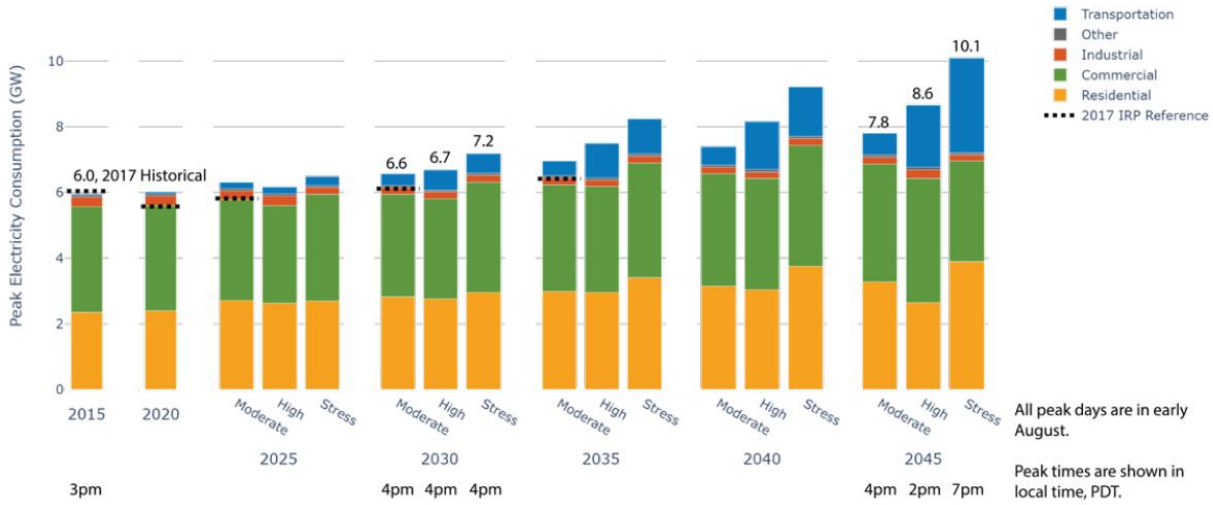
Figure 3-3. LA 100: Futures for Customer Electricity Demands



Source: NREL LA100 Renewable Energy Study, March 2021[12]

Figure 3-4 presents LADWP's historical and forecasted peak demand, by sector, for each of the three electricity futures presented in Figure 3-3. Demand is expected to increase at a moderate rate up to 2025 but projected to grow at much faster rate the following 10 years. Notably, electricity demand will increase by well over 50 percent under the Stress future, driven by rapid electrification of the transportation sector.

Figure 3-4. Demand Forecast by Sector



Source: NREL LA100 Renewable Energy Study, March 2021

[12] Bullet 1 in the third Futures box, "All the electrification of **High**", indicates that the third Futures box includes electricity demand for all the electrification initiatives outlined in the second Futures box (labeled "**High** energy efficiency, electrification, and demand flexibility").

3.1.1.3 Resource Supply Options

The four pathways evaluated in LA100 produced a range of power resource additions that vary based on the pathway assumptions outlined in Figure 3-2. However, certain resource additions and outcomes were common to all pathways, as highlighted in Figure 3-5. The doubling of power production resources to meet load growth and renewable energy targets requires up to 10,000 MW of supply from solar and wind alone, with 2,600 MW met by energy storage. Further, a minimum of 2,600 MW of load-following or fast-response generation must be located within the LA Basin to comply with federal and regional reliability requirements.[13] The four pathways also include comprehensive upgrades to the transmission and distribution system, both within and outside of LADWP's service area. Changes in the use of existing transmission pathways from out of state resources that have or will be retired or repowered are also common among the four pathways. Further details on transmission and distribution upgrades and the utilization of transmission pathways are presented in Section 3.2 – Power Physical Infrastructure.

Figure 3-5. LA100 Pathway Resources

Source: NREL LA100 Renewable Energy Study, March 2021

Regardless of the outcome of the 2022 SLTRP plan, all four pathways have common elements, including up to 70 percent to 90 percent of long-term demand met by large wind and solar PV plants, imported from both within and outside of California, together with substantial amounts of large and small solar plants located within the LA Basin. Other common elements include the retirement or conversion of OTC natural gas units in the LA Basin (to burn hydrogen produced by renewable energy), retirement of IPP coal units and addition of new energy storage.

3.1.2 Assessment of LADWP's 100 Percent Renewable Resource Plan

Los Angeles Mayor Garcetti indicated that LADWP would seek to proceed with LA100's most aggressive pathway – to procure a mix of generation sources comprised of wind, large and small-scale solar, energy storage, and conversion of existing fossil fuel generation to hydrogen, along with existing renewable generation such as hydroelectric sources, to achieve 100 percent

[13] e.g., Generators on Automatic Generation Control ("AGC") that can immediately respond to changes in load or contingency events, as well as to provide stability to the grid and avoid violation of federal reliability standards that LADWP is obligated to meet.

renewable supply by 2035.[14] Several in-basin OTC natural gas generators are scheduled to be retired or converted to burn hydrogen, while out-of-state sources such as LADWP's 803 MW[15] share of the Intermountain Power Project (IPP) coal station will be retired in 2025 and replaced with an 840 MW combined-cycle unit fueled initially by natural gas, that will eventually transition to hydrogen-only operation. LADWP's 388 MW share of the Palo Verde nuclear plant is assumed to remain in service as a non-carbon emitting resource.[16]

As noted, a specific pathway and selection of a preferred resource plan has not been finalized; the 2017 Power Integrated Resource Plan remains LADWP's most recent plan, until the next SLTRP is issued, likely by Fall 2022. Guidehouse expects that the 2022 update of the SLTRP will follow the resource plan outlined in the Early and No Biofuels option, which proposes 100 percent renewables by 2035, to align with the City Council's objectives.

LADWP does not currently have any significant reliability issues with the current level of renewable penetration, at about 34 percent.[17,18] However, the transition to 100 percent renewables will require significant amounts of in-basin generation, as well as transmission and distribution system upgrades, to meet system reliability requirements. There will be a need for firm dispatchable generation to meet growing load within the LA Basin, to replace fossil fuel powered units that are scheduled to retire. Figure 3-6 illustrates LADWP's current Renewable Portfolio Standard (RPS) goals for 2021 through 2025, which will be updated with the 2022 SLTRP to reflect the more aggressive goal of achieving a 100 percent carbon-free supply by 2035. Notably, LADWP's current supply forecast indicates that deficits in proposed renewable energy will occur beginning in 2025.

[14] In his April 19, 2021 State of the City address, Los Angeles Mayor Garcetti indicated that LADWP would adopt a goal to be 100% carbon-free by 2035.

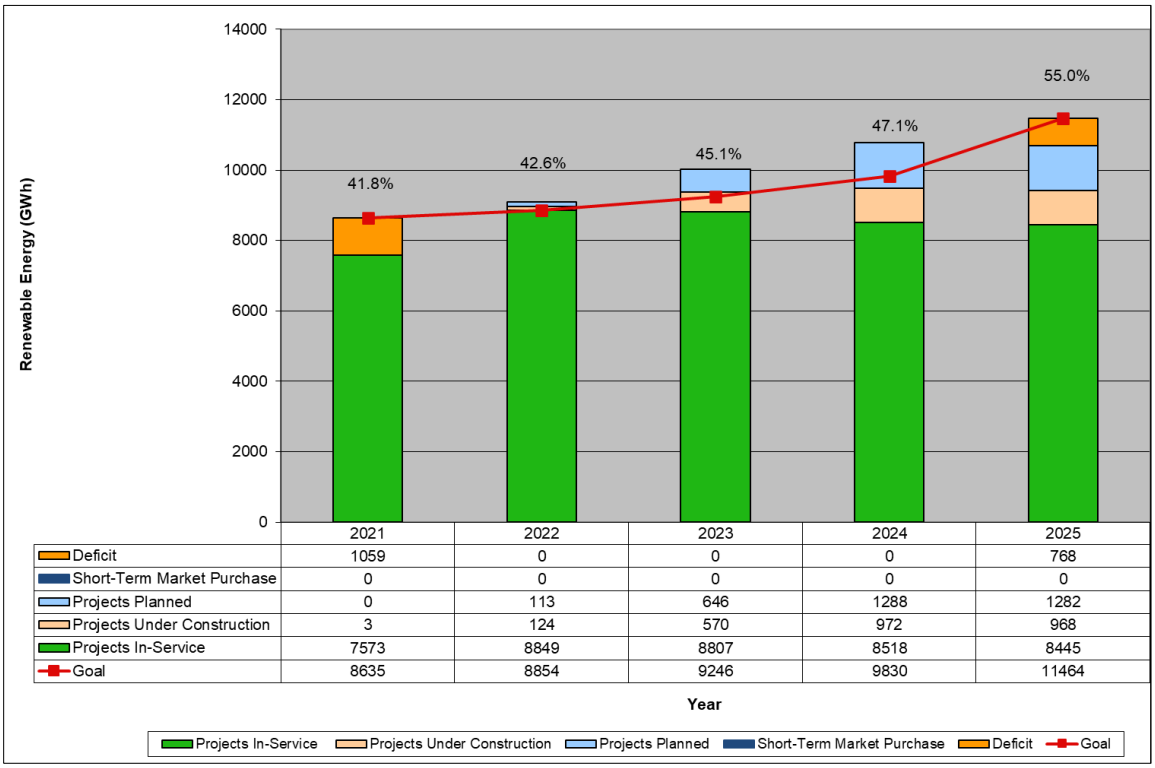
[15] LADWP has an additional 399 MW share of IPP related to purchase obligations, for a total of approximately 1,200 MW of capacity.

[16] LADWP, 2017 Strategic Long-Term Resource Plan (SLRTP).

[17] Renewable energy sources include biomass & waste (0%), geothermal (9%), eligible hydroelectric (3%), solar (12%), and wind (10%).

[18] *LADWP Facts & Figures*, February 2022, **https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-power/a-p-factandfigures?_afrLoop=496470073693401&_afrWindowMode=0&_afrWindowId=t6kru07qy_1#%40%3F_afrWindowId%3Dt6kru07qy_1%26_afrLoop%3D496470073693401%26_afrWindowMode%3D0%26_adf.ctrl-state%3Deb1s7xb6d_4**.

Figure 3-6. LADWP RPS Supply, 2021-2025 (GWh)



	2021	2022	2023	2024	2025
Deficit	1059	0	0	0	768
Short-Term Market Purchase	0	0	0	0	0
Projects Planned	0	113	646	1288	1282
Projects Under Construction	3	124	570	972	968
Projects In-Service	7573	8849	8807	8518	8445
Goal	8635	8854	9246	9830	11464

Source: LADWP RPS Master Project List, February 2022.

In order to meet the growing electricity demand with 100 percent renewable energy by 2035, LADWP will need to significantly increase the amount of renewable generation that exists on its system today. The gap between LADWP's current level of renewable penetration and 100 percent renewables is two-fold; not only will LADWP need to replace or convert existing in-basin fossil fuel-based generating facilities that are scheduled to be retired or decommissioned, but also the Department will need to increase renewable generation beyond that to meet growing electricity demand, as sectors such as transportation electrify. The LA100 report confirms that at least 2600 MW of generation capable of responding to rapidly changing loads or contingency events needs to be located in the LA Basin. Conversion of existing OTC units and new combustion turbines using hydrogen as a fuel source are proposed to meet this requirement. In the interim, continued operation of in-basin fossil-fueled generation is required to maintain system reliability and performance consistent with federal requirements and those established by regional planning organizations such as the Western Electricity Coordination Council (WECC). LADWP is also proposing new hydrogen-fuel generation to replace coal units that will be retired at the Intermountain Power Project, Power Purchase Agreements (PPAs) for importing large solar and wind generation into LADWP's Balancing Area (BA), along with in-basin energy storage and distributed resources.

The following sections discuss in detail the resources that LADWP proposes to retire and deploy to achieve the City's 100 percent renewable target, namely:

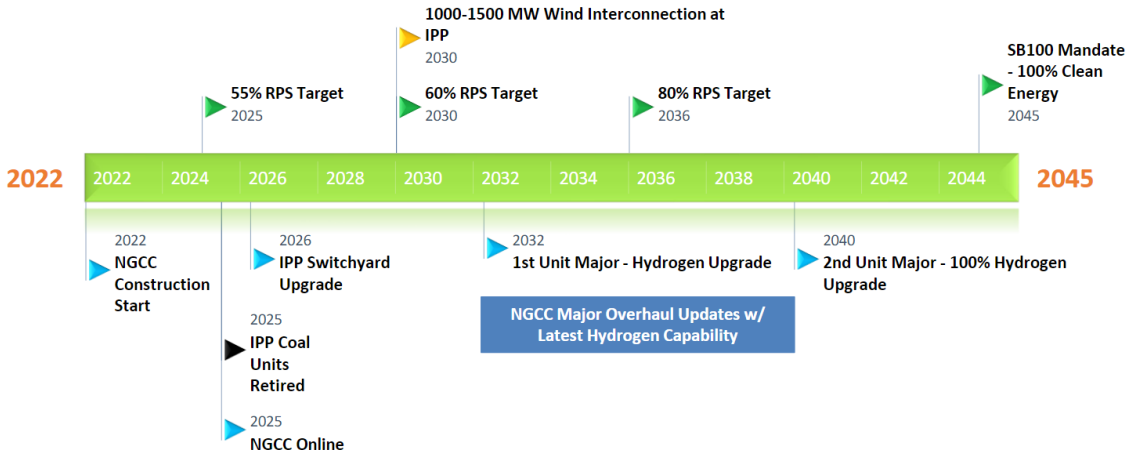
- Intermountain Power Project retirement and replacement;
- Energy storage;
- Utility-scale solar and wind;

- Geothermal;
- Hydroelectric (Castaic, Hoover);
- Nuclear (Palo Verde);
- Distributed energy resources (solar PV, energy efficiency, demand response); and
- In-basin generation: OTC repowering and hydrogen fuel source.

3.1.2.1 Intermountain Power Project Retirement and Replacement

LADWP and its partners are moving forward with plans for an 840 MW combined cycle natural gas/green hydrogen facility to replace the coal-fired Intermountain Power Project (IPP) in Utah. The IPP will utilize a blended fuel containing 30 percent green hydrogen and is expected to be operational by mid-2025. Green hydrogen is hydrogen gas produced exclusively by renewable energy resources. The new combined cycle units are on schedule to transition to 100 percent hydrogen by 2045, with the first unit being fully converted to green hydrogen by 2032. While the IPP conversion project is currently on schedule,[19] the availability of storage capacity in deep salt caverns is critical to the green hydrogen conversion of IPP, meaning that the IPP Operating Agent will need to enter into an agreement for green hydrogen salt cavern storage.[20] Figure 3-7 presents the timeline for the IPP green hydrogen conversion project.

Figure 3-7. IPP Green Hydrogen Conversion Timeline



Source: LADWP Board Meeting, "Intermountain Power Project Update", January 26, 2021.

3.1.2.2 Energy Storage

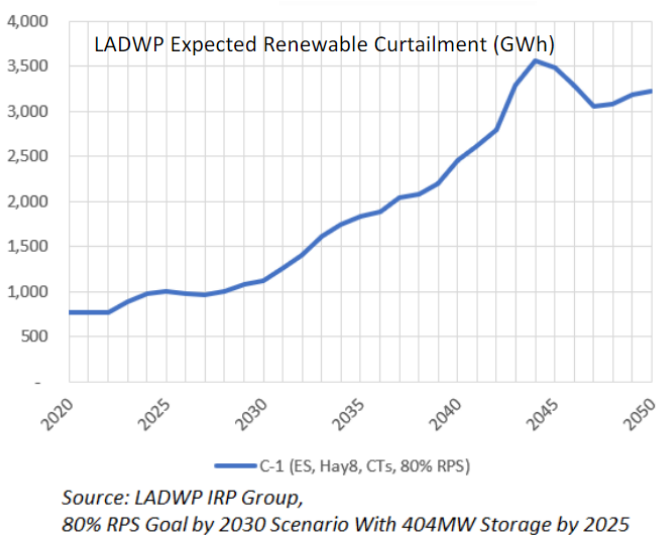
To meet policy goals, LADWP will need to build new and expand existing energy storage facilities. Energy storage will be crucial to meet grid reliability needs, reduce curtailment of renewable resources, allow for renewable resources to be dispatchable, provide ancillary

[19] IPP Renewed website, February 2022. **https://www.ipautah.com/ipp-renewed/**.

[20] LADWP Power System Six-Month Strategic Objectives, March 30, 2021 – September 15, 2021. A presentation was to be made for the IPP CC Subcommittee by September 15, 2021 on the pathway for the IPP Operating Agent to execute the agreement.

services, and meet RPS goals.[21] As LADWP adds more storage to the generation mix, the amount of expected curtailment will increase as illustrated in Figure 3-8.

Figure 3-8. Projected Curtailment or Renewable Generation (GWh)



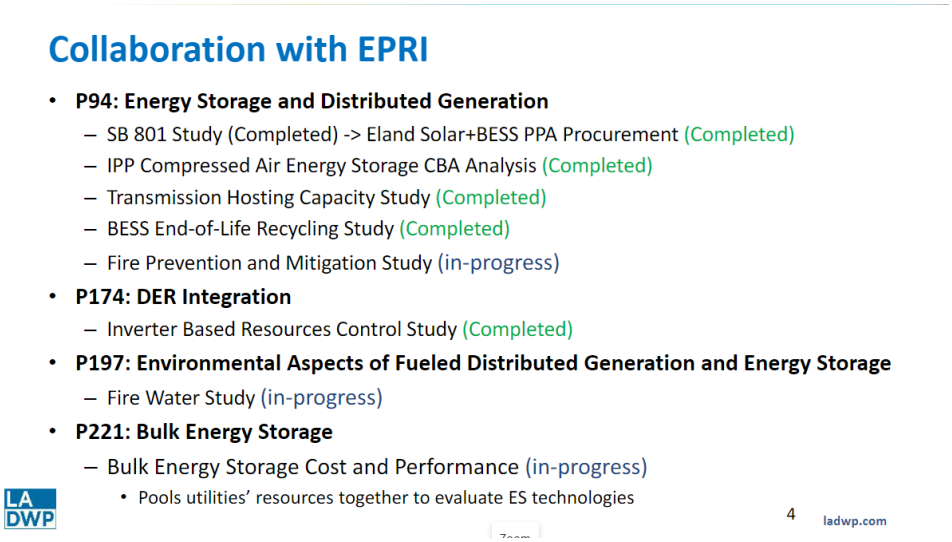
Source: Energy Storage Briefing (LADWP Board Meeting), September 28, 2021.

To ensure storage targets are met as outlined in LA100 for the accelerated pathway, LADWP will need to add over 2,600 MW of energy storage. LADWP is planning to accelerate its energy storage plans by building over 1,000 MW of energy storage by 2030, with a tentative in-basin energy storage target of 360 MW and a tentative out-of-basin energy storage target of 681 MW. The in-basin tentative target consists of utility-scale storage close to in-basin generating stations, e.g., behind the meter batteries, distributed storage, and a storage project at Los Angeles World Airport (LAX), RS-X. To meet the goal of adding distributed energy storage systems, LADWP is in the planning phase of setting up a Community Energy Storage Program (CESP) that will reduce the demand charge component of the customers' bill in exchange for participating in the program and paying a program fee. The 681 MW tentative target for out-of-basin energy storage consists of an additional 25 MW for the Beacon Storage project, 281 MW PV co-located with a storage facility at Eland I & II, and potentially up to 450 MW of storage from other parties currently under negotiation.[22]

In preparation for adding further energy storage capacity to the power grid system, LADWP has teamed with EPRI to learn from demonstration projects to identify potential gaps associated with the 2030 storage targets. Figure 3-9 shows a list of projects which LADWP has partnered with EPRI on related to energy storage:

[21] Energy Storage Briefing (LADWP Board Meeting), September 28, 2021.
[22] Energy Storage Briefing (LADWP Board Meeting), September 28, 2021.

Figure 3-9. LADWP & EPRI Collaboration for Energy Storage Studies



Source: Energy Storage Update: Energy Storage and New Technologies (ESNT) Group, November 18, 2021

LADWP participated in an EPRI-led study completed in 2021 evaluating utility-scale PV systems co-located with energy storage to evaluate the functional capabilities of smart inverters, co-location of PV and energy storage systems, and solar forecasting. The study found that high accuracy long term forecasts would be critical for the energy storage system to function. Short term solar forecasts are expected to need additional improvements in accuracy and reliability before being useful in solar ramp rate control type applications. Other highlights of the study included using the energy storage system for nighttime reactive power support capabilities and reducing voltage variations at the point of interconnection.[23]

3.1.2.3 Utility-Scale Solar and Wind

LADWP proposes to increase imports of renewable energy, such as including utility-scale wind and solar in its balancing area (BA) from sources within and outside of California. Capacity from existing transmission pathways that has or will become available due to the retirement of generation will be used to import new wind and solar capacity. Existing transmission corridors surrounding the LA Basin will also be upgraded to enable increased imports from both out-of-state and in-state renewable resources.

To meet the 100% renewable goal by 2035 with the high demand scenario studied in LA100, LADWP will need to add a large amount of utility-scale solar. Table 3-1 presents 2020 capacity of utility solar and wind, as well as targets for 2035.

[23] Inverter-based Resource Control for Grid Support: Advanced Solar Photovoltaic Plus Energy Storage System Demonstration and Technology Assessment, EPRI, October 2021.

Table 3-1. Generation Capacity of Utility-Scale Solar and Wind (MW)[24]

Technology Type	Capacity in 2020 (MW)	Capacity Target in 2035 (MW)
Utility PV	1,190	1,970
Utility PV + Storage	90	1,730
Wind	1,000	4,300

Source: NREL LA100 Data Viewer, Early and No Biofuels.

3.1.2.4 Geothermal

As of 2022, there are about 392 MW nameplate capacity of geothermal generation that LADWP has access to through PPAs. To achieve the LA100 Early and No Biofuels pathway (100% renewables by 2035) under the high demand scenario, LADWP will need to have 500 MW of available capacity from geothermal generation.[25] However, geothermal sites are not extensively available, require large capital costs, impose exploration risks, and may have limited transmission line access.[26]

3.1.2.5 Hydroelectric (Castaic, Hoover)

LADWP's generation mix includes both small and large hydroelectric facilities. Small hydroelectric facilities can be defined as having generating units with a nameplate capacity of less than 40 MW for each unit that is operated as part of a water supply or conveyance system (per SB 2, 1X). The small hydroelectric facilities qualify as renewable resources for electricity generation; however, the large hydroelectric facilities do not qualify as renewable resources for electricity generation.

LADWP's small hydroelectric facilities are located along the Los Angeles Aqueduct. As of October 2021, the total capacity of the small hydroelectric facilities in LADWP's generation mix is about 261 MW. This capacity is not expected to grow and LA100 Early and No Biofuels assumes it to remain at the same level.

The larger hydroelectric facilities include the Castaic pumped-storage hydroelectric plant and a portion of Hoover Dam capacity. The Castaic pumped-storage facility, consisting of seven units, provides a net dependable capacity of 1,265 MW. The portion of Hoover Dam contributes about 303.5 MW of net dependable capacity.[27] Castaic and Hoover Dam will need to remain as part of the generation mix as firm capacity, especially Castaic, to provide dispatchable generation to the in-basin demand pockets for reliability purposes.

3.1.2.6 Nuclear (Palo Verde)

LADWP directly owns 5.7 percent, or approximately 229 MW, of dependable capacity from the Palo Verde Nuclear Generating Station (PVNGS). LADWP also has a 67 percent generation entitlement interest in the 5.91 percent of PVNGS belonging to the Southern California Public Power Authority (SCPPA) through PPAs, which provides an additional 159 MW of dependable

[24] NREL LA100 Data Viewer, Early and No Biofuels.
[25] NREL LA100 Data Viewer, Early and No Biofuels.
[26] LADWP's 2017 SLTRP.
[27] LADWP's 2017 SLTRP.

capacity.[28] It is assumed in LA100 that nuclear generation remains part of the generating mix to reach 100 percent renewable generation by 2035. PVNGS has two generating units that came online in 1986 and a third unit that came online in 1988. By 2035, the plant will have been in operation for almost 50 years. Unit 1 currently has approval by the Nuclear Regulatory Commission (NRC) to operate until 2045, unit 2 through 2046, and unit 3 through 2047.[29]

3.1.2.7 Distributed Energy Resources

The Clean Grid LA plan involves the deployment of 1,000 MW of local solar, 500 MW of demand response, and the doubling of energy efficiency to meet the increased demand from building and transportation electrification initiatives, such as the 580,000 new electric vehicles targeted by 2030. In 2020, customer PV generation (also referred to as local solar) was about 340 MW of capacity and in 2035, with the Early and No Biofuels LA100 scenario, it is assumed that customer PV generation would reach 1,730 MW of capacity.[30]

Part of the increase in distributed generation will be achieved via programs that enable widespread participation in distributed solar resources. LADWP adopted a goal of 50 percent of distributed energy resource (DER) investment in disadvantaged communities.[31] According to the LA100 study, existing solar adoption in Los Angeles is skewed to mid-to-high-income, single-family homes. The investment to make distributed generation opportunities more widely available for all LADWP customers will be crucial to push towards the needed amount of distributed generation resources.

LADWP demand-side management programs include demand response and energy efficiency (EE). According to LADWP's Clean Grid LA plan, LADWP's goal is to double energy efficiency and add 500 MW of demand response. In the LA100 report, EE is highlighted as a tool to smooth the energy transition to 100 percent renewable energy by helping "to offset climate-and electrification-driven load growth and potentially higher electricity rates [and] lowers energy burden for low-income residents."[32]

3.1.2.8 In-Basin Generation Needed for System Reliability

LADWP will need to have sufficient in-basin dispatchable generation to meet balancing area reliability requirements. Currently, in-basin natural gas generation, along with support from the Castaic hydroelectric pumped storage facility and Hoover hydroelectric plant, meet the reliability needs for current levels of renewable penetration and electric demand. However, in the future there will be a need for in-basin dispatchable generation, determined to be more than 2,600 MW across all LA100 pathways.[33]

3.1.2.9 Once-Through-Cooling Power Plant Repowering

LADWP's Power System and resource planning organization are assessing the Clean Grid L.A. options to identify clean energy projects and other alternatives to meet in-basin power generation currently supplied from coastal natural gas OTC power plants. In February 2019,

[28] LADWP's 2017 SLTRP.

[29] LADWP's 2017 SLTRP.

[30] NREL LA100 Data Viewer, Early and No Biofuels.

[31] Clean Grid LA Plan Update / Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

[32] NREL, LA100 Key Findings (https://www.nrel.gov/docs/fy21osti/79445.pdf).

[33] Clean Grid LA Plan Update / Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

plans were cancelled to repower the remaining generating units that use ocean water for cooling. LADWP is required by state and federal regulations to phase out the use of ocean water cooling (known as once-through cooling or OTC) at the Scattergood, Harbor, and Haynes Generating Stations. The repowering of Scattergood OTC generating units, originally scheduled for completion by 2024, has been delayed by at least four years. LADWP has filed for an extension of the deadline to 2029 with the Water Board.

The current status of LADWP's compliance milestones with the Water Board are presented in Table 3-2.

Table 3-2: OTC Compliance Milestones as of October 19, 2021.[34]

Milestone	Date
Haynes units 5 & 6 in compliance, repowered without OTC[35]	12/31/2013
Scattergood unit 3 in compliance, repowered without OTC[36]	12/31/2015
Scattergood units 1 & 2 in compliance, repowered without OTC[37]	12/31/2024
Haynes units 1 & 2 in compliance, repowered without OTC	12/31/2029
Harbor unit 5 in compliance, repowered without OTC	12/31/2029
Haynes unit 8 in compliance, repowered without OTC	12/31/2029

The impact of the replacement cycles will be that LADWP will need to work on certain units to prepare for repowering while in-basin generation need increases due to increase in demand and while other system lines are being repaired or built out. The LA basin will have a risk of not having sufficient generation to produce reliable electricity while meeting clean energy goals.

3.1.2.10 Conversion of In-Basin Natural Gas Generation to Hydrogen Fuel

As of May 11, 2021, the Clean Grid LA plan indicated that LADWP desires to transition Scattergood to run on green hydrogen and set up a green hydrogen request for information (RFI) for all in-basin generating stations.[38] The RFI intends to understand the feasibility of hydrogen as a generation resource for LADWP, namely the production, transportation, storage, and electricity generation potential of green hydrogen. Based on LA100, LADWP estimates an increasing need for hydrogen as outlined in Table 3-3.[39] Green hydrogen would provide dispatchable generation to serve in-City load and meet in-basin reliability needs as electricity demand increases and more renewables are introduced into LADWP's resource mix.

[34] *Water Quality Control Policy on the use of Coastal and Estuarine Waters for Power Plant Cooling*, October 2021, **https://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/docs/otc_policy_2021/otc_policy.pdf**.

[35] Haynes Units 5 & 6 have been repowered as air cooled.

[36] Scattergood Unit 3 was repowered as air cooled and has since been decommissioned. LADWP, *Scattergood Unit 3 Decommissioning,* **https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-power/a-p-projects/a-p-p-scattergood3decom?_afrLoop=238908554704981&_afrWindowMode=0&_afrWindowId=null#%40%3F_afrWindowId%3Dnull%26_afrLoop%3D238908554704981%26_afrWindowMode%3D0%26_adf.ctrl-state%3D1bug6wnmmk_4**

[37] LADWP is seeking an extension to 2029 (information given during interviews with LADWP).

[38] Clean Grid LA Plan Update / Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

[39] LADWP RFI For Green Hydrogen Pathways for Supporting 100% Renewable Energy, August 2021 **https://www.ammoniaenergy.org/wp-content/uploads/2021/09/Green_Hydrogen_RFI_-_8.5.21-Power-SAL.pdf**.

Table 3-3: Estimated Hydrogen-Based Capacity (MW) from LADWP RFI on Green Hydrogen

Generating Station	2025 and 2030	2035	2040	2045
Harbor Generating Station	-	257-543	543-548	548-902
Haynes Generating Station	-	762-1,488	831-1,448	
Scattergood Generating Station	0-616	188-616	188-616	188-616
Valley Generating Station	-	891-1,331	891-1,331	1,331-1,391
Total In-Basin	-	2,099-3,550	2,454-3,612	2,898-4,091

3.1.3 Resource Plan and Investment Forecast

If LADWP is to meet the 100 percent renewable energy goal by 2035, capital investments need to be undertaken for both in-basin and out-of-basin generation plants to have sufficient capacity for the growing demand in its service territory. The LA100 study projected that to reach the target of 100 percent renewable energy by 2035, the cumulative annualized cost for developing and operating a reliable power system would be around $38 billion from 2021-2035 and around $86 billion between 2021-2045.[40] LADWP is now aligning future planning through Clean Grid LA to transition to LA100 for the near-term future, while awaiting completion of the 2022 SLTRP. The updated SLTRP will include a long-term outlook of the resources and investments needed to meet the 2035 goal, comprised of both renewable generation and dispatchable generation, the latter to maintain grid reliability. Table 3-4 presents the latest approved five-year resource investment plan.

[40] NREL, LA100: The Los Angeles 100% Renewable Energy Study Executive Summary, **https://www.nrel.gov/docs/fy21osti/79444-ES.pdf**.

Table 3-4. Approved Five-Year Resource Capital Investment Plan ($1000's)

Description	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
Harbor GS	$10,359	$1,910	$1,987	$6,980	$2,020	$23,256
Haynes GS	$18,484	$20,218	$40,680	$35,414	$54,664	$169,460
Scattergood GS	$17,458	$15,707	$8,551	$25,108	$10,902	$77,726
Valley GS	$37,156	$38,029	$34,922	$6,450	$14,696	$131,253
Castaic PSH	$58,973	$49,976	$48,765	$49,720	$50,463	$257,897
Palo Verde NS	$12,256	$12,509	$12,822	$13,130	$13,418	$64,135
General & Other	$9,350	$4,998	$5,130	$5,202	$5,203	$29,883
RPS & Other[41]	$52,636	$56,647	$59,193	$63,404	$64,120	$296,000
GHG-and-LCSF Funded Projects	$41,970	$34,928	$31,034	$25,140	$24,515	$157,587
PSRP-Generation	$25,189	$24,796	$26,139	$27,713	$34,535	$138,372
Total	**$283,831**	**$259,718**	**$269,223**	**$258,261**	**$274,536**	**$1,345,569**

3.2 Physical Infrastructure

Utilities, regulators, and other energy stakeholders face serious, often-conflicting challenges in delivering both clean and resilient electricity. Utilities must take proactive steps to ensure that the building blocks of critical infrastructure continue to be delivered, while significantly increasing renewable energy supply. In addition to conventional grid infrastructure upgrades, utilities across the country are encouraging customers to adopt distributed energy resources (DER) that can provide resiliency during extreme weather and customer benefits during normal conditions, but that also introduce new grid challenges. The City of Los Angeles is at the forefront of these changes, accelerated by a policy goal to achieve 100 percent renewable energy by 2035, as set forth in L.A.'s Green New Deal, and now NREL's LA100 study that identifies pathways to achieve this goal. At the same time, LADWP has for years been grappling with system reliability and security due to aging infrastructure and, increasingly, climate change impacts such as wildfire threats.

The solution to consistently improving power system performance—while adapting to increased renewable energy and DER—is active asset management, the systematic and coordinated set of activities and practices through which an organization optimally manages its physical assets, and their associated performance, risks, and expenditures over their lifecycle for the purpose of achieving its organizational strategic plan. With active asset management, LADWP can make the smartest decisions possible to achieve desired asset performance.

[41] Includes Demand Response and Energy Storage.

Several key changes are driving the need for LADWP to reexamine their planning for power transmission and distribution assets:

- LA100 and proposed strategic resource plans and their impact on the power delivery infrastructure
- Aging infrastructure and upgrades needed to integrate and deliver power from large renewable resources, both within and outside of California
- Pressure from customers for reliable service and state/federal regulatory mandates for system reliability
- The need to integrate significant amounts of energy storage and distributed energy resources into the distribution system
- Transformational technologies (including DER such as energy storage and electric vehicles, smart grid and AMI, and advanced control and communications)

Given these challenges, Guidehouse assessed the capital investments necessary for distribution and transmission grid enhancements to enable integration and transportation of the large amounts of renewable generation needed to meet the City's renewable energy targets.

3.2.1 Power Delivery System Assessment

LADWP is contending with aging infrastructure, human resource constraints, and increased spending pressures. Additionally, it must integrate increasing amounts of intermittent renewable generation resources and transformational technologies such as energy storage, electric vehicles, and enabling technologies to manage these resources. These challenges will place additional stress on the Department's existing transmission and distribution assets and will require substantial near-term investment. Addressing these challenges while maintaining safe and reliable power supply at competitive rates requires robust planning and management of critical assets.

Guidehouse assessed LADWP's approach to asset management against best practice in the power utility industry, identified gaps, and provided recommendations to address existing gaps, using primarily the Power System Reliability Program (PSRP) data and the 2020 Long-Term Transmission Assessment. Insights from interviews and supporting document review complemented these analyses. To a certain extent, this chapter also addresses linkages (or lack thereof) between the two Power Infrastructure areas, since best practice aligns resource planning with infrastructure asset management to ensure aging assets are replaced with infrastructure that is able to meet new system requirements and maintain reliability with a modern generation mix.

The review and assessment of LADWP's documented plans were conducted several weeks in advance of and in parallel with the diagnostic interviews. The assessment was based on a series of structured interviews with engineering and operations personnel, and ultimately determined:

1. How LADWP's resource plans have changed since the prior assessment, and the impact of accelerated renewable energy targets on the power production and delivery system.

2. Whether the power delivery system can safely and reliably integrate large amounts of additional capacity from within and outside of its service territory.

3. The amount and timing of system upgrades and enabling technologies needed to integrate and deliver large amounts of additional capacity.
4. Whether transmission and distribution plans are consistent with existing policy directives within the existing technical and operational constraints.
5. Whether there are sufficient internal and external labor resources available to construct the necessary new facilities and introduce new technologies in the required timeframes.
6. The status of system reliability, including progress made per LADWP's PSRP goals.
7. Progress against recommendations in the 2017 Distributed Energy Resource Integration Study (DERIS), given the acceleration of renewable energy targets since the prior assessment.
8. Whether recommendations included in LADWP's plans are adequately focused on ensuring continued reliability and resilience of the Power System, while accommodating increasing levels of renewable energy and growth in transportation and building electrification at the lowest cost to ratepayers.
9. The impact of future scenarios from LA100 as it relates to transmission and distribution system planning for DER, large-scale renewables, retirement and conversion of existing generation, reliance on new fuel sources, and in-basin resource requirements needed to maintain reliability; and potential uncertainties associated with the transformation of LADWP's power resource and delivery system.

3.2.1.1 Risk Factors Associated with High Levels of Renewables Integration

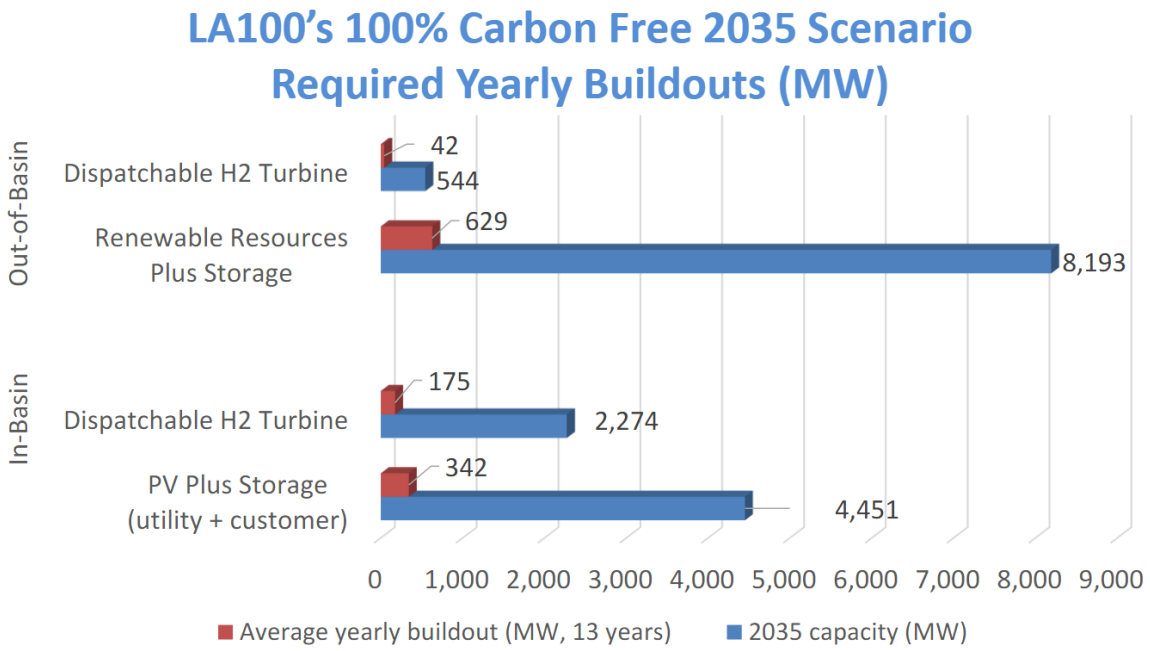
The LADWP electric power generation and delivery system is in a period of transition, driven by the City's accelerated adoption of clean energy and low carbon generating resources. The pathways and common elements outlined in LA100 have significant implications for the adequacy of LADWP's energy delivery system to reliably integrate and deliver energy from these sources to load centers. Notably, many new renewable wind and large solar sources are outside of LADWP's service area; several are located outside of California. Foremost among challenges posed by these resource plans is the need to upgrade and expand the transmission and distribution system to reliably integrate with these sources and deliver power to LADWP's electric grid. The need to proactively address these challenges is underscored in LADWP's Clean Grid LA Plan Update, where it states: The next 10 years are critical to LADWP's success in reaching 100% by 2035.[42]

All four scenarios in LA100 include the doubling of total generating capacity, from approximately 10,000 MW today to over 20,000 MW by the early 2030's to meet renewable energy targets. The large increase in generating capacity is necessary due to the lower energy production and firm capability requirements assigned to renewable energy sources. The doubling of generating capacity will require a substantial increase in the capability of the transmission system to deliver power from both in-basin and out-of-state sources. Because of the long lead-times associated with the planning, design, permitting, and construction of transmission lines and substations, several of these upgrades are now under construction or expected to begin within the next five years. The lead time assumption for building out new transmission infrastructure at LADWP is between 7–13 years. Further, land and rights-of-way needed to accommodate new lines, and substations may be limited and costly to acquire.

[42] Clean Grid LA Plan Update / Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

Similarly, LADWP's distribution system will require substantial expansion and upgrades to lines and substations to integrate and deliver power from local, in-basin resources – mostly from directly connected and behind-the-meter (BTM) solar PV. All four pathways in LA100 require substantial amounts of in-basin generation, including small renewable energy sources. Up to 1,000 MW of local, in-basin BTM solar and 910 MW of in-basin energy storage is forecasted by 2030. Figure 3-10 highlights the significant amount of renewable generation that will need to be integrated into the power delivery system for the most aggressive LA100 pathway.

Figure 3-10. LA100 Early & No Biofuel Pathway



Source: Clean Grid LA Plan Update / Aligning with LA100, presented to the Board of Water and Power Commissioners, May 21, 2021.

In addition to LA100 resource requirements, the City's transportation electrification initiatives are driving further increase in electricity demand. The increase in electric demand on local distribution systems caused by electric vehicles and charging stations will require reinforcement and upgrades on low and higher voltage lines. The LA100 reports estimates up to $500 million will be needed to upgrade and reinforce LADWP's distribution system. However, current estimates indicate distribution system investments will likely be significantly higher. Although the lead time for distribution system enhancements is less than transmission, the complexity and coordination requirements of these upgrades place additional demand on LADWP distribution planning, engineering, and construction personnel.

3.2.1.2 Grid Reliability and Supply Risk

Additional challenges and risks associated with current resource plans have arisen since the prior IEA survey was issued in 2015. The complexity and timing of new resource additions and upgrades to the power delivery system places significant demands on LADWP's staff to plan, design, and coordinate the construction of numerous transmission and distribution system upgrades, a strain exacerbated by COVID-19 and competitive employment opportunities potentially causing resource constraints. The availability of internal and external contract crews to construct these facilities will need to be addressed by LADWP as well.

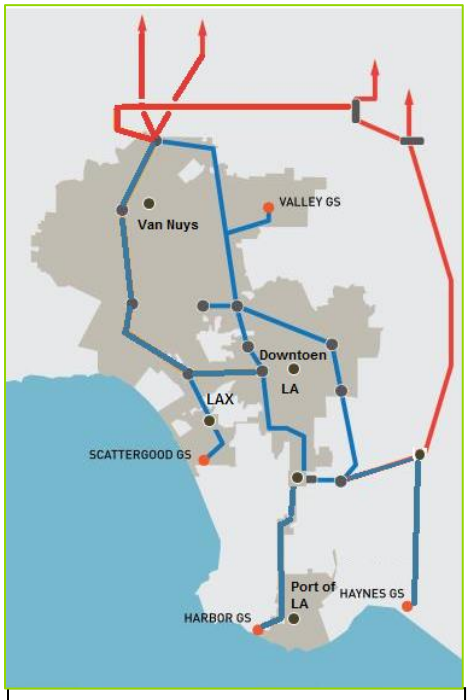
Operating risks also need to be addressed, including compliance with North American Electric Reliability Corporation (NERC) reliability standards that apply to balancing authorities such as LADWP. LADWP's bulk power system, comprised of generators and high voltage transmission lines and substations, must be capable of maintaining system reliability under both normal and abnormal conditions; the latter includes the interruption of supply from generators or transmission lines. The increase in wildfire risk heightens the need for a transmission system that can reliably withstand a loss of critical lines due to wildfires or climactic events.

LADWP must also have generating resources capable of meeting NERC requirements for frequency regulation in response to rapid changes in load or varying generator output within its balancing area. Although up to 50 percent or more of LADWP's generating capacity will be supplied from outside the LA Basin (and LADWP's balancing area), sufficient amounts of fast response (i.e., ramping) generation or other ramping resources[43] must be located within LADWP's balancing area to comply with NERC reliability standards. LADWP has been able to meet NERC Area Control Error ("ACE") requirements, in part due to existing in-basin generation on Automatic Generation Control ("AGC"), along with hydroelectric sources at Castaic and Hoover providing a significant source of fast response and regulating capability. The retirement of in-basin generation will decrease regulating capacity that will need to be replaced as outlined in the LA100 study.

Guidehouse's assessment of LADWP's physical infrastructure and its capability to address the challenges associated with its transition to 100 percent renewable targets is addressed in the sections that follow.

3.2.2 Transmission System

The main planning document governing LADWP's transmission system upgrades and expansions is the 2021 Long-Term Transmission Assessment. Several major transmission projects outside the LA Basin are currently under construction or expected to be completed within the next eight years. The adjacent map presents major transmission corridors outside the LA Basin (red), lines within the Basin (blue) and the coastal generating stations at Scattergood, Haynes and Harbor. A regional map indicating major transmission lines in red and black across the Western States can be seen in Figure 3-11. A series of major upgrades have been completed or are underway on the 230kV and 500kV system to increase renewable import capability along major transmission lines and reduce reliance on natural gas generation within the city. For example, the scheduled completion of upgrades to the Vic-LA transmission path will increase import capability from renewable resources into the city by 450 MW while improving operational efficiency and reliability.



LADWP Transmission and Preferred Resources, May 8, 2018

[43] FERC Order 2222 requires system operators to create programs that enable Distributed Energy Resources to participate in markets for ancillary services. The California ISO ("CAISO") has introduced a flexible ramping product to allow for third parties to participate in ancillary service markets.

In its May 2021 Clean Grid LA Plan, LADWP indicated that adoption of the LA100 resource plan requires the acceleration of 10 in-basin transmission facilities projects in addition to the existing planned projects to integrate new renewable resources and serve in-basin load, including critical load centers at the Port of Los Angeles and LAX, and increased load due to transportation and building electrification initiatives. Further, it was identified that continued operation of Scattergood along with substantial increases in demand response is essential to ensure reliability is not compromised during contingency events.

Figure 3-11. Western States' Major Transmission Lines

Source: LADWP.

3.2.2.1 2020 Short and Long-Term Transmission Plans

LADWP's 2021 Long-Term Transmission Assessment (2021 LTA)[44] outlines the timing of specific transmission system upgrades and remedial action schemes (RAS) that are necessary for the bulk electric system to meet NERC reliability requirements under both normal and contingency conditions. The 2021 study concluded that post-contingency stability and Interconnection Reliability Operating Limits (IROL) were met for the 10-year interval, and normal and contingency facility rating violations can be mitigated by a series of line upgrades, protection schemes, shunt and series reactors, voltage support and operating actions proposed by LADWP. If no unforeseen substantial risks arise or delays incurred, Guidehouse concludes these recommendations can be completed and implemented.

[44] LADWP 2021 Long-Term Transmission Assessment, December 2020. The "Assessment is comprised of studies to demonstrate that LADWP Bulk Electric System (BES) is planned such that the interconnected transmission system can be operated reliably over a wide range of system conditions throughout the ten-year horizon." The approach undertaken by LADWP is structured to conform to NERC Standard TPL-001-4 and Western Electricity Coordinating Council (WECC) Regional Criterion.

Key assumptions such as changes in generator status and transmission line upgrades associated with the forthcoming resource plan update could impact the results of the next LTA. Among other issues, the availability of Scattergood as an in-basin resource is viewed as critical to meeting regulation and post-contingency performance requirements. The repowering of Scattergood Units 1 and 2 to eliminate once-through cooling originally was scheduled for completion in 2024.[45] The repowering project has been delayed until at least 2027 (and likely to 2029); cancellation is also a possible outcome. Guidehouse views this delay as potentially increasing reliability exposure, as Scattergood provides in-basin support to compensate for the loss of key transmission lines or generation, or when lines are out of service due to construction upgrades or maintenance.

All LA100 pathway options rely on the availability of interstate transmission capacity resulting from the retirement of generation such as the IPP coal plant, that will release up to 600 MW of available transmission capacity, to import greater amounts of large solar and wind generation. Similarly, LADWP's 30 percent allocation of transmission capacity from the since removed Mohave generating plant in Nevada released over 700 MW of available capacity that will be used for importing renewable energy. Available capacity from other transmission pathways located within and outside of California will be used to import renewable energy sources, including large wind and solar PV plants, into the LA Basin. As noted, the capability to import large amounts of renewable capacity is contingent upon completion of major transmission projects both within and outside of the LA Basin region.

NREL LA100 Renewable Energy Study, March 2021

LADWP has indicated that it will develop a Strategic Transmission Plan (similar to that of CAISO's 20-year transmission outlook) which would be a comprehensive overview of the transmission system that will be used as a long-range blueprint for meeting a 100 percent clean energy target.

3.2.2.2 Transmission Budget Plan (excluding Asset Management and Reliability)

Table 3-5 presents LADWP's transmission investments over the next five years, including those required to meet reliability requirements per the 2021 LTA, in addition to those required to import or deliver renewable energy resources to LADWP load centers, per the Clean Grid LA Plan.

[45] This repowering was planned due to Once-Through-Cooling (OTC) regulations that prohibit the use of ocean water cooling in all coastal power stations.

Table 3-5. Approved Five-Year Transmission Plan ($1000's)

Description	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
LT Planning & Development	$144,984	$228,464	$251,152	$427,257	$594,719	1,646,576
Major Projects[46]	$153,437	$113,166	$30,960	$16,936	$9,691	$324,190
PSRP-Transmission	$26,479	$29,692	$28,523	$20,800	$71,762	$177,256
PSRP-Substations	$5,548	$6,614	$6,995	$7,142	$7,114	$33,413
CIPS & Security	$26,814	$30,024	$30,414	$33,575	$23,444	$144,271
Total	**$357,262**	**$407,960**	**$348,044**	**$505,710**	**$706,730**	**$2,325,706**

3.2.3 Distribution System

LADWP's distribution system is comprised of lines operating at 34.5kV and 4.8kV. The 34.5kV system operates mostly in a network configuration and serves larger commercial and industrial customers. The 34.5kV system is also connected to substations that step down delivery voltage to the 4.8kV distribution system. The 4.8kV system operates radially and serves mostly residential and smaller commercial and industrial loads. LADWP's distribution system is one that was designed several decades ago when electricity demand was far lower. While the 4.8kV system has operated reliably, it has and will continue to be stressed to meet increased electricity demand, integrate renewable resources, and accommodate electrification initiatives outlined in LA100. Many electric utilities throughout the U.S. have distribution systems that operate at higher voltages that are capable of serving higher electric demand and integrating renewable resources. Many of those with lower voltage lines similar to LADWP have or are in the process of converting them to operate at higher voltage.

3.2.3.1 Distributed Resource Integration

The Distributed Energy Resource Integration Study (DERIS) completed in 2017 outlined several initiatives to integrate higher amounts of renewables, primarily solar PV, and energy storage.[47] The purpose of this study was to forecast the potential benefits and costs to the Department of continued deployment of Distributed Energy Resources (DER) on the power system, and to recommend changes in planning, organization, technology, rates, and business models as necessary to manage future DER deployment for the benefit of LADWP, its customers, and other stakeholders. The DERIS also identified areas of the distribution system where circuit or substation upgrades could potentially be deferred via DER comprised of renewable energy, energy efficiency, and demand response.

LADWP's distribution planning activities include targeting DER to areas of the distribution system where capacity need is greatest. Related recommendations from the DERIS report including organization changes, updates to planning and design criteria, and operations and maintenance practices, some of which have already been adopted. The DERIS recommendations will be increasingly important to follow as the Clean Grid LA plan includes the deployment of 1,000 MW of local solar, 500 MW of demand response, doubling energy efficiency, and supporting around 580,000 electric vehicles by 2030.[48]

[46] Major projects include Barren Ridge, PP1/PP2 Conversion and Sylmar.

[47] Distributed Energy Resources Integration Study, IRP2-081, April 2017.

[48] Clean Grid LA Plan Update, Board of Water and Power Commissioners Update May 11, 2021.

Following the issuance of the DERIS report, several initiatives and programs, including accelerated renewable energy targets outlined in LA100 and LADWP's current clean energy plan, have increased the need to upgrade the distribution system. Significant amounts of solar PV, energy storage and electrification initiatives (building and transportation) collectively will place inordinate demands on LADWP's distribution lines and substations, particularly the 4.8kV distribution system. Combined, these initiatives may stress LADWP's distribution system and its ability to reliably integrate these clean energy resources and serve the additional load associated with electrification. Upgrades are required to mitigate distribution hosting constraints,[49] increase line capacity, and enhance asset utilization and reliability via automation and operational controls. Coordination of distribution upgrades with transmission planning is essential to ensure system upgrades are achieved at lowest cost and on schedule.

3.2.3.2 Transportation Electrification

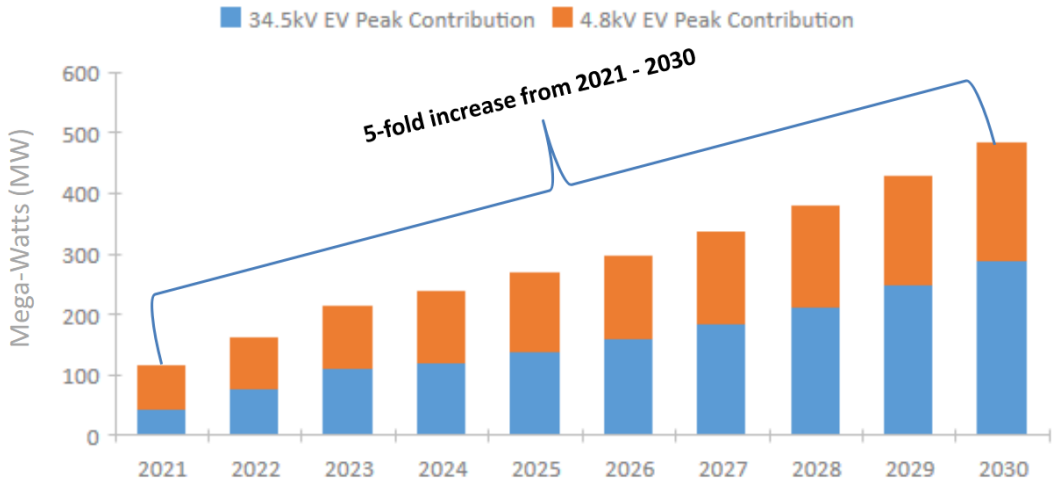
Electrification of major emitters such as the transportation sector will be critical to fulfilling the City's plans for decreased GHG emissions. In pursuit of this goal the City has issued a directive for Zero Emission Vehicles (ZEV) to comply with the following:

- Governor Newsom's Executive Order (N-79-20) requires the state of California to end the sale of new fossil fueled light-duty vehicles by 2035 and to electrify freight trucks by 2030 and heavy-duty fleets by 2045.
- AB 2127 directs the state of California to have 1 million public and shared private EV chargers to support 5 million EVs by 2030.
- LA's Green New Deal targets include achieving 100% zero emission vehicles by 2050, electrifying 100% of Metro and LADOT buses by 2030, and reducing port related GHG emissions by 80% by 2050.

As of September 2021, there were 13,904 chargers in the city. The stated regulatory directives and infrastructure goals will necessitate about 104,000 additional chargers to be connected to LADWP's distribution grid. Figure 3-12 shows the additional demand that the increase in the number of charges will add to the coincident peak by voltage class.

[49] Hosting capacity limits on LADWP's 4.8kV system currently is 700 MW; 2600 MW on the 34.5kV system.

Figure 3-12. Coincident EV Charging Peak Contribution by Voltage Class



Source: LADWP Board Meeting, "Electric Transportation Program Updates", September 28, 2021.

LADWP is planning to prepare the distribution system for this increased demand by upgrading 4.8 kV feeder capacity, expanding the 34.5 kV system, installing new 4.8 kV and 34.5kV distribution station capacity, upgrading and installing new receiving station capacity, and converting 4.8kV distribution lines to operate at a higher voltage.

3.2.3.3 Distribution System Upgrades and Conversion

LADWP's distribution system is comprised of circuits rated 34.5kV and 4.8kV. The higher voltage circuits serve larger commercial, industrial, and institutional customers and are highly integrated (e.g., operate as a network), and 4.8kV lines mostly serve smaller commercial and residential load and operates radially. The 4.8kV system, while fully functional and capable of serving current load, is limited in its ability to accommodate increased load and renewable resources in some locations. As noted, many electric utilities in the U.S. have either fully converted or are in the process of converting 4.8kV distribution to higher voltage (e.g., 12.47kV or 13.8kV). LADWP plans to convert segments of its distribution system to higher voltage to accommodate renewable resources, increased load, and full system electrification, as well as to improve efficiency and reliability; however, extensive conversion will likely be phased in over several years, focusing first on areas of greatest need.[50]

3.2.3.4 Grid Modernization and Operational Technology

The increased complexity of the distribution system resulting from the integration of renewable energy resources, active demand response, increased automation, electric vehicle charging, and greater variability in line loadings and voltages will require highly advanced monitoring and control systems to enable system operators to effectively manage the array of resources. Advanced Distribution Management Systems (ADMS) and Distributed Energy Resource Management Systems (DERMS) are operational technologies LADWP will need to implement in concert with initiatives outlined in its Clean Energy Plan and LA100. These systems provide for enhanced visibility, operational control, complex switching and line transfer automation,

[50] The voltage conversion may include the reconfiguration of ungrounded delta connected 4.8kV circuits to operate as grounded wye.

abnormal condition detection, and other functional responsibilities associated with operating a highly complex distribution system. Upgrades to the communications system also may be required to enable ADMS and DERMS functionality.

LADWP's implementation of distribution operational technology systems are in the early stages. Currently, LADWP is in the final stages of commercializing a new Distribution Management System (DMS). Enhancements to the DMS likely will be required for real-time DER management and control. The time to procure, implement, verify, test, and train operations staff is a lengthy process, involving integration of highly detailed distribution system attributes with operational technology software. In addition, adjunct systems for managing and tracking customer and third-party transactions for DER programs, such as settlement and transaction accounting may be required for proposed DER programs to achieve the goals outlined in LA100.

3.2.3.5 Asset Management and Reliability Performance

The 2015 survey indicated LADWP made good progress in developing an asset management (AM) strategy and implementing initiatives based on AM principles. LADWP continues to build upon prior asset management initiatives, focusing on processes and systems related to efficient utilization of assets and targeting spending on transmission and distribution equipment that are at greatest risk for failure or performance degradation. This includes a systematic approach to evaluate condition health and the consequences of failure to prioritize and select mitigation and replacement options. Among other initiatives, LADWP has shifted from reactive to preventative maintenance, consistent with current utility AM practice.

Although COVID-19 has impacted LADWP's personnel availability, the Department has met most of the targets set for replacing at-risk assets documented in its Power System Reliability Program (PSRP) over the past several years.[51] The PSRP Performance program is a large component of the pathway to LADWP having a reliable and well-maintained power grid. Other goals of the program include proactively performing replacements and maintenance, minimizing operational and repair costs, and standardizing materials and processes.[52] Table 3-6 lists actual versus targeted replacements for all major categories.

[51] LADWP initiated a Power Reliability Program in 2007 and expanded it to include additional asses in via the PSRP in 2014.

[52] Power System Reliability Program, Fiscal Year 19-20 Report and Fiscal Year 20-21 Update (May 11, 2021).

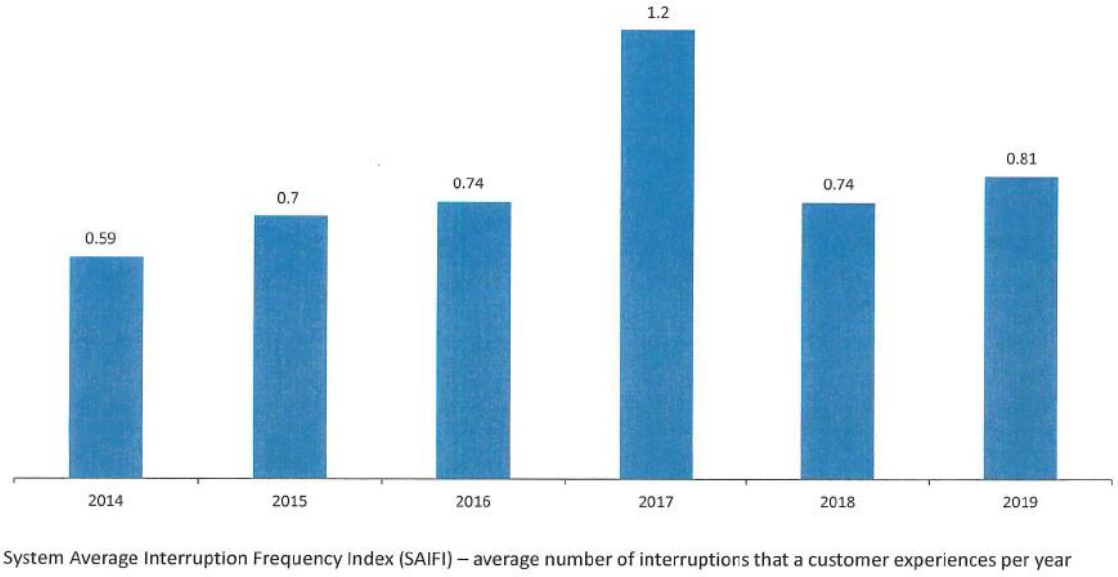
Table 3-6. Fiscal Year 2019/2020 PSRP Targets and Actuals

Asset	Targets	Actuals
Generation		
Generator Transformer (GSU & AUX)	2	Ongoing
Major Inspection (Thermal)	1	Ongoing
Major Inspection (Hydro)	2	Ongoing
Major Inspection (Pump)	1	Ongoing
Transmission		
138-kV UG Transmission Circuit	2	1
Maintenance Hole Restraints	24	25
Substation		
TRANSFORMERS (per can):		
Extra High Voltage (high side >230kV – RS, SS, HV DC Converter Stations)	2	1
High Voltage Transformers (high side 100kV to 230kV – RS, SS)	2	0
Medium Voltage Transformers (high side below 100kV to 230 kV – RS, SS)	21	15
CIRCUIT BREAKERS:		
Transmission Circuit Breakers (>100kV – RS, SS, HV AC Switchyards)	2	2
Subtransmission Circuit Breakers (34.5kV – RS, DS)	18	5
Distribution Circuit Breakers (4.8kV – DS)	16	8
SUBSTATION AUTOMATION UPGRADES:		
Distributing or Receiving Station Upgrades	12	7
EQUIPMENT LIFE EXTENSIONS:		
DS Transformers:		
34.5kV/4.8kV (1-phase and 3-phase cans)	24	3
Circuit Breakers:		
34.5kV, RS, and DS	240	41
4.8kV, DS	12	80
Distribution		
Poles	4,000	4,033
Crossarms	10,000	10,628
Cables (Miles) – Synthetic & Lead	50	56.8
Transformers	850	876
Substructures	20	20

The Power System's reliability performance, as measured by industry-accepted metrics, has remained favorable over the past six years, with modest increases in interruption frequency and

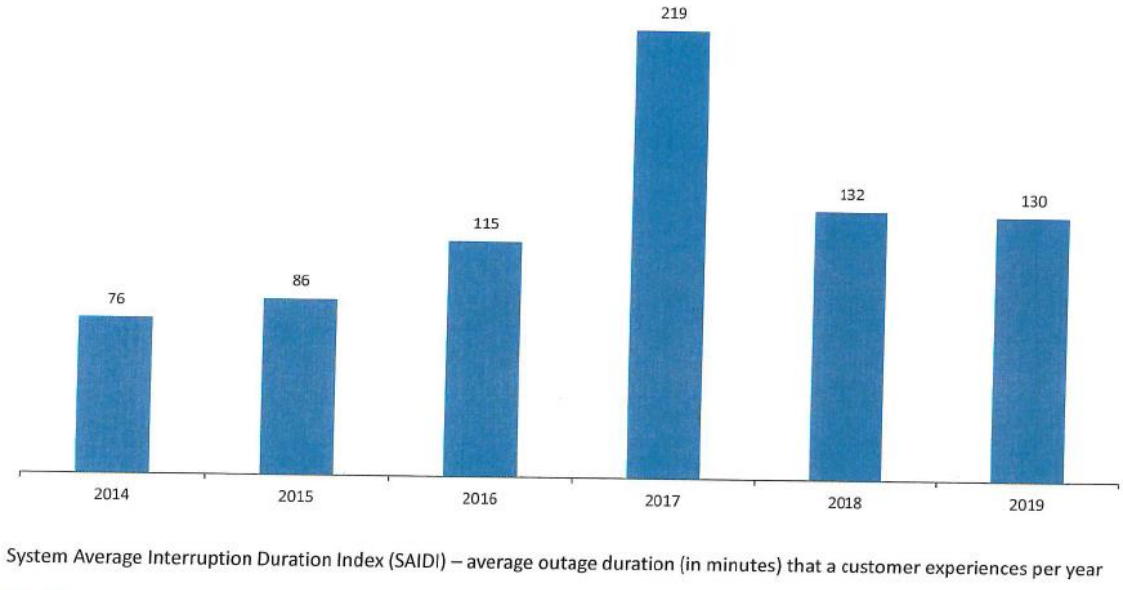
outage duration. The following two charts display reliability performance since 2014, the first year PSRP was implemented. Guidehouse expects reliability performance will continue to improve, with system upgrades such as voltage conversions and new operational systems such as ADMS.

Figure 3-13. SAIFI Reliability Performance



Source: Power System Reliability Program, Fiscal Year 19-20 Report and Fiscal Year 20-21 Update (May 11, 2021).

Figure 3-14. SAIDI Reliability Performance



Source: Power System Reliability Program, Fiscal Year 19-20 Report and Fiscal Year 20-21 Update (May 11, 2021).

3.2.3.6 Distribution Budget Plan

Table 3-7 presents LADWP's five-year distribution investment plan by major category. The majority of these investment are for the PSRP distribution program. Similar to the transmission system upgrades, executing these investments will place significant demands on LADWP's planning, design, and construction staff, among others. Extensive project management and coordination of design and construction activities across several concurrent projects is expected over the next five years.

Table 3-7. Approved Five-Year Distribution Plan ($1000's)

Description	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	Total
New Business & St Lights	$194,062	$201,915	$210,389	$214,485	$212,704	$1,033,555
Smart Grid	$924	$1,133	$1,179	$114,343	$111,973	$229,552
Automated Meters	$21,260	$ 22,232	$23,155	$24,922	$24,633	$116,202
PSRP-Substations	$124,447	$134,687	$150,363	$146,831	$214,576	$770,904
PSRP-Distribution	$336,315	$367,128	$407,662	$431,500	$423,720	$1,966,325
Operational/Information Technology/Automation	$123,097	$118,645	$99,077	$99,616	$74,103	$514,538
Inter-Agency & Cust Initiatives	$45,576	$52,788	$63,310	$ 58,242	$63,623	$283,539
Facilities, Fleet & Tools	$15,045	$15,949	$18,554	$30,016	$78,946	$158,510
Total	**$860,726**	**$914,477**	**$973,689**	**1,119,955**	**1,204,278**	**$5,073,125**

3.2.4 Wildfire Mitigation

Wildfire events have significantly increased in California over the last decade, with several high-profile fires stemming from ignitions of energized utility equipment. This situation led legislators to pass Senate Bill (SB) 901 in 2018, which requires electrical corporations, cooperatives, and publicly-owned utilities (POUs), such as the LADWP to establish Wildfire Mitigation Plans (WMPs) and update those plans on an annual basis. LADWP must also adhere to legislative and statutory requirements and consider guidance issued by the state Wildfire Safety Advisory Board (WSAB), with input from the California Natural Resources Agency (CNRA) Office of Energy Infrastructure Safety (OEIS). The WSAB was established in response to Assembly Bill (AB) 1054 and AB 111 in 2019 and serves as an advisory body, to review and provide recommendations for all WMPs. WMPs must consider the elements codified in Public Utilities Code (PUC) § 8387 to enhance wildfire prevention through improved asset management inspections, vegetation management, grid operations, system hardening, situational awareness, designated roles, data governance, proactive de-energization protocols, and customer communication, coordination, and response.

LADWP presented its first WMP version to the governing body comprised of the Board of Water and Power Commissioners (Board) prior to January 1, 2020, aligning to statutory mandates.

LADWP updated its WMP in April 2020 and in May 2021 and in June of 2022[53]. In December 2020, the WSAB issued its *Guidance Advisory Opinion for the 2021 Wildfire Mitigation Plans of Electric Publicly Owned Utilities and Cooperatives*. LADWP provided its update to the WSAB in May 2021 following the recommendations provided by WSAB and incorporating additional lessons learned. The updated documentation submitted to the WSAB consists of a records review that comprise the WMP program, as well as most recent WMP publications, which inform the public on latest trends, metrics, and implementation of wildfire mitigation activities.

In relation to physical infrastructure, the WMP exceeds baseline operational practices for maintaining the service territory by categorizing higher risk areas with priority measures to ensure future fire risk is mitigated. LADWP has considered varying types of infrastructure enhancements and replacements to ensure effective reduction in risk drivers, which are supported by the Department's unique position, risk analysis, and review of alternative strategies undertaken by similar utilities across the state.

3.2.4.1 Wildfire Mitigation Plan Objectives

LADWP notes that the primary goal of the WMP and its associated programs is to ensure the safety of customers and communities that LADWP serves. The second goal describes improving the overall resiliency of the electric grid to reduce interruption of service and improve restoration efforts. The final goal aims to measure the effectiveness of specific wildfire mitigation strategies. This final goal aligns with the aspect of continuous improvement of the WMP, as lessons learned are captured each fire season and incorporated into future efforts.

3.2.4.2 LADWP Wildfire Mitigation Plan Roles and Responsibilities

Several individuals and groups perform significant roles in managing, monitoring, and executing the elements of the WMP and the goals depicted above. The Board reserves the highest level of decision making and oversight of initiatives attributed to wildfire mitigation programs and procedures. The Board holds the duty to enforce all necessary rules and regulations governing the "construction, maintenance, operation, connection to and use of the LADWP and to acquire, construct, extend, maintain and operate all improvements, utilities, structures and facilities,"[54] as deemed necessary. The General Manager serves to manage the operations of the Department and to ensure administration is executed under the Board's direction. The Power System Executive Office manages grid operations related to construction, maintenance, power supply, distribution, transmission, engineering, and strategy. The Power Transmission and Distribution (PTD) group is directly responsible for enacting initiatives approved by the Board. The PTD maintains the system in a manner to reduce risk of potential wildfire ignitions, while maintaining compliance with relevant regulatory and state laws. The PTD group also conducts vegetation management activities for substations and routine landscape maintenance. Distribution Operations and the Distribution Construction and Maintenance groups are housed under the PTD group.

LADWP's Power Construction and Maintenance (PCM) group employs internal fire prevention procedures for necessary crew dispatch for reporting, repairing, and directly mitigating any known fire hazards. Routine and off-cycle inspections for generation and substation facilities are performed by the Power Supply Operations group, with all construction and design of planned infrastructure carried out by the Power Planning, Development, and Engineering team.

[53] This report was largely drafted before the publication of the 2022 WMP. The 2022 WMP was not evaluated as part of this report.

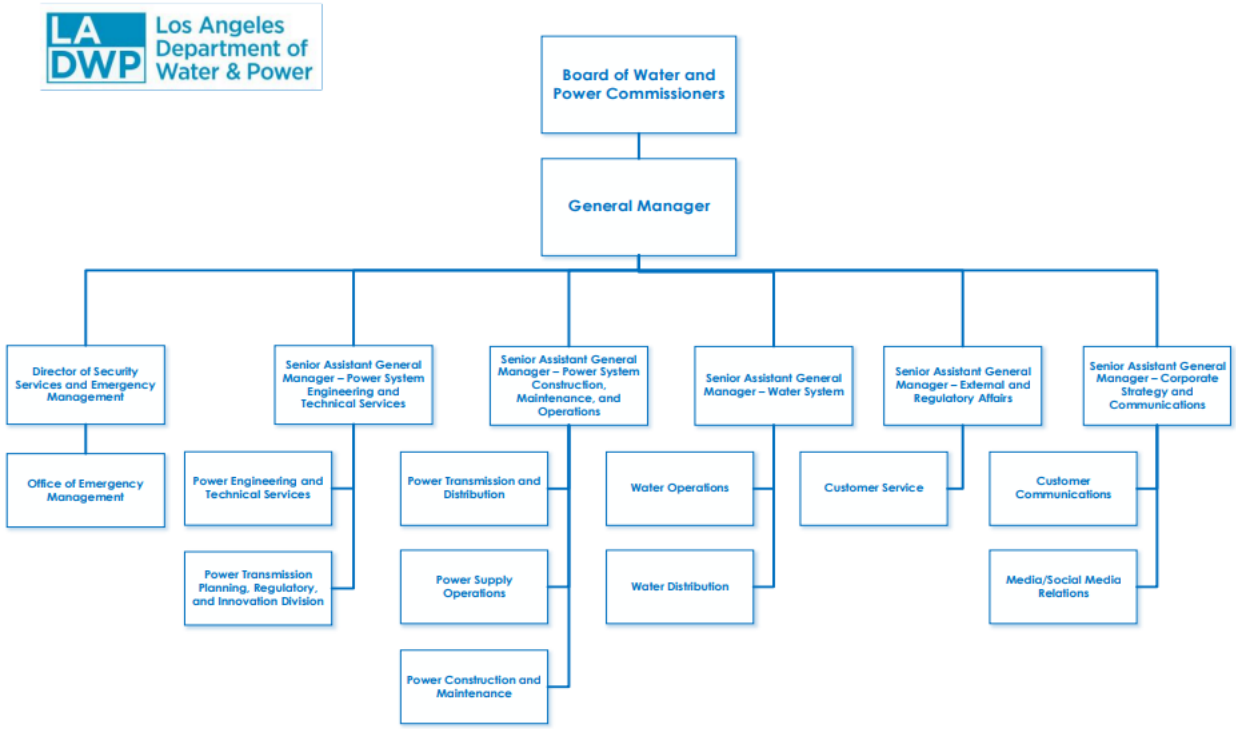
[54] LADWP, *Wildfire Mitigation Plan Version 1.2*, May 2021.

Additional contributors to the overall roles and responsibilities of the WMP include the Power New Business Development and Technology Applications division, the Power Regulatory Compliance and Specifications division, and the Water System division.

Emergency response and management activities are carried out by the Office of Emergency Management (OEM), which coordinates with public safety partners within the City of Los Angeles to ensure preparation of communication and response if an ignition event occurs. The core function of the OEM is to manage disaster preparedness, mitigation, response, and recovery and to coordinate with the respective departments of the City of Los Angeles. The City of Los Angeles will engage the Los Angeles Fire Department or the City Emergency Operations Center as appropriate. The City also utilizes the California Standardized Emergency Management System (SEMS) framework. SEMS includes the activation of an Incident Command System when facing an emergency event. LADWP also relies upon the utility mutual assistance networks including those under the SCPPA, the California Utilities Emergency Association (CUEA), the Western Energy Institute (WEI), and the American Public Power Association (APPA) agreements.

The roles described above are visually depicted in the LADWP organizational chart presented in Figure 3-15, pulled from the 2022 LADWP WMP.

Figure 3-15. LADWP 2022 WMP Organization Chart



Source: 2022 LADWP WMP.

3.2.4.3 Identification of Risk Drivers

Wildfire risk drivers and associated analyses are identified and discussed in LADWP's WMP. The Department acknowledges inherent vulnerabilities with aging overhead power equipment, which is incorporated in routine design and construction standards and assessed through asset

management and inspection practices. Wildfire risk drivers subsequently combine existing equipment risk with meteorological and terrain conditions, such as high winds, elongated drought periods, fuel loading, and low humidity. Additional factors include vegetation or object blow-ins, felled trees, aging equipment, electrical line faults, and related incidents outside of ongoing and routine equipment management. Due to these risk drivers, the Department regularly surveys its service territory through regular and enhanced vegetation and electrical inspection management. The Department leverages state-created risk maps to establish perimeters of risk-prone areas into categorizations of Tier 1,[55] Tier 2 (elevated risk), and Tier 3 (extreme risk) High Fire Threat Districts (HFTDs) adopted by the California Public Utilities Commission (CPUC) and several stakeholders in January 2018.

Risks should be categorized within a wildfire risk register tracking mechanism to reveal measurable data points that can enable optimal decision-making practices for future risk spending. Public resources also exist and have been adapted for general use to navigate any best practice approaches in monitoring ongoing topographical and climatological risks within the HFTDs, the City of Los Angeles Fire Department (LAFD) Fire Zone, and Local Responsibility Areas (LRAs) defined by CAL FIRE's Fire and Resource Assessment Program (FRAP) maps. Each of these geographical representations serve to establish LADWP's unique Fire Threat Map, which is included in the publicly available WMP.

LADWP maintains 303,186 poles, 7,268 circuit miles of overhead, and 3,764 miles of underground distribution lines across the service territory.[56] Tier 3 areas contain 0.4 and 0.5 percent of distribution poles and circuit miles, respectively. Tier 2 areas contain 12.3 percent of distribution poles and circuit miles each within the Los Angeles service territory. The Department additionally considered an area not within Tier 2 and 3 that comprises the City's Very High Fire Hazard Severity Zone (LAFD Fire Zone or High Fire Risk Zone) established by the City and the Department. This area bears resemblance to the definitions of the HFTD and is considered a high threat area with prioritization for wildfire mitigation and enhancements. This area includes 2.2 and 2.3 percent of LADWP's distribution poles and circuit miles.

The Department maintains transmission assets of 15,452 towers over 4,050 circuit miles with the greatest presence in Tier 2. Table 3-8 presents the total identified assets in circuit miles that fall within the HFTD.

Table 3-8: Circuit Miles within the HFTD

Percentage of Circuit Miles in Wildfire Threat Zones (Including Owens Valley)		
	Tier 2	**Tier 3**
Percent of Overhead Distribution (Circuit Miles)	13.8	0.5
Percent of Overhead Transmission (Circuit Miles)[57]	6.3	8.6

Source: LADWP WMP 2021, pg. 16

LADWP's WMP and related documentation provide descriptions of initiatives approved to mitigate the wildfire risk drivers identified in Table 3-8. Interviews held with LADWP staff indicate that decision-making relies on the determination of the risk profile of the LAFD Fire Zone and

[55] Tier 1 includes the presence of areas identified as High Hazard Zones (HHZs) on the U.S. Forest Service-California Department of Forestry and Fire Protection (CAL FIRE) joint map of Tree Mortality HHZs.

[56] LADWP, *Wildfire Mitigation Plan Version 1.2*, May 2021.

[57] "Of LADWP's total transmission circuit miles, approximately 6.3 percent are located in Tier 2 HFTD and 8.6 percent are located within the Tier 3 HFTD," 2021 WMP.

conforming HFTDs to inform decisions for risk mitigation. These activities align with similarly situated utilities. Although the majority of the service territory resides in Tier 1, LADWP treats Tier 2 regions in line with elevated risk areas and applies related decision-making, akin to Tier 3 designations.

Since 2008, through the PSRP and in accordance with the WMP, LADWP has implemented capital improvement activities evaluated to be prudent and cost-effective to improve "its physical assets, operations, and trainings."[58] However, Guidehouse did not receive unique decision-making resource documents to reasonably verify the risk determination, identification, and selection process of each wildfire mitigation measure. The WMP provides roles and responsibilities with descriptions of activities associated with each department and group. The WMP also details the Board's governing qualities in reserving the rights to approve or deny planned initiatives. However, the exact process for arriving to these conclusions through enterprise-wide risk evaluation (e.g., key decision reports, cost comparisons, and alternatives assessments) were not described in full.

Discussions with LADWP provided evidence that the Department aims to align mitigation initiatives with industry standards and best practice cases demonstrated by regulated utilities in the state and other similar POUs. LADWP would benefit from identifying such decision-making processes for the uniqueness of each initiative as well as a cursory cost-benefit analysis of any considered alternatives.

LADWP has applied a risk assessment to determine active ignition threats. Table 3-9 describes the identified risk drivers and activities to mitigate those risks presented within LADWP's WMP.[59]

[58] LADWP, *Wildfire Mitigation Plan Version 1.2*, May 2021.
[59] LADWP, *Wildfire Mitigation Plan Version 1.2*, May 2021.

Table 3-9: LADWP Ignition Risk Drivers and Mitigations

Risk Drivers	Mitigation Measures and Associated Programs
High Wind Event	• Construction Standards • Operational Protocols • Blocking Reclosers on Tier 3 circuits
Vegetation Contact	• Transmission and Distribution Vegetation Management Programs
Conductor Failure	• Power System Reliability Program • Transmission and Distribution Maintenance and Inspection Plans • Construction Standards
Conductor Slap	• Power System Reliability Program • Transmission and Distribution Maintenance and Inspection Plans • Construction Standards
Pole/Hardware Failure	• Power System Reliability Program • Transmission and Distribution Maintenance and Inspection Plans • Construction Standards
Aging Infrastructure	• Power System Reliability Program • Construction Standards

Source: LADWP WMP V1.2, May 2021, pgs. 13-14

Documentation for wildfire mitigation activities indicates that LADWP continuously surveys its service territory to address principle topographical and climatological risks that may lead to a fire incident. These include reviewing the terrain and its accessibility for first responders, the presence of dense vegetation and its ability to serve as wildfire fuel, drought and current weather conditions, and any impacting historical weather patterns.[60] The trends and ignition recordings from these resources can be categorized in a risk tracker or similar platform or mechanism to inform the enterprise-wide risk evaluation of associated threats. LADWP has illustrated these showings through a risk bow-tie analysis to demonstrate the risk drivers and consequences to varying degrees of severity. Adopting a formulaic approach with weighted risk scores can better define active threats to inform future planning cycles.

3.2.4.4 Mitigation Activities

The review of LADWP's planned and executed mitigation measures included publicly available documents, requested documents, and primary source interviews with responsible parties that oversee planning and execution of mitigation efforts. LADWP is in the process of producing the third iteration of its WMP. Each year, the executed activities and available indicators of risk should be tracked and maintained for continued improvement in providing reasonable justification for future initiative planning. Examples of events that should be tracked to develop findings of trends include inspection findings, outages, remediations, downed wires, faults, and third-party impacts.

As with most other CA POUs, the Department exceeds its baseline operational practice by adhering to specific General Orders (GOs) issued by the CPUC for regulated investor-owned utilities (IOUs). GO 95 directs regulated utilities to strengthen overhead utility equipment

[60] LADWP, *Wildfire Mitigation Plan Version 1.1*, April 2020.

management for tiered findings requiring a timeline-driven effort for remediation and replacement of identified issues. Therefore, the Department's electrical equipment and facilities are designed and constructed to exceed POU statutes and meet or exceed applicable federal, state, and industry standards. LADWP has maintained its electrical system under this prudent standard since 2008 and has increased line construction standards to reduce associated overhead line risk, which include wildfire hazards and threats. This exceeds current design standards for POUs. LADWP maintains its system in a manner to allow for ease of inspection and remediation expeditiously through its right of way (ROW) maintenance procedures.

Additional capital initiatives underway at LADWP that serve to mitigate wildfire risk include:[61]

- Installing fire resistant poles such as ductile iron, steel, and concrete
- Including larger conductors with fiberglass arms
- Increasing space between conductors to reduce faults and sparks
- Insulating high-risk conductors
- Increasing pole load calculations to enable poles to sustain greater wind pressure

Guidehouse found that LADWP exceeds the minimum standards for all vegetation management practices and adheres to the North American Reliability Corporation FAC-003 reliability standard[62] where applicable. LADWP exceeds POU standards for distribution ROWs maintenance by meeting the requirements of CPUC GO 95 Rule 35, which exists as compliance objectives for IOUs only. Maintenance activities also meet the requirements codified under Public Resources Codes 4292 and 4293. Adhering to such standards allows LADWP to maintain proper ROW clearances, exceed baseline prudent management standards, and minimize potential objects from making contact with the lines and electrical facilities.

Additional vegetation management activities include regular tree trimming and pruning, at-risk species removal, off-cycle clearing, brush and pole clearing, and monitoring growth cycles of vegetation within the service area. LADWP personnel stated that upwards of 125,000 trees are pruned each year out of an inventory of 400,000. Most of these trees reside in Tier 2. Aerial vegetation inspections and LiDAR satellite imagery is also performed. Annual quality checks are conducted to ensure compliance with LADWP's vegetation management program. Per the 2021 WMP, the Department also leverages the ALERT Wildfire network of wildland cameras to support real-time situational awareness of the service area.

CPUC GO 165 inspection requirements inform LADWP's equipment inspection and maintenance programs. Accordingly, the Department performs annual patrol inspections of the entire distribution overhead system and completes detailed inspections every five years. Intrusive pole inspections are conducted after a pole is in-service for 20-years and then every 10 years thereafter. To account for areas with increased risk, LADWP applies a more aggressive inspection schedule within the HFTD Tiers 2 and 3. This includes the inspection practice of infrared scanning, which uses heat sensing cameras to identify "hot spots" that may lead to sparking and arcing of the lines or failed components. Looking ahead, LADWP is investigating rapid earth fault current limiting technology to identify circuit faults prior to the potential of sparking capability.

[61] "Of LADWP's total transmission circuit miles, approximately 6.3 percent are located in Tier 2 HFTD and 8.6 percent are located within the Tier 3 HFTD," 2021 WMP.

[62] FAC-003-4 Transmission Vegetation Management.

Transmission aerial patrols are performed biannually to monitor vegetation encroachments along with equipment damage, earth movement, or any other condition, which may impact transmission system assets and property or facilities within the ROW. Towers receive inspections on a cycle, completing each tower inspection in order of the circuit from lower voltage drops to before the point of generation. LADWP also performs insulator washing to minimize contamination and gives special attention to any road or body of water crossing with tower climb inspections. Additional transmission-related maintenance activities are under consideration for future use such as utilizing drone technology to provide better visibility of the structures.

In conjunction with the WMP programs, policies, and procedures, LADWP invests in its PSRP, which maintains and replaces aging infrastructure and bringing the overall system into a more resilient condition. This program commenced in 2007 and further evolved in 2014 to assist in prioritizing capital investments for power system asset maintenance. Under the PSRP, LADWP sets replacement targets by fiscal year with an emphasis on assets within the HFTD. In support of these goals, the WMP allows for an increase in capital and operations and maintenance spending, which has been approved by the Board through 2022.[63]

LADWP incorporates its PSRP into its WMP accounting for planned execution of replaced poles, cross-arms, transformer upgrades, substation maintenance, and covered wire initiatives to both increase system reliability and to reduce fire risk. To better distinguish incremental benefit beyond reliability, LADWP should investigate a process to formulate accounting mechanisms to apply future risk reduction effectiveness measurements. Maintenance and replacement actions may create multiple streams of benefits or singularly address wildfire mitigation. LADWP, along with its utility peers, are working to determine appropriate initiatives that reduce wildfire risk and those necessary for baseline operational practices. As costs for wildfire mitigation are approved through the PSRP, LADWP may choose to consider breaking up those expenditures to reveal the incremental cost of reducing wildfire risk to effectively measure risk reduction over time and optimize future investments.

Operational protocols are also addressed in the programs and policies of the WMP, including those outside of direct asset management and investment. These include procedures for allowing to block reclosers or even to de-energize electrical equipment as a measure of last resort, although the Department does not officially maintain a Public Safety Power Shutoff (PSPS) protocol. Additionally, LADWP does not currently sectionalize its grid topology to segment targeted outages at this time. The Department asserts in Section 4.7 of the WMP under the heading “Incident Based De-energization” that LADWP considered PSPS procedures but “determined that the adverse impact on health, safety, and quality of life of its customers outweighs the perceived benefits derived from pre-emptive power shutoffs” and prefers “to execute its de-energization protocols on a per incident basis.” The WMP does not explicitly set forth the criteria that anticipates the need for proactive de-energization or what meets internal thresholds necessary for such de-energization. Currently, LADWP states it “may block reclosers or de-energize its lines in the event of a wildfire, or specific threat identified by LADWP personnel if it is deemed necessary based on safety and reliability issues.” Additional clarification, of what criteria may indicate such threats may be beneficial to field and operating personnel who may initiate such de-energization actions. Further, if such conditions arise, immediate activation of the notification protocols including actions to alert at-risk customers should be addressed. Notifications of this nature should also occur if power supply from Southern California Edison (SCE) is affected by an SCE-initiated PSPS. Such measures are

[63] Documented cost budgets are grouped under the PSRP and forecasts expenditures of $481.43 million in operations and maintenance and $567.73 million in capital investments for fiscal year 2021-2022.

already active in neighboring IOUs and POUs in Southern California with formalized PSPS plans but, it should be noted, those utilities have a higher frequency of recorded wildfire events and face more significant wildfire risks.

The protocols to disable reclosers and de-energize line segments are described within the WMP and are coordinated by the Operations and Engineering group, while notices are provided by the Energy Control Center. LADWP plans to disable reclosers within Tier 2 and 3 of the HFTD under certain high-risk conditions. For example, all 4.8 kV reclosers will be disabled within Tier 3 and higher voltage 34.5kV recloser blocking will be subject to prevailing wind conditions, humidity levels, and presence of high fuel load. This aligns with RFWs issued by the National Weather Service.

These actions may be performed remotely or manually by field crews depending on the equipment and its location. The details of the operational procedures and augmented work functions during high-risk conditions are not detailed within the WMP. Department leads communicated with Guidehouse that these procedures are standardized and produced by internal operations and maintenance teams for field crew trainings, pre-activity tailgate meetings, and during the safety minutes conducted at the start of each field operation.

To enhance its current procedures and protocols, LADWP may elect to design a prospective PSPS plan that accounts for PSPS outages enacted by adjacent utilities. This should describe any operational actions as well as the coordination and communication needed between the utilities and with the public. This could be included at any time throughout the year as a separate internal plan or presented for approval in future versions of the WMP.

3.2.4.5 Wildfire Mitigation Summary

The documentation and available resources LADWP provided to Guidehouse included planned initiative summaries, a preliminary risk assessment of applicable measures, and initial outcomes of the WMP and associated programs. LADWP has made substantial progress in reducing wildfire risk to its system through the application of prudent and methodical measures across its service area through capital investment, operations and maintenance, and programmatic procedures and policies. The Department has executed on its planned initiatives and maintains accounting of its activities through public-facing documents updated on an annual basis. While the WMP and its associated programs and procedures continue to evolve, further enhancement of its monitoring and tracking activities will be necessary to inform future updates to the WMP.

3.3 Power System Conclusions and Recommendations

From its assessment of LADWP's power infrastructure initiatives, Guidehouse offers the following findings and conclusions on LADWP's transformation of its electric power resource and delivery system to achieve 100 percent clean energy supply:

1) The long-term resource plan that LADWP now proposes has changed significantly since the prior Survey, which was based on the 2015 IRP. The City of Los Angeles has indicated it will accelerate the transition to 100 percent clean energy, achieved by increasing renewable energy supply as outlined in NREL's March 2021 LA100 report.
2) The NREL LA100 included four pathways to reach the 100 percent renewable energy target; three pathways meet the target by 2045, one by 2035. The City has indicated it plans to meet its renewable energy goals by 2035, which is the "Early and No Biofuels" pathway.

3) An updated resource plan outlining the resources and programs LADWP proposes to meet the 2035 renewable energy target has not been completed. An updated resource plan is expected to be completed in Fall 2022 via the 2022 SLTRP process.
4) Electricity demand and consumption is expected to grow well above historical levels, driven by electrification of the transportation sector. The LA100 study indicates electricity demand may increase by over 50 percent over the next 10 years.
5) LADWP's power supply resources are expected to double from 10,000 MW to over 20,000 MW by 2035 to serve the additional demand. Approximately 10,000 MW will be supplied by solar PV and wind resources, with a significant percentage located outside the LA Basin and in other states.
6) Existing natural gas OTC generation within the LA Basin is scheduled to be retired or retrofitted to comply with Water Board regulations; several will be repowered using "green" hydrogen as the main fuel source. The repowering of Scattergood OTC generating units, originally scheduled for completion by 2024, has been delayed by at least four years. LADWP has filed for an extension of the deadline to 2029 with the Water Board.
7) The LA100 report indicates that between 2,600 MW to 5,000 MW of fast response generation must be located in the Basin by 2045 to respond to rapidly changing loads and contingency events, such as transmission line outages or loss of in-basin generation. Completion of proposed repowering of OTC generation is essential to ensure bulk power system reliability is not compromised.
8) Energy storage from existing hydroelectric generation at Castaic and Hoover and large new storage devices are critical resources, as they are expected to provide the firm capacity and fast response capability needed to maintain stable electric performance and meet balancing area reliability requirements.
9) Existing transmission pathways to other states will be repurposed to transmit new solar and wind resources both from within and outside of California. Several major upgrades and enhancements to LADWP's transmission system within and outside of the Basin are needed to reliably import additional amounts of renewable energy.
10) In-basin generation needs to be available to support the transmission system while upgrades are underway, as many of the upgrades require existing lines and substations to be taken out of service during construction.
11) LADWP's distribution system is comprised of lines rated 34.5kV and 4.8kV, the former serving large commercial and industrial customers, the latter residential and smaller commercial loads. The lower voltage system is inadequate to meet the future integration of large amounts of renewable generation and rapid electric vehicle adoption and will need to be upgraded.
12) LADWP has adopted comprehensive asset management policies and programs. Most PSRP targets have been met and reliability has been acceptable. However, the 4.8kV system is aged and inadequate to integrate large amounts of new solar and supply increased load driven by electrification initiatives.
13) Significant internal and external resources are needed to plan, design, manage, and construct new or upgraded transmission and distribution assets. These competing demands are expected to place a strain on LADWP internal resources. Several hundred vacancies currently exist in LADWP's workforce.

14) Extensive training of the LADWP work force on the design, operation, maintenance, and control of new supply sources, operational technologies, and advanced systems will be required for whichever LA100 path is chosen in LADWP's next resource plan.

15) New and upgraded facilities, equipment, materials, and an electrified fleet will be needed to accommodate the additional workforce and stock associated with the introduction of new resources and systems as required by the transition to 100 percent renewable energy supply and to support upgrades to the energy delivery system.

16) LADWP has made substantial progress in reducing wildfire risk to its system through the application of prudent and methodical measures across its service area through capital investment, operations and maintenance, and programmatic procedures and policies.

17) The numerous changes and upgrades to LADWP's energy resources, energy delivery system, and work force requirements outlined above, collectively, introduce risk factors that need to be proactively addressed to ensure continued reliable electricity supply to Los Angeles' consumers at reasonable cost and rates.

Based on these conclusions, Guidehouse has developed the recommendations noted below for the continued improvement of the Power System's strategic planning and physical infrastructure investments.

2022 Power System Recommendations
1. Develop a 2022 Strategic Long-Term Resource Plan (SLTRP) based on resource additions that provide the greatest flexibility and lowest risk for load growth forecasts over a range of electrification scenarios and outcomes. The preferred plan should be sufficiently flexible to allow the Department to adjust resource needs to align differences in load forecasts or EV adoption rates in order to minimize rate impacts associated with unanticipated changes to each scenario.
2. Ensure the 2022 SLTRP includes sufficient in-basin, spinning, fast-response generation to reliably meet customer electricity demand under normal and contingency conditions, including contingencies that may occur while transmission lines and substations are out of service due to upgrades or replacement. Vigorously pursue the extension of Scattergood repowering deadlines to 2029.
3. Complete studies to determine the magnitude and timing of distribution upgrades and voltage conversions for each of the growth scenarios evaluated in the 2022 SLTRP. Prepare a detailed project plan that outlines the specific projects, resources, and work tasks that LADWP will need to implement over the next five years, including costs.
4. Update the current 10-year transmission plan to align with the 2022 SLTRP, including adjustments to schedules for proposed upgrades based on changes in the timing and capacity of power resources outlined in the LA100 study.
5. Determine the level of internal and external crews and support resources needed to complete the work outlined in the 2022 SLTRP and associated transmission and distribution system enhancements and upgrades. Prepare a detailed plan that identifies work to be completed by internal and external crews, and a strategy to ensure sufficient resources are available to construct proposed facilities based on proposed schedules.

6. Prepare an Operational Technology (OT) plan that outlines required enhancements to the ongoing Distribution Management System upgrades to incorporate Distributed Energy Resource Management System functionality that can reliably integrate, manage, and control distributed resources for existing and upgraded facilities for the resource scenarios outlined in the 2022 SLTRP. The OT plan should incorporate Substation Automation and Real-Time monitoring systems that capture digitally connected smart devices, sensors and protection systems.
7. Assess the benefits of developing an overarching asset management plan and systems jointly used by LADWP's Water and Power organizations. Develop processes and procedures that are consistently applied to Water and Power, including funding prioritization and allocation.
8. Identify the additional facilities needed to accommodate conversion of LADWP's vehicle fleet, work crews, training facilities, and equipment storage associated with the build out of the power delivery system.

Wildfire Recommendations

9. Provide transparency to the Board and the public on decision-making processes in establishing new LADWP wildfire mitigation investments.
10. Continue to track metrics and trending risk drivers to inform future Wildfire Mitigation Plan updates.
11. Formalize the criteria for activation and notification protocols that address events before, during, and after an incident-based de-energization or loss of power supply because of a PSPS initiated by SCE.
12. Power System Reliability Program (PSRP) investments should account for incremental activities that align to the High Fire Threat District (HFTD) wildfire risk reduction in addition to resiliency initiatives.

4. Security and Emergency Preparedness

During the normal course of business, LADWP is exposed to numerous threats that may have an impact on the ability to provide secure and reliable service to customers. Threats such as natural disasters, acts of sabotage, bioterrorism, terrorism, cyber-attacks, and disease outbreaks could disrupt normal Department business processes and severely impact operations. Emergency preparedness and robust security practices are key components of LADWP's operations, to ensure such interruptions have as little impact on customers as possible.

The Director of Security Services and Emergency Management is responsible for both Physical Security and Emergency Preparedness, and the role reports through the Corporate Services division. The Chief Information Security Officer reports through the Chief Information Technology Officer. Close coordination and collaboration among these groups is imperative to ensure security across both cyber and physical environments and to ensure that the NERC Critical Infrastructure Protection (CIP) compliance program is cohesive and each CIP Requirement has an accountable party for all applicable assets. Such coordination has improved in recent years, and the groups have established clear lines of communication. This review therefore builds upon LADWP's activities to address critical recommendations for improving Security and Emergency Preparedness practices discussed in the 2015 IEA survey report.

Cyber and physical security are top priorities for LADWP, and the Department has made significant progress in improving its cyber and physical security posture along with its emergency preparedness capabilities. While emergency preparedness is recognized as important within the Department, Guidehouse found that the groups responsible lack resources and cohesion across the enterprise. For this Survey, Guidehouse performed an overarching assessment of the Department's emergency preparedness and security functions. Guidehouse reviewed the Department's current state infrastructure, capabilities, and methodologies for identifying, planning for, and mitigating the variety of threats to normal operations at LADWP. While there are many commonalities between the threats posed to the Water and Power Systems, the attack vectors and attack surfaces can differ significantly, which increases the complexity of this review.

First, the review of Security Services covers physical security plans, procedures, and status reports. Guidehouse determined that Security Services implemented mature physical security processes and procedures and is making steady progress on its goals to protect the physical assets of all LADWP Water and Power Systems facilities. Some challenges persist due to resource and staffing constraints. While these issues are common across the electrical sector, interviews with Security Services indicated the Department is making progress in these areas.

Second, the review of Cybersecurity includes cybersecurity plans, procedures, threat identification and response capabilities, and status reports. Guidehouse determined that Cybersecurity continues to maintain a current and forecasted budget that provides the necessary headcount to support its activities. The Technology Modernization Update quarterly status reports provide critical information regarding current hiring activities along with number of vacancies and any hiring progress. Additionally, these reports provide necessary information on current IT projects and status. Organizational structure and reporting appear to be optimal with knowledgeable assistant directors providing leadership within cybersecurity and other areas of IT.

Third, the review of Emergency Preparedness covers Emergency Response Plans (ERP), Business Continuity/Disaster Recovery (BC/DR) documents, Risk Assessment and Management (RAM) plans, and status reports. The Department's Emergency Preparedness process to integrate ERP and RAM across the LADWP service territory is mature and covers most of the Water and Power Systems facilities and associated systems. Emergency Preparedness continues to work with IT to develop and complete the Business Continuity Management Plan (BCMP), which includes the BC/DR components.

4.1 Security

Security at LADWP is critical to infrastructure protection, and it is important for the Department to institute effective plans, processes, and structures to ensure that threats and vulnerabilities are identified, assessed, prioritized, and mitigated, as applicable.

Further, the North American Electric Reliability Corporation (NERC) is an international regulatory authority whose mission is to assure the reliability of the bulk power system in North America. NERC develops and enforces Reliability Standards, monitors the bulk system through system awareness, and trains and certifies industry personnel. NERC's jurisdiction includes users, owners, and operators of the bulk power system. Accordingly, LADWP must comply with NERC requirements. NERC Reliability Standards define the reliability requirements for planning and operating the North American bulk power system. The Reliability Standards focus on measurable performance, risk mitigation strategies, and entity capabilities. Key components of these NERC standards include the Critical Infrastructure Protection (CIP) mandatory and enforceable standards, which address physical and cybersecurity of the bulk electric system. LADWP has matured its CIP Compliance program, including elevating the required expertise level to a higher skill set commensurate with the performance of the complex and significant compliance-related work, and has identified areas to further mature its program to align with the expectations of NERC and its regional monitoring and enforcement entity, the Western Electricity Coordinating Council (WECC).

As part of the 2022 IEA Survey scope, Guidehouse approached Security by dividing the topic into two areas:

- **Physical Security Threat Mitigation Capability:** A physical security review to assess the abilities of the LADWP to deter, protect, detect, communicate, and coordinate in case there is a threat made or realized to LADWP critical infrastructure and the Water and Power System facilities.

- **Cybersecurity Threat Mitigation Capability**: A cyber-risk assessment across the recognized primary domains of cybersecurity.

Guidehouse reviewed and assessed LADWP's activities over the past five years to address the 2015 IEA Survey Recommendations, including physical security and cybersecurity plans and processes that were intended to mitigate threats and vulnerabilities identified in the 2015 report. This report focuses on new or updated findings. A summary of recommendations for corporate policy and governance actions moving forward related to cyber and physical security is provided at the conclusion of this chapter. Insights from interviews and document review complement these assessments.

4.1.1 Physical Security Threat Mitigation

In 2019, the California Public Utilities Commission (CPUC) issued CPUC D.19-01-018, which mandated that utilities safeguard the electric distribution grid against terrorist attacks.[64] This Order ensures that utilities perform threat assessments of critical distribution facilities and implement security plans mitigating threats.

NERC Reliability Standard CIP-014-2 mandates vulnerability risk assessments for bulk electric system facilities.[65] CIP-014-2 requires the development and implementation of risk mitigation plans for transmission stations or substations identified as CIP-014 Critical Facilities and their primary Control Centers. As of December 2018, preliminary mitigation plans were submitted to WECC that address the identified security gaps for CIP-014 Critical Facilities within the LADWP transmission system. These mitigation plans were approved by WECC and are currently being implemented.

LADWP has made significant progress in physical security since the 2015 survey. Leadership has clearly prioritized physical security over the past several years, in reaction to both the 2015 Survey and the NERC CIP-014 Requirements becoming effective. LADWP appears to be currently compliant with NERC CIP-014 physical security for its transmission stations or substations identified as critical facilities under the CIP-014 criteria, as described in an interview with Security Services.[66] Security Services is applying its mature CIP-014 vulnerability and risk assessment processes to extend similar protections to all Water and Power System facilities; however, this is a work in progress. In 2021, Security Services hired eight investigators who are tasked with current risk assessments of CIP-014 critical facilities and CPUC D.19-01-018 distribution facilities. Security Services plans to roll this risk assessment model out across all LADWP Water and Power System Facilities.

Typically, Guidehouse would analyze a utility's Corporate Security Plan. In consideration of the fact that the Department has not yet completed its Corporate Security Plan in accordance with the 2015 recommendation, Guidehouse reviewed risk assessment and mitigation documentation and discussed CIP-014 physical security information in an interview with Security Services. Guidehouse continues to recommend that LADWP work to complete the Corporate Security Plan to design and implement necessary physical security protective measures and controls for all LADWP Water and Power Facilities and Cyber Systems. Guidehouse also recommends Security Services work to complete the Corporate Security Plan to design and implement necessary physical security protective measures and controls for all LADWP Water and Power Facilities and Cyber Systems.

Guidehouse sought to conduct a comprehensive assessment of the Department's risk and threat assessment processes and risk register. For this purpose, a Risk Register is defined as "a central record of current risks, and related information, for a given scope or organization. Current risks are comprised of both accepted risks and risks that are have a planned mitigation path."[67] There is not an enterprise-wide approach to risk assessment nor an enterprise-wide risk register. LADWP has also historically faced challenges due to limited resources to focus on BCMP planning and the lack of trained personnel to conduct risk assessments. However, in

[64] Phase I Decision On Order Instituting Rulemaking Regarding the Physical Security of Electrical Corporations, January 2019.

[65] NERC CIP-014-2 Physical Security Regulation

[66] NERC has constrained access to CIP-014 documentation to on-site access only by qualified individuals, due to the sensitive nature of the information.

[67] NIST, *Computer Security Resource Center – Risk Register*, **https://csrc.nist.gov/glossary/term/risk_register**

2019 LADWP planned to train several additional employees and have them certified in this area. As a result, LADWP has implemented several risk management programs related to cyber and physical security.

The Security Services group reported improvement in Department-wide communications regarding threat identification and response. Real-time communications are open among Water, Power, and Security groups to ensure that threats are communicated quickly and to the proper channels. While there is still improvement to occur around formalizing and automating these communication networks, the Department has made progress in breaking down organizational barriers to ensure that security issues are communicated quickly.

Guidehouse observes, however, that most utilities work cross-functionally across Security and Emergency Preparedness along with the Director of Cybersecurity to test and implement the BCMP/DR plans and the Business Impact Analysis (BIA; discussed further in Section 4.2 – Emergency Preparedness) process across all Water and Power System Facilities. The Department is still in the development phase of its BCMP/DR plans and is not yet at the maturity level of fully collaborating cross-functionally with respect to the BCMP/DR plans and the BIA process.

4.1.2 Cybersecurity Threat Mitigation

Review of progress since the 2015 IEA Survey clearly illustrates that the Department has prioritized improving its cybersecurity threat identification and mitigation. The Department has made significant progress by implementing the Enterprise Cyber Security Plan, establishing a Chief Information Security Officer, and bringing on a new Chief Information Technology Officer with responsibility over Security in 2021. Further, conducting Cybersecurity Vulnerability Assessments since 2017 is a significant step toward advancing threat identification and response capabilities.

While the Department has made progress, it was unable to provide a cohesive Cybersecurity Strategy that aligns with Department strategy. It is also not apparent that LADWP has established a Cybersecurity Program Plan that covers Information Technology and Operational Technology comprehensively and that aligns with a Cybersecurity Strategy. When developing a cybersecurity plan, it is recommended to determine if the general enterprise cybersecurity plan will include (or not include) mandated compliance such as NERC CIP Standards. While having one centralized plan can provide a single path to increasing cybersecurity posture, the impact of mandated compliance may require additional tasks.

An enterprise-wide strategic approach would mitigate one of the issues identified in Department interviews—knowledge of all assets that exist in each environment. Asset management and, accordingly, access management, continue to challenge the Department.

LADWP achieved industry standard by establishing 24x7 cybersecurity monitoring with its Security Operation Center (SOC). A SOC provides a common operating picture of the cybersecurity environment in near real-time, and it is an important achievement for LADWP. A SOC provides a single point of contact for any anomalous cyber activity and is staffed with individuals who are more knowledgeable in system administration than traditional help desk support tasks. Most, if not all, utilities of the size of LADWP have operationalized SOCs, which are an integral part of the utility's own security, and security of the grid at large, due to rapid information sharing among utilities.

Due to exponential growth in the need for cyber security personnel across all industries, the Department's proposed job classifications are broad and have presented a challenge for LADWP to hire qualified personnel. The proposed classifications were designed to include multiple disciplines within cyber security including the following responsibilities:

- Technical system requirements
- Governance, Risk, and Compliance (GRC)
- Auditing
- Privacy
- Business continuity

Such a broad list of responsibilities within a classification in an area of constantly evolving responsibilities proved to be difficult to place within traditional classification requirements, duties, and designations typically associated with Civil Service hiring. The Information Technology Services Division (ITSD) is participating in an LADWP subcommittee with the City's Information Technology Agency (ITA) to review and discuss common classifications utilized by all City Departments facing cyber security threats.

LADWP continues to navigate challenges related to staff hiring and tenure within a position. Due to the nature of Civil Service hiring and represented positions, it is often difficult to recruit and retain individuals for specific technical roles. In order to mitigate industry-wide scarcity of security staff and LADWP's specific hiring challenges, it is prudent to perform an overall analysis of an individual contributor's employment habits (e.g., what would entice employees to remain in a position). This would provide data to design an employee package centered around attracting and maintaining a consistent workforce. Additionally, the same study could be implemented across other IT environments and provide insight into further reducing transient employees.[68]

4.1.3 Conclusions

Security at a complex utility requires a strategic and multi-faceted approach. Guidehouse observes that LADWP has made significant progress in many areas of improving its security posture, security leadership, and strategy. However, the Department can continue to improve in many areas, beginning with documenting its strategy across the enterprise and continuing to ensure that cross-functional collaboration occurs for all of the Department's divisions. With respect to physical security, the Department's focused investments and response to regulatory requirements are demonstrating a commitment to protecting its assets and customers. In the realm of cyber security, evolving threats, complex regulations, and staffing issues pose ongoing challenges for the Department. The Department can continue to improve the maturity of its cyber security program through thorough documentation and strategic planning.

4.2 Emergency Preparedness

Comprehensive emergency preparedness planning is central to LADWP's strategic and operational planning, as natural and man-made threats can significantly disrupt normal operations. As a municipal utility, the Department has a unique accountability to ensure the design, implementation, testing, and continuous improvement of emergency preparedness programs. Indeed, such plans are critical for ensuring that the Department can achieve its

[68] Transient due to promotions and lateral moves within LADWP.

mission to provide “clean, reliable water and power in a safe, environmentally responsible and cost-effective manner with excellent customer service.”

At the highest level, the Department’s Business Continuity (BC) and Disaster Recovery (DR) plans serve as the centerpiece of LADWP’s response capability. These plans are part of an integrated process of Business Continuity Management (BCM) that:

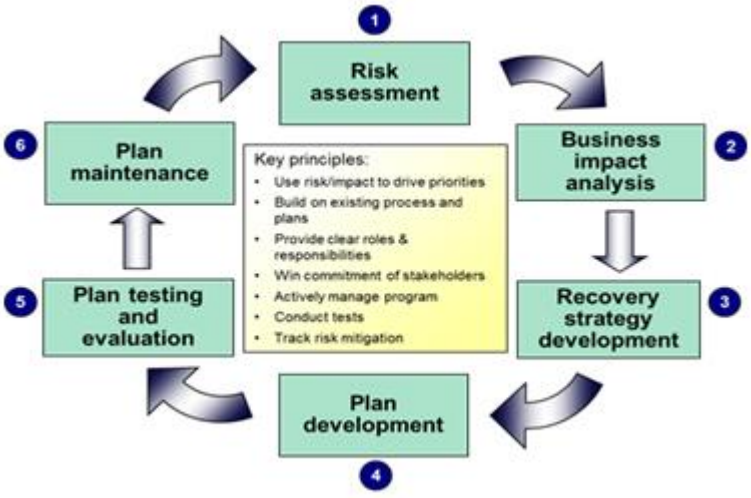
- Identifies, in advance, the potential impacts of a wide variety of worst-case disruptions and determines what is a tolerable loss relative to LADWP’s risk appetite.
- Provides a method of restoring the Department’s ability to supply its critical products and services to an agreed-upon level.
- Delivers a capability to manage the disruption and protect LADWP’s reputation and brand.
- Proactively improves the Department’s resilience.
- Specifies plans and actions to recover system applications & infrastructure in a tiered approach.

By their very nature, these response plans are developed from many assumptions and detailed analyses concerning operations and assessment of impact. Further, the ongoing review, testing, and refining of such plans is a key aspect of any planning effort. The BCM process is comprised of the following high-level steps:

- **Risk Assessment:** Specification of risk drivers and impacts.
- **Business Impact Analysis (BIA):** Identification of the critical business processes that are most affected by a worst-case disruption and prioritization of the recovery strategies that may be necessary during an extended business disruption.
- **Recovery Strategy Development:** Strategies to improve business resilience (e.g., business enablers) and technology resilience (e.g., system and applications).
- **Plan Development:** Detailed planning documents that establish recovery teams, the recovery process, and other facets of recovery.
- **Plan Testing and Evaluation:** Protocols for testing the plans (including walkthroughs and unannounced drills).
- **Plan Maintenance:** Governance over the plan, testing, and program enhancement.

Guidehouse assessed the Department’s BCM planning documents, infrastructure, capabilities, and protocols related to the processes identified above and in Figure 4-1.

Figure 4-1. Business Continuity Planning Process



Emergency Preparedness encompasses numerous physical security and cybersecurity functions at LADWP. While this function is a primary responsibility of the Emergency Preparedness unit within the Security Services Division, various components of LADWP's overall Emergency Preparedness have been delegated to other functional areas. While this is necessary to ensure that accountability lies in appropriate areas operationally, the Department could benefit from more cross-functional documentation and collaboration with respect to emergency preparedness.

Key objectives and outputs of the Emergency Preparedness program include:

- **Business Continuity Management (BCMP):** Ensures the continuity of LADWP critical processes during a disruptive event while recovering from the event.
- **Department Emergency Plan:** An introduction to the disciplines of Emergency Preparedness and Business Continuity. Provides guidance for the development of specific component plans.
- **Continuity of Operations Plan (COOP):** A description of common preventive and recovery processes and practices adopted by LADWP.
- **Emergency Preparedness Plans:** An overview of the various standards that influence emergency preparedness.
- **Emergency Response Plans**: Processes and procedures required to implement LADWP planned responses.
- **Disaster Recovery Plans**: Specific procedures with action items designed to recover to LADWP's normal operational status after a disruptive event.
- **Risk Assessment and Management Plans**: Processes and procedures to identify threats and vulnerabilities, assess risk to LADWP critical systems and facilities, and develop mitigation plans to recover from realized events.
- **Annual Department Report of Preparedness:** LADWP's report identifying current status of emergency preparedness.
- **Emergency Management Department Training Activities:** Planned and ongoing activities to prepare department personnel to handle actual emergencies and events.

- **Emergency Response and Service Restoration Evidence:** An assessment of the current and proposed policies and practices at LADWP.

The Department faced major challenges implementing the recommendation related to emergency preparedness from the 2015 IEA Survey report. The Department experienced delays with the Enterprise Technology Advisory Services (ETAS) contract for development of the Business Continuity Management Plan (BCMP), including Business Impact Analysis and Business Continuity/Disaster Recovery (BC/DR) plans for specific Water and Power System facilities and information systems, and administrative vacancies. The Department develops annual Emergency Response Plans (ERPs) and Continuity of Operations Plans (COOP) in accordance with the L.A. City Administrative Code, Division 8, Chapter 3 and Mayor Villaraigosa's Executive Directive No. 15. The COOP discusses topics including, but not limited to, prioritization of reporting locations, shift assignments for supervisors and officers, repurposing of contract security, and communication logistics. However, these existing plans are broad and focus primarily on emergencies, with less discussion of other business disruptions. A more detailed Business Continuity Management Program (BCMP) and Business Impact Analysis (BIA) are required to meet industry standards.

4.2.1 Business Continuity Management

Guidehouse reviewed an LADWP Office of Emergency Management (OEM) presentation on Business Continuity Management that indicated major goals for OEM, including the following four high priority line items drawn from the 2015 IEA Recommendations:

- Finalize the Business Continuity Management Program (BCMP) and BIA
- Confirm a consistent approach to plan development across Systems
- Expand and enforce emergency training and exercises
- Develop a Disaster Recovery (DR) plan to prioritize IT functions in the event of an emergency

As of December 2018, OEM was in the process of developing a Request for Proposal (RFP) for the selection of a vendor to implement a Business Continuity Management Plan (BCMP) which included a Business Impact Analysis (BIA). The Department is in the process of implementing this RFP and bringing on a consultant for this work. Further, the Department is collaborating with the Corporate Program Management Office (CPMO) to develop the strategy for Executive Management support for the adoption of the BCMP. OEM is set to work with Security Services to develop the objectives for LADWP's COOP.

During interviews held in January-February 2022, Guidehouse noted ongoing challenges for fully implementing the 2015 IEA Survey recommendations for BCMP development, including delays in the ETAS for BCMP and administrative vacancies.

4.2.2 Department Emergency Plan

The implementation of the BIA, which includes the BCMP process, was transferred from Corporate Security to Information Technology (IT) and is currently still in progress with no estimated time of completion.

Guidehouse reviewed the LADWP Business Continuity document that described problems associated with the lack of a cohesive and integrated BCMP. This document also stated, "LADWP has developed Emergency Response Plans (ERPs) and Continuity of Operations

Plans (COOP) that identify potential threats, mitigation efforts, training requirements, essential functions, resources and dependencies as part of the department's business continuity." LADWP provided a series of ERP documents developed at the business unit level, but the individual plans do not appear to function cohesively, as stated above. Although the LADWP Physical Security and Cybersecurity teams recently participated in a Caiso GridExVI Playbook exercise, this was the sole instance of joint testing of LADWP emergency planning and response capability across multiple business units.

Further review of LADWP enterprise-wide emergency planning requires the completion of the ETAS, full development and implementation of the BCMP and its components, and integrated testing of all business unit component plans to evaluate the cohesiveness and efficacy of an enterprise-wide emergency plan.

4.2.3 Continuity of Operations Plan

The current status of the devised action plans from the Emergency Preparedness perspective is unclear but includes management's review of a draft response protocol/divisional standing plan and/or a Security Services COOP for responding to major operational incidents. Aspects of this plan include, but are not limited to:

- Prioritization of reporting locations (Water/Power)
- Coordinating A/B 12-hr shift assignments for supervisors and officers
- Coordinating and relocating contract security
- Security Planning and the Office of Special Investigations responsible for:
    - Communications and establishing an emergency command post
    - Transportation (Emergency Vehicles)
    - Logistical Issues
        - Auxiliary Power (generators)
        - Food/water (to be coordinated with OEM)
        - Emergency gear for responders
    - Develop a continuity of administrative services (e.g., payroll, equipment requisitions, Cal-OSHA/Injury tracking) plan

Guidehouse reviewed the 2021 LADWP Continuity of Operations Plan (COOP). This document contains essential functions to be performed during an event, COOP process testing, guidance for activating a COOP team, and operational aspects during an event, training, and exercises. The document indicates that COOP training is applied across Water and Power Systems groups and appears to be relatively mature, based on the numbers of LADWP personnel who were trained in applicable components of the COOP.

4.2.4 Emergency Preparedness Plans

During interviews held in January-February 2022, LADWP personnel indicated Emergency Preparedness personnel meet with IT on a regular basis to discuss the BCMP/BIA processes. Earlier discussions indicated a pilot program with IT, but the BCMP, Disaster Recovery (DR), and BIA have since been wrapped into the Enterprise Technology Advisory Services (ETAS). The ETAS is addressed below in more detail.

4.2.5 Emergency Response Plans

Guidehouse reviewed currently available Emergency Response Plans such as the 2021 Water Distribution Division Emergency Response Plan (WDDERP), 2021 Power System Emergency Response Plan (PSERP), Human Resource Division – Emergency Response Plan (HRD-ERP), 2017 Water Operations Division Metro Emergency Response Plan (WODM-ERP), and 2021 WETS-Emergency Response Plan (WETS-ERP). Guidehouse determined the LADWP Water and Power Systems emergency response plans are current, identify common threats/hazards and potential impacts, provide guidance to mitigate the identified threats/hazards, and address common Emergency Preparedness training processes and procedures.

However, as noted above, the ERPs appear to be developed on a business-unit basis and do not appear to have been fully tested for cohesiveness and integration for an enterprise-wide LADWP emergency planning process.

4.2.6 Disaster Recovery Plans

In interviews held in January 2022, the Emergency Preparedness group indicated that the Power System DR plan is approximately 75% completed, and that IT is finalizing the DR plan and has run test scenarios with key stakeholders in the Power Systems and Financial Services groups. Once the complete plan has been implemented with the IT group, it will be implemented across all LADWP Water and Power Systems functions. Guidehouse recommends reporting on the progress of the DR plan implementation and oversight or audit activities to ensure the DR process has been completely implemented. Other than that effort, there are no Disaster Recovery plans completed or implemented across the LADWP Water and Power Systems.

4.2.7 Risk Assessment and Management Plans

Guidehouse reviewed the Water System Strategic Asset Management Plan (SAMP) document. The SAMP includes a section for integrating with the LADWP Strategic Plan but does not integrate the plans from an emergency preparedness perspective. Guidehouse also reviewed numerous individual Water System AMP documents, which indicated the Water divisions that did participate in the AMP process used the current AMP Framework defined in the SAMP document or a prior iteration to develop the individual AMP documents. Accordingly, the practice for risk-based AMPs appears to be relatively mature across the Water System divisions.

Guidehouse was not provided with comparable Power Systems Risk and Asset Management Plans. However, a review of the 2021 Power System Emergency Response Plan indicates Emergency Preparedness implemented a robust risk assessment process that includes threat and hazard identification and analysis, and applicable mitigation processes. Disaster Recovery is covered extensively in this plan. Guidehouse was not able to identify specific progress rates toward implementing risk assessment and management across all Power System facilities.

4.2.8 Annual Department Report of Preparedness

Guidehouse reviewed the 2022 Office of Emergency Management (OEM) Strategic Plan, which identified OEM as the collaborative partner responsible for "*integrat[ing] the principles of emergency management by identifying, developing, formalizing and assessing System emergency management plans, procedures, and activities of LADWP*" for all LADWP Water, Power, and Joint Systems, as well as City departments, partner agencies, and associations. The BCMP/BIA development process is incomplete, and the development of the risk

assessment process and risk mitigation toolsets are still in progress. OEM expressed resource shortages, including insufficient Emergency Preparedness/Management Coordinator (EP/MC) personnel as a significant factor that "*often results in gaps and the inability to meet OEM and System goals with specificity and timeliness of solutions to challenges facing the department,*" which impacted the development of the BCMP/BIA process.

Guidehouse reviewed the most current LADWP Water Infrastructure Plan (WIP), which provided an overview of current status of FY 2017/18 goals and projected goals for the FY 2018/19 timeframe for the primary Water System divisions and critical infrastructure. Guidehouse did not identify any significant discussion of Emergency Preparedness in this document.

Guidehouse reviewed the Power System Reliability Program Update (PSRPU) presentation which contained the FY 2019/20 report and the FY 2020/21 update. This report discussed the Power System objectives to address system reliability concerns through the implementation of proactive maintenance and infrastructure component replacements for the Generation, Transmission, Substation, and Distribution divisions. The PSRPU presentation indicated the four divisions were making good progress toward their targets in some areas, but lesser progress in others. These differentials may have been related to COVID-19 constraints on maintenance projects and the need to shift resources to operational activities. However, Guidehouse was not able to locate specific information relative to Power System Emergency Preparedness efforts, other than Strategic Planning documents ranging from 2016 through 2017, and Strategic Planning Objectives matrices (2017-2021) that indicated most Power System goals were "On Target" each year with very little other information.

4.2.9 Emergency Management Department Training Activities

Guidehouse reviewed the 2022 OEM Strategic Plan, which listed numerous training and emergency preparedness activities for individual business units. Guidehouse did not identify any significant issues with LADWP Emergency Preparedness training and considered the current personnel training program to be robust and comprehensive.

4.2.10 Emergency Response and Service Restoration Evidence

LADWP prioritized four emergency levels to provide an applicable measured response to implement emergency responses and service restoration activities:

- Level Normal
- Level 1 (Increased Workload/Light Storm)
- Level 2 (Severe Storm / Heavy Workload), and
- Level 3 (Complex Storm / Earthquake)

LADWP provided organization charts, and Levels of Response Personnel documentation that display the Water Emergency Command Center roles and the roles and responsibilities for Power System Control Centers. The Levels of Response Personnel document provides response protocols for Level 2 and Level 3 roles, and responsibilities for the Energy Control Center that indicated key emergency response and restoration roles are staffed and prepared to respond to identified emergencies and restore services across the LADWP service territory for Level 2 and Level 3 contingencies. LADWP Water and Power System Control Centers are staffed 24/7 to provide coverage for Level Normal and Level 1 contingencies.

Guidehouse reviewed the ETAS – Statement of Work and Deliverables, which contains a list of the statements of work (SOWs) for the ETAS including the following key items:

- Strategic Planning and Business Case Development Services
- Program and Project Management Services
- Systems Integration Services
- Technology Testing and Troubleshooting
- Digital Customer Experience Report

Guidehouse did not identify any work or deliverables specific to Security or Emergency Preparedness in the ETAS document, other than Operational Risk Assessment reports to identify and assess risks associated with enterprise technology programs in item b – "Program and Project Managed Services." The Department indicated the DR development work is occurring under the ETAS contract, and Guidehouse observes that additional documentation to codify the progress being made.

The Disaster Recovery Readiness Initiative Re-Bid document indicates some progress has been made toward developing a more robust BC/DR program for enterprise information systems, but Guidehouse was unable to verify the status of the ETAS work through documentation. Interviews indicated that it is a top priority and there has been progress in developing these plans and evidence.

4.3 Security and Emergency Preparedness Conclusions and Recommendations

From its assessment of LADWP's physical and cyber security and emergency preparedness as outlined in its physical and cyber security plans, emergency preparedness plans, and other documentation, Guidehouse concludes the following:

1) LADWP has made significant progress in many areas of improving its physical and cyber security programs by implementing executive-level positions to address security, an Enterprise Cyber Security Plan, risk criteria and physical risk assessments, and 24x7 threat monitoring.
2) In August 2021, LADWP brought on a new Chief Information Technology Officer, to whom the Executive Assistant to the GM for Enterprise Cybersecurity Services reports. The Director of Security Services, who oversees physical security, has remained under the Chief Administrative Officer (CAO), according to a March 2021 CAO Organization Chart. It is clear that there are additional plans for continued improvement in the areas of security and emergency preparedness.
3) The Department continues to annually update the Emergency Response Plan and Continuity of Operations Plan documents, but they are still working to establish a more detailed Business Continuity Management Program that incorporates a Business Impact Assessment. Hiring of experienced cybersecurity staff continues to be challenging because of civil service classifications, ambiguity around existing staff skillsets, and absent or incomplete succession planning.
4) LADWP has made significant progress in many areas of improving its emergency preparedness program by implementing detailed continuity plans to sustain and restore operation if a disruption occurs, including a complete BIA. Emergency preparedness

requires coordination across multiple groups and a robust set of operational documentation to guide teams in the event of various emergency situations. The Department can continue to improve in many areas including cross-functional collaboration, documentation, and ensuring that the enterprise Business Continuity groups have adequate resources to manage the program.

5) The ETAS contract that will further improve the emergency preparedness program is still in an early stage of deployment, largely due to delays in progressing the RFP, competing priorities, and limited dedicated staff.

Based on these conclusions, Guidehouse has developed the recommendations noted below for the continued improvement of the Department's security and emergency preparedness.

2022 Security and Emergency Preparedness Recommendations

Physical & Cyber Security

1. Guidehouse recommends LADWP continue to focus on the following 2015 Recommendations:
    a) Security Services and the Director of Cybersecurity work together to complete the Corporate Security Plan to design and implement necessary physical and cyber security protective measures and controls for all LADWP Water and Power Facilities and Cyber Systems.
    b) Guidehouse recommends LADWP review the current cybersecurity strategy, perform any updates, then develop and implement the cybersecurity plan.
    c) Guidehouse recommends Security and Emergency Preparedness continue to work with the Information Technology (IT) division to test and implement the Business Continuity Management Plan (BCMP)/ Disaster Recovery (DR) plans and the Business Impact Analysis (BIA) process across all Water and Power System Facilities.
    d) Guidehouse recommends Security continue developing its risk assessment process and implement risk assessments and mitigation plans to identify and mitigate physical security threats and vulnerabilities across all Water and Power System facilities.
2. Guidehouse recommends Security continue developing its risk assessment staff and processes to implement prioritized risk assessments and mitigation plans for all LADWP Water and Power System Facilities.
3. Guidehouse recommends Security move forward with its underlying strategic plan for establishing a corporate security framework. Once approved, Guidehouse recommends Security develop a phased and prioritized project plan to implement the corporate security framework across all LADWP Water and Power System Facilities to close critical security gaps.
4. Guidehouse recommends LADWP conduct a complete review of technical employee retention practices to reduce employee attrition and turnover. This should not deter employee professional growth.

Emergency Preparedness

5. Guidehouse recommends Security and Emergency Preparedness remain focused on the 2015 Recommendation to develop continuity plans and a BIA by continuing to (a) prioritize critical facilities, (b) test and implement detailed continuity plans to update BIA risk assessments across all Water and Power System Facilities, and (c) ensure timely restoration plans are created and maintained for each identified critical facility.
6. Guidehouse recommends LADWP Office of Emergency Management (OEM) personnel coordinate with Security and IT to ensure the Disaster Recovery planning process is finalized and implemented across all LADWP critical infrastructure and Water and Power System facilities.
7. Guidehouse recommends LADWP assign specific members of the OEM and IT teams with the responsibility to move forward with the Enterprise Technology Advisory Services (ETAS) and fully develop and implement the BCMP and its BIA and BC/DR components.
8. Guidehouse recommends LADWP develop an overall LADWP emergency scenario to integrate all business unit emergency plans and evaluate the effectiveness of enterprise LADWP emergency planning and response practices.
9. Guidehouse recommends OEM obtain and maintain sufficient staff to accomplish its strategic goals, including the completion of BCMP/BIA and DR project development and implementation across all LADWP Water, Power, and Joint Systems.
10. Guidehouse recommends LADWP integrate the ETAS Operational Risk Assessment reports into its overall enterprise risk assessment and mitigation process.

5. Support and Administration – Information Technology

Utilities today are confronted by numerous significant challenges that are calling into question legacy "ways of working" and long-standing assumptions around the operating model for delivering safe, reliable, and cost-effective service. While cost and operational efficiency are important considerations when thinking about changes to a utility's operating model, additional factors such as control, customer service, and overall effectiveness are key when considering how best to organize and operate a modern utility. LADWP is unique among most utilities as a government agency with represented (union) labor for both knowledge workers and management. While it is common to have represented employees within utilities, the majority of Information Technology (IT), knowledge workers, and management are typically not represented by a labor union.

Questions concerning the utility operating model are particularly important at the intersection of "people, process and technology." LADWP, like most utilities, faces significant IT investment needs in core areas of operation. In many instances, legacy systems are unable to handle the requirements associated with modern utility operations. In addition to causing bottlenecks in day-to-day operations, these systems and related business processes are often defined by unstable and poorly controlled workarounds and the inability to gather and optimize data for decision-making. Given these circumstances, technology investment is a top priority for many utilities in today's environment.

However, identifying, prioritizing, selecting, and maintaining the right technologies to align with strategic objectives is only one aspect of the IT challenge. Utilities must also determine optimal technology-related organization and staffing configurations to meet strategic objectives, including appropriate staffing levels and skills required to maintain and enable optimal operation of today's technology stack. The inability to manage and maintain legacy systems and the need to outsource significant aspects of maintenance to outside vendors can often increase risks that impact reliable delivery of service to customers.

Below, Guidehouse provides a requirements assessment related to insourcing strategic and limited tactical functions/roles in IT. In our experience, the state of the art for most utilities is to fully insource strategic functions while ensuring tactical functions have a primary liaison to the outsource vendor with sufficient backup.

In order to lead this review, Guidehouse performed an assessment of the Department's IT strategic plan to understand and evaluate the current state IT system infrastructure and future plans for IT investment. We also evaluated the current organization, staffing levels, and focus areas of LADWP's IT organization, with an eye toward understanding what functions/roles are outsourced today. Guidehouse reviewed the Monthly Major Project Status Reports and analyzed them for appropriate resource allocation. Further, Guidehouse held two interviews with the newly established Chief Information Technology Officer (CITO) and sought to understand the Department's plans for future improvement of IT project management and resource allocation. Current alignment or misalignment between the "people" and "technologies" (current and planned) are identified and recommendations are made regarding insourcing more critical and strategic IT roles.

5.1 Information Technology Division – Overview of Current State

The Department's IT Division is led by the Chief Information Technology Officer (CITO) and is divided into the following groups:

- Network, GIS, & Web Applications
- Data Center & Infrastructure
- Enterprise Cybersecurity Services
- Corporate Applications, ERP, & IT PMO
- Customer Billing & System Support
- Safety

This structure enables the Department to successfully manage, upgrade, and implement technology infrastructure for the Water, Power, and Joint Systems, but there remain a significant number of large ongoing and future implementations that are necessary to support the City's aggressive goals related to climate change. With these aggressive goals and the significant number of upcoming projects, prioritization and resourcing are becoming even more critical within the IT division. However, the CITO cites prioritization of projects as an ongoing challenge. There is little transparency regarding how projects are prioritized, and the first projects to be addressed are not necessarily those that are the most urgent. The CITO is striving to implement a more transparent and structured enterprise Project Management Office (PMO) and governance structure.

Long-term IT-related projects at LADWP in 2021 included 17 major projects and the CIS Upgrade project. Of these projects, four projects are considered multi-year and will extend into 2022. These projects include:

- New governance, risk and compliance software (October 2022)
- SharePoint Online (Q1 2022)
- Distribution Automation (Multi-year)
- Level Pay/Budget Billing Pre-Planning

These projects rely on both internal and professional service contractors due to their long-term nature and the subject matter expertise required. These professional service contractors assist with the completion of the project and then perform knowledge transfer to the LADWP employees.

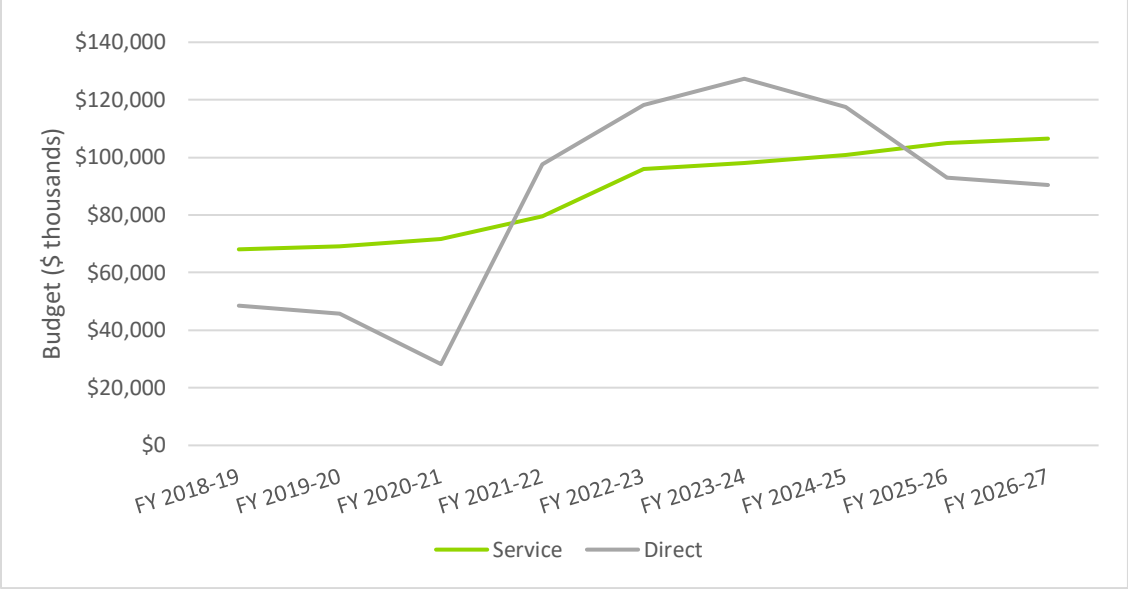
Professional services account for approximately 28% of the total LADWP IT labor budget for FY 2020/21 and increase to an estimated 57% in the FY 23/24 projected budget. Due to the represented nature of the LADWP labor force, it is often difficult for the Department to implement outsourcing, staff augmentation, and use of professional services. However, hiring and retaining the necessary internal staff has also been challenging. The IT department has observed and communicated numerous challenges related to insourcing:

- Required skillset unavailable within current workforce
- Hiring process lead times
- Inability to fill vacant positions
- Transient employees (due to promotions and lateral moves within LADWP)
- The need for temporary resources with specific skill sets to accommodate projects

The union representation of the labor force, which is common with civil service jobs, also creates the challenges for external candidate hiring and department employee retention. Hiring managers are required to seek internal candidates first, as either lateral moves or possible promotions before posting positions external to the LADWP. This creates long lead times to fill positions by first posting positions internally and then, if there are no qualified candidates, posting the positions externally. The number of vacancies allows the existing workforce flexibility in positions and provides the opportunity for a transient workforce that may move from job-to-job as permitted. While providing benefits of growth for the employee, this does not reduce the overall vacancy count and creates additional challenges for hiring managers as the vacant positions change without backfill.

Figure 5-1 illustrates DWP IT Full Time Employee Costs (Direct Costs) compared to the budgets for professional services (Services Costs). Services Costs are the budgets typically used for consultants and other non-LADWP labor.

Figure 5-1. Direct Costs Budget vs Service Costs Budget FY 2018/19 through FY 2026/27



Source: ITSD Trend Analysis FY 2018-19 through FY 2026-27

With the exception of FY 20/21, the direct costs budget is expected to exceed the services budget by ~20% in coming years, with the only noticeable future decline in 2025 – 2027.

5.2 Current Utilization of Outsourcing

Guidehouse identified IT-related staffing as a key consideration in the 2009 and 2015 IEA Surveys. In particular, in 2015 Guidehouse observed that “a more detailed Strategic IT Plan is necessary to transform and modernize the Department’s use of technology” and that “a central aspect of this strategic plan would include an approach to address current and potential staffing limitations, which may hinder the achievement of IT objectives.”

LADWP has historically utilized external contractors and consultants for longer term projects and when a specific skillset is required, to augment specific information technology-related tasks and job duties. Consultants are not generally engaged outside of projects and are not a viable option for staff augmentation. Typically, LADWP will utilize consultants (professional services)

when a specific IT skillset is required that is not available in-house and often when executing a capital project as described above. IT leadership also utilizes the expertise of vendor-available subject matter experts (SME). This professional service offered by manufacturers of IT hardware or software is utilized when the Department requires subject matter expertise for a particular hardware component or software that it has deployed. While outsourcing to vendor-available SMEs is a solution for specific single vendor issues, vendor-available SMEs may not provide an enterprise view for specific concerns.

A current example of a large-scale project using different types of resources is the Enterprise Resource Planning (ERP) project. ERP is large-scale technology package used for accounting and other critical business functions but is not involved in water or power management. The Department is using both outside professional services and a matrixed group of internal resources, as described above. Internal resources include 32 Infrastructure Technology Systems resources, 8 HR resources, 18 Financial resources, and 5 Procurement resources. According to the CITO, ERP is consuming most of the Department's IT PMO capabilities, leaving little time to implement other projects.

There are numerous drivers for insourcing IT—the desire to improve customer service, the need for improved controls, and cost reduction. However, there are also several challenges to moving certain functions "in-house." Specifically, ramping up the staff necessary to insource quickly and effectively can often be challenging, as can taking the necessary steps to ensure that internal staff have the necessary training and skills to support both ongoing operations as well as future goals. Finally, in some instances, insourcing can lead to higher costs (at least in the near-term).

Guidehouse observes that the Department's use of mixed resources to address the gaps in skillsets is aligned with industry standards, but its inability to use staff augmentation is not in alignment with industry standards. The Department can streamline the use of outside vendor resources by ensuring proper knowledge transfer throughout the project. Accordingly, the matrixed employees will have the requisite knowledge and skillsets to be able to help reduce the reliance on outside vendor resources once a project like ERP is fully implemented.

5.3 Considerations for Outsourcing

Outsourcing for companies is generally used for either temporary specialized staffing, projects that require additional personnel, or for staff augmentation. Typically, specialized staffing and project resource allotment are paired together. Staff augmentation generally results from either unavailability of appropriately trained staff or a temporary influx of workload that requires temporary staffing. Utilizing outsourcing for staff is generally straightforward due to the at-will nature of employees at most companies. However, when the knowledge workers and management are represented by labor unions, this can introduce additional hurdles for outsourcing. Resources for projects can be provided in two ways: utilizing a matrix of existing employees and experts or relying on external resources for the success of the project.

5.3.1 Matrix Approach

For the purposes of this report, a matrix approach is where employees report through one organization but work on projects in other organizations. Using matrix management has several benefits. These benefits include engaging existing employees into the project to become aware of new technologies and practices while the employee's position is backfilled using contract or temporary labor. Engaging employees in new projects with new technologies greatly increases the acceptance and "buy-in" of the technology because employees are aware of the current infrastructure and can participate in project decisions. New technology implementations

inevitably require staff level administration, so early participation by employees is critical. Matrix management for project resources does not eliminate the need for backfill of the employee's position. Generally, this backfill is accomplished through the use of temporary external resources. The tasks of the employee to be matrixed into the project must be well-documented and repeatable in order to minimize the onboarding time of the temporary resource and to be successful at utilizing matrixed resources for projects.

External resources can be used for projects regardless of if the project is implementing new technology or is updating existing technology. Some of the benefits of using external resources include current expertise for the technology being deployed, minimal startup time as compared to a matrix resource environment, and well-documented knowledge transfer. Conversely, utilizing external resources for projects removes the employees who will be required to administer the technology from the day-to-day project decisions and the initial technology implementation process. This will then require the internal staff to utilize knowledge transfer methods and runbooks to administer a new system without having the benefit of working with the technology during the initial design and build phases of the project.

In addition to project resources, outsourcing lends itself towards specific services, specific expertise, and predetermined tasks. Most companies will utilize specific services for technologies that have been introduced to the environment. For example, if a company utilizes Cisco network switches, the company can purchase support from Cisco at different levels. Even though this support is purchased through the technology vendor, it is still outsourcing of specific expertise. It is very common in today's technology environment for vendors to either build in technical service with the product regardless of how often the customer actually uses the technical service. Further, the vendors will offer professional services when expanding the systems or performing technical refreshes. Generally, this form of outsourcing is very easy to justify based on the licensing of technology and inclusion of Technical Support. Utilizing vendor-specific professional services for technology integration of multiple vendors can often be difficult due to the need to coordinate multiple vendor professional services.

Consultant technology experts have the diverse expert skills to understand the entire technology landscape when dealing with multi-vendor technology implementations. It is often very helpful at this level to utilize consulting experts to be able to understand the overall architecture landscape of the technology. The consultant is able to plan out and illustrate for the utility how the integrated technology could operate in benefit of the utility. Robust understanding of the technology implementations is key to planning how the technology will address the business requirements and justify the project or technology. After the architecture is understood and agreed upon, vendor experts or even staff augmentation can be utilized for the "run" portion of the project.

5.3.2 Staff Augmentation

Utilities typically undertake staff augmentation when they lack available and qualified resources, when full time positions are not funded or budgeted, or when there are an unexpected number of retirees and/or resignations.

The goal of a staff augmentation approach is to fill the positions quickly with qualified candidates that can begin useful and productive work with little onboarding effort. All these factors can be beneficial to a department that is lacking in expert resources. It is generally thought that staff augmentation will cost more than the individual permanent employees, however the fully loaded cost of utility employees (wage, benefits, sick, retirement, etc.), may be comparable to staff augmentation. Additionally, when the amount or type of work is temporary in nature, utilizing

staff augmentation allows for temporary expenditures while necessary and easy reduction of those expenditures when no longer necessary. Budgeting for external or outsourced resources can be achieved through either capital or O&M budgets, depending on the project or use of the resources.

5.3.3 Represented Employees

Most investor-owned utilities utilize a non-represented IT staff and management. Union employees are generally only found with employees working in the field or at control centers. The lack of represented employees and management allows for the use of external resources as needed by these utilities. The regulations around employee hiring and use of consultant or contractor labor is generally provided through the human resources department. While non-represented employees offer management a great deal of flexibility in using external resources and limiting permanent employees, a lack of representation does not afford the employees the benefit of collective bargaining.

Municipally-owned utilities utilize represented employees and management because of the civil service aspect of the utility. Unions offer employees and management a great deal of benefits through collective bargaining and representation but can introduce some obstacles when a temporary workforce might be necessary for the completion of a project or a maintenance effort. Generally, the hiring manager must first exhaust all internal candidates before seeking external candidates who are permanent employees and must consult with the union prior to contracting with a consultant or other non-permanent employee. Hiring lead times for permanent employees can be in excess of six months. If a utility has a large number of vacancies, this can create a situation where employees apply for other positions within the company. This type of movement enhances employee opportunity to move positions throughout the organization. The manager of the employee who moved, however, must now begin the process of filling the new vacancy. If this new vacancy is filled by an internal employee, the process repeats with no new net resource count increase. Because hiring managers must first post positions internally before considering external candidates and any temporary employment must be approved by the unions, there are rolling vacancies across the organization.

5.4 Insourcing and Outsourcing Constraints

Guidehouse observed several constraints when completing its IT staffing analysis to determine how the Department can better optimize the hiring of internal and external resources. First, hiring lead times and a transient workforce lead to vacant positions. Second, barriers around hiring temporary workers amplifies those vacancies by burdening employees and leaving skillset gaps unaddressed. Third, reporting consistent data around vacancies and existing skillsets within IT is a necessary foundation for supporting insourcing with workers with requisite skillsets. Addressing these issues in a systematic way will help IT to make informed decisions around contract and temporary resources and address its overarching staffing and skillset issues.

5.4.1 Transient Workforce and Hiring Lead Times

When internal employees fill job vacancies that were created due to a decrease in total employee headcount, either through retirement or other separation from DWP, total vacancies do not decrease. This adds pressure to fill vacant positions especially when outsourcing is not considered a viable alternative. As described above, the majority of the LADWP workforce is represented by unions, so employees enjoy the ability to explore alternate positions and career paths. A migration of any percentage of the workforce to another division will leave vacancies in

other areas, effectively rotating employee resources without lowering the total vacancy count. This problem is particularly acute for roles in the IT division because there is a significant amount of specialized technical knowledge required to operate certain systems. Additionally, the represented nature of employees deters the use of consultants and/or contractors for staff augmentation because temporary staff augmentation is required to be approved by the labor union for each contract. Further, the extended hiring lead time can result in a deficit of critical employees within a specific IT department.

Migration of employees between positions becomes a significant burden on entire groups, and the Department recognizes the need to reduce employee migration to the extent possible. The migration and movement of the employees is due the requirement of hiring managers to first consider internal candidates for either lateral or proportional opportunities unlike unrepresented workforce and management where external candidates could be preferred. When internal candidates have preference over external candidates and the number of vacancies is high, any movement to a new job posting does not result in net new head count and the manager where the internal candidate resigned must now begin the hiring process, resulting in many months delay to potentially adding to the total number of resources. The Service Desk group has the greatest turnover, and LADWP is currently reviewing options for employee retention within that group.

Lead times for new hires are typically two to three months within an organization. Currently lead times with the IT division at LADWP, however, are averaging about six months. The requirement to prioritize internal hiring limits opportunities to decrease overall vacancies. Further, longer lead times result in negative outcomes such as external candidate loss and internal candidates seeking different opportunities. Finally, in a fast-paced environment requiring specialized skills such as technology, long hiring lead times reduce LADWP's ability to adapt quickly to changing technologies.

5.4.2 Barriers to Hiring Temporary Workers

LADWP currently utilizes consultants to implement large capital projects and to train existing employees when transitioning project to "run" or "maintenance" mode. Consultants are not typically engaged to fill temporary resource needs for non-project subject matter experts. Due to the role of the labor unions, LADWP must consult with the union for the use of temporary workers. This is highly unusual within the industry when a specific technical skillset is needed. To that end, Guidehouse did not observe any evidence of the use of temporary workers at this time. It is imperative for an IT Department to be able to modify staffing as needed to ensure business continuity and seamless operation of critical systems.

It is more feasible to limit the use of consultants and contract labor with a less transient workforce, which LADWP does not currently have. Further, limiting the ability to utilize temporary SMEs increases the overall workload and incentivizes over-burdened individual contributors to seek new positions, amplifying the vacancy cycle. Within operational IT, there are often tasks that, while important, are often neglected due to lack of resources. These tasks receive low priority and are often not completed. These tasks, and other important similar tasks, benefit from a temporary workforce who can perform the task, complete any required documentation, and hand over to the operational organization a completed, well documented task. This knowledge transfer from the consultant to the DWP knowledge workers allows for the practical use of special expert consultants – provided effective knowledge transfer is completed.

5.4.3 Consistent Reporting on Vacant Positions

Consistent data and reporting around (a) cost comparisons of internal employees and contract labor, (b) employee vacancies, and (c) employee skillsets are key components of a supportable analysis of insourcing and outsourcing labor. The Department has not completed cost analysis comparing the fully loaded labor rate of an LADWP permanent employee versus a consultant or contractor. Typically, the fully loaded rate for a permanent employee is greater than two times the wage rate due to benefits, sick leave, and vacation. Consideration for the fully loaded rate of an LADWP employee versus temporary expert labor may provide initial cost savings and reduce the burden of off-cycle maintenance tasks provided sufficient negotiation may be performed with the unions.

The Department has been reporting on vacancies, but the reporting structure has recently changed. For FY 21/22, LADWP has increased budgeted positions in IT from 610 to 705 positions. While this will allow filling necessary positions and allow for more insourcing of technology experts, last year's quarterly technology modernization updates cited an average vacancy rate of 105 positions while the budgeted headcount was 610 positions.

Table 5-1. Calendar Year 2021 Technology Modernization Updates

	Q1	Q2	Q3	Q4
Budgeted Positions	613	613	610	705
Vacancies	95	112	108	

Source: ITSD Trend Analysis FY 2018-19 through FY 2026-27

The 'Technology Modernization Updates' are published quarterly on a calendar year; however, all budget data is based on fiscal year (e.g., FY 21/22). Data for the Q4 Technology Modernization Update was inconclusive due to those changes in the reporting format; however, the February 2022 report published that ITS filled 137 vacancies and may have resulted in only 66 vacancies for the Q4 report. Each of these quarterly reports, except for the February 2022, included:

- Number of funded positions
- Number of vacancies
- Number of hiring packages
- Status and placement of overfill

While these quarterly reports provide additional information on projects and other relevant IT concerns, the vacant positions are highlighted at the beginning of each presentation. Moreover, inconsistent reports do not allow for tracking of the vacancy data and may not provide a full view of the hiring initiatives. There were three quarterly reports from 2021 that presented information on staffing in January, April, and September. The next report was produced in February 2022, and there were differences in metrics such that Guidehouse is unable to truly compare the vacancy information. For example, the February 2022 report does not display the number of funded positions, does not include how many vacancies are still open and does not show the projects that were coming due at the end of the year. Instead, the February 2022 report focuses more on recruitment efforts. Reporting should be consistent and include such metrics as:

- Number of vacant positions at beginning of reporting period
- Additional positions added due to budget increase/project needs etc.

- Number of positions filled by internal candidates
- Number of net new vacant positions due to employee movement
- Number of positions filled by external candidates
- Current number of vacancies

Consistent reporting will provide hiring managers and leadership insight into the trends around workforce management.

Skills analysis is critical to understanding the needs of vacant positions as well as any required contract labor. To date, the Department has been unable to conduct a successful skills analysis due to union constraints. Data regarding skillsets and technical qualifications would provide important insight into whether positions could be insourced with existing LADWP employees, externally hired into LADWP, or outsourced using the contract labor methods described above. Maintaining data on technical expertise including any technical certifications and/or training and updating that data on a yearly basis is a best practice.

5.5 IT Conclusions and Recommendations

From its assessment of insourcing and outsourcing for LADWP's IT division as outlined in its IT budgets, technology modernization reports, interviews, and other documentation, Guidehouse concludes the following:

1. Long lead times for new employees, a transient workforce, and the inability to implement temporary staff augmentation requires LADWP to view insourcing of subject matter experts as a path for resolving the current challenges of SME outsourcing.
2. In August 2021, LADWP brought on a new Chief Information Technology Officer. It is clear that there are additional plans for continued improvement in the area of technology staffing, including decisions around insourcing and outsourcing staff.
3. The Department utilizes vendor support and contractors where available for many projects. Guidehouse recommends that the Department continue utilizing vendor support where available and viable, and to consider knowledge transfer as a key component of each capital project.
4. Until the open position vacancies are reduced to a minimal level (<20), LADWP would benefit from exploring the use of temporary SME implementations for a defined set of circumstances including break/fix, critical need, and reduction of overall backlog of IT documentation and maintenance issues.

Based on these conclusions, Guidehouse has developed the recommendations noted below for the continued improvement of the Department's security and emergency preparedness.

2021 IT - Support and Administration Recommendations
1. Address serious staffing deficiencies and skill gaps. Conduct a workload/workforce balancing analysis to establish the necessary skillsets for ongoing and future IT projects and to validate IT employee skillsets and certifications. The outcome of this analysis should be a firm understanding of skillset deficits within the division.
2. Maintain a list of qualified consultant Subject Matter Experts (SMEs) that can fulfill identified skillset gaps and implement Service Level Agreements (SLA) where possible to provide technology specific SMEs for break/fix and/or compliance issues. These same consultants could provide augmentation for overdue technical housekeeping such as documentation management and updates or other low priority tasks.
3. Review the IT hiring process to determine where delays can be mitigated, potentially through proactive backfilling.
4. Establish an employee retention program to determine the divisions most affected by transient employees and develop methods or incentives to encourage employee retention, particularly in areas requiring unique skillsets.
5. Perform a cost analysis of fully loaded employee costs compared to temporary consultant labor, including the impact of turnover.
6. Establish documented processes for knowledge transfer as a critical component of any IT project, to bridge any gaps left by temporary consultants or transient staff.

6. Key Performance Indicators

The Board approved performance metrics (Rates Metrics) in the 2016 Rate Action to establish Key Performance Indicators (KPIs) and corresponding targets and variances that represent the Department's acceptable progress toward its operational, financial, strategic, and policy goals. This performance reporting structure is consistent with the current trend in utility operations and practices statewide to tie utility investments and programs to their impact on rates.

The Department has identified and defined 59 metrics for FY 21/22 applicable to the Water, Power and Joint Systems, and each is tied to the relevant water or power rate component it impacts. For example, four metrics are designed to measure annual spending and project completion progress against plan related to the key projects contributing to the Water Infrastructure Adjustment Factor component of water rates, including fixed asset replacement spending and mainline, trunk line, and meter replacement against plan. In addition, the Department tracks progress against 15 equity metrics across four major categories.

As defined in the Water and Electric Rate Ordinances, the Department's Office of Corporate Performance gathers the information on these metrics and reports to its Board in February and August of each year on 1) the Rates Metrics and results; 2) Rates Metric targets; 3) variance of actual performance from the target; 4) the Department's explanation of the cause of the variance; and 5) if necessary, a proposed mitigation plan to address variances outside of the established acceptable range. The Ratepayer Advocate receives quarterly updates on the Rates Metric results and can provide its own assessment and recommendations to the Board on this topic.

Based on the semi-annual report reviewing the period ending April 2021, the Department has met or exceeded most (63%) of the goals tracked in the Rates Metrics.[69]

Based on our review of the current set of metrics, the metrics are working as intended and are being updated to reflect the changing focuses of the Department and to provide targeted information on performance against plan to the Ratepayer Advocate. Given that the metrics are continually reviewed by the Department's Office of Corporate Performance and the Ratepayer Advocate, the changes recommended in this report are limited. All of the current metrics are summarized below along with any potential recommended additions and reductions. However, we understand that any change to the Rates Metrics would require alignment between the Department and the Ratepayer Advocate, and ultimately Board consideration and approval.

6.1 Water

As noted above, the Water metrics were reviewed in FY 2021/22 and several changes were made, including removing the pump station and regulator station spending against plan due to small impact on Water Infrastructure Cost Adjustment, removing the tracking of groundwater production until it represents a larger portion of supply, and adding an additional metric on the number of Water Distribution field staff hired against plan to provide additional insight on staff dedicated to Mainline replacement, which has targets that are increasing substantially over the next several years. Guidehouse agrees with these changes and notes the potential for removing a few additional metrics related to spending on the Los Angeles Aqueduct. As noted in the Interim Rate Review, these metrics are not a priority for the Department to track and any

[69] *LADWP Rates and Equity Metrics Semi-Annual Report*, August 2021. **https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB766652&RevisionSelectionMethod=LatestReleased**

significant deviations in spending would be noted in other metrics that monitor overall spending on water supply sources. Guidehouse also proposes tracking an additional metric related to water loss, specifically the number of leaks per 100 miles of pipe. This metric will provide additional insight on the mitigation of water loss and the replacement of deteriorating mainline assets.

Table 6-1. Water Key Performance Indicators and Recommendations

Water Key Performance Indicators	Recommendation
Number of Full Time Equivalents (FTEs) for Water Distribution dedicated to Infrastructure field positions as compared to plan	No change; recently added – will provide additional insight on Water Distribution hiring, which is critical to increasing mainline replacement
Water Supply Costs Budget vs. Actual ($M) for Capital	No change; informs Water Supply Cost Adjustment
Water Supply Costs Budget vs. Actual ($M) for O&M (excluding Purchased Water costs)	No change; informs Water Supply Cost Adjustment
Annual quantity of purchased water in acre-feet (AF) vs. Plan	No change; informs Water Supply Cost Adjustment
Annual quantity of recycled water delivered vs. Plan (AF)	No change; informs Water Supply Cost Adjustment
Stormwater system capacity Milestones vs. Plan (AF)	No change; informs Water Supply Cost Adjustment
Budget vs actual ($M) for Aqueduct refurbishment capital	Consider removing; as discussed during the Interim Rate Review, any deviations in budget would be covered in monitoring overall water supply costs
Budget vs actual ($M) for Aqueduct refurbishment O&M	Consider removing; as discussed during the Interim Rate Review, any deviations in budget would be covered in monitoring overall water supply costs
Level of water conservation vs. Target (GPCD)	No change; informs Water Supply Cost Adjustment
Budget vs actual ($M) for fixed assets replacement	No change; informs Water Infrastructure Cost Adjustment
Assets replaced vs Plan (Feet of mainline)	No change; informs Water Infrastructure Cost Adjustment
Assets replaced vs Plan (Feet of trunk line)	No change; informs Water Infrastructure Cost Adjustment

Water Key Performance Indicators	Recommendation
Assets replaced vs Plan (Number of meters)	No change; informs Water Infrastructure Cost Adjustment
Total Water Quality Budget vs. Actual ($M) for capital	No change; informs Water Quality Cost Adjustment
Total Water Quality Budget vs. Actual ($M) for O&M	No change; informs Water Quality Cost Adjustment
Owens Lake O&M Budget vs. Actual expenses	No change; informs Owens Valley Cost Adjustment
NEW - Water Leaks per 100 miles Actual vs. Target	Guidehouse recommended new metric; to inform performance of mainline replacement program

6.2 Power

The Power System metrics were reviewed in FY 2021/22 in Resolution No. 022 040; the metrics were deemed to be on track and a few key changes were made. There was the removal of the "Cost per mile of underground circuits" metric, adopted under Resolution No. 016-157, as the underlying project is expected to be completed by the end of FY 2020/2021. There was the addition of a new Power labor-related metric, "Number of Full Time Equivalents (FTEs) for Power Distribution field positions as compared to plan," with the intention of reducing vacancies for the Power Distribution field positions to 443 vacancies or less by the end of the fiscal year and supporting hiring and retention practices for the power system. Resolution No. 022 040 also adds two Power System metrics, the "Distribution Automation Project total spending against plan" and the "Distribution Automation Project progress against schedule." Guidehouse recommends adding one new metric for LADWP, Reliability Performance vs PSRP targets (SAIFI, SAIDI, CAIDI), which is different than the similar metric in the equity section which was added to track reliability metrics for segments of its distribution system serving customers designated as located within equity areas. This new target will track the progress which LADWP is making against the PSRP targets specifically.

Guidehouse agrees with the changes made effective by Resolution No. 022 040; however, Guidehouse also notes that due to the aggressive goals for the city for transitioning to renewable energy, Guidehouse recommends that the Power System focus on a few key areas, as they relate to the metrics in the table below:

- Operation & Maintenance per kWh or customers served (transmission and distribution)
- PSRP actual versus budgeted spending per major category (generation, transmission, and distribution)
- Unit costs (Underground, overhead, and substations)
- Reliability performance versus target (SAIFI, SAIDI, and CAIDI)
- RPS Targets
- Hiring and retention of staff

Guidehouse makes no recommendations to change the current set of metrics beyond the addition described above.

Table 6-2. Power Key Performance Indicators and Recommendations

Power Key Performance Indicators	Recommendation
Average cost of training per Electric Distribution Mechanic Technician (EDMT) trainee	No change, aligns with the Reliability Cost Adjustment Factor
Average cost of training per Electrical Mechanic Technician (EMT) trainee	No change, aligns with the Reliability Cost Adjustment Factor
Number of Electric Distribution Mechanic Technician (EDMT) trainee graduates against Power System Training Plan	No change, aligns with the Reliability Cost Adjustment Factor
Number of Electrical Mechanic Technician (EMT) trainee graduates against Power System Training Plan	No change, aligns with the Reliability Cost Adjustment Factor
Number of Full Time Equivalents (FTEs) for Power Distribution field positions as compared to plan	No change
Renewable Portfolio Standard (RPS) Percentage (%)	No change, aligns with the Energy Cost Adjustment Factor
Total RPS Cost ($/MWh) vs. Plan, Wind	No change, aligns with the Energy Cost Adjustment Factor
Total RPS Cost ($/MWh) vs. Plan, Solar	No change, aligns with the Energy Cost Adjustment Factor
Total RPS Cost ($/MWh) vs. Plan, Geothermal	No change, aligns with the Energy Cost Adjustment Factor
Last signed power purchase agreement (PPA) ($/MWh) by technology (wind)	No change, aligns with the Energy Cost Adjustment Factor
Last signed PPA ($/MWh) by technology (solar)	No change, aligns with the Energy Cost Adjustment Factor
Last signed PPA ($/MWh) by technology (geothermal)	No change, aligns with the Energy Cost Adjustment Factor
Budget vs actual ($M) for capital in the Generation budget	No change, aligns with the Reliability Cost Adjustment Factor
Budget vs actual ($M) for capital in the Transmission budget	No change, aligns with the Reliability Cost Adjustment Factor
Budget vs actual ($M) for O&M in the Transmission budget	No change, aligns with the Reliability Cost Adjustment Factor

Power Key Performance Indicators	Recommendation
Budget vs actual ($M) for capital in the Substation budget	No change, aligns with the Reliability Cost Adjustment Factor
Budget vs actual ($M) for O&M in the Substation budget	No change, aligns with the Reliability Cost Adjustment Factor
Budget vs actual ($M) for capital in the Distribution budget	No change, aligns with the Reliability Cost Adjustment Factor
Budget vs actual ($M) for O&M in the Distribution budget	No change, aligns with the Reliability Cost Adjustment Factor
Number of fixed assets replaced against plan for critical Distribution assets (Transformers)	No change, aligns with the Reliability Cost Adjustment Factor
Number of fixed assets replaced against plan for critical Distribution assets (Poles)	No change, aligns with the Reliability Cost Adjustment Factor
Number of fixed assets replaced against plan for critical Distribution assets (Crossarms)	No change, aligns with the Reliability Cost Adjustment Factor
Number of fixed assets replaced against plan for critical Distribution assets (miles of Cable)	No change, aligns with the Reliability Cost Adjustment Factor
Average Unit Cost per Transformer	No change, aligns with the Reliability Cost Adjustment Factor
Average Unit Cost per Pole	No change, aligns with the Reliability Cost Adjustment Factor
Average Unit Cost per Crossarm	No change, aligns with the Reliability Cost Adjustment Factor
Average Unit Cost per Mile of Cable	No change, aligns with the Reliability Cost Adjustment Factor
Distribution Automation Project total spending against plan	No change
Distribution Automation Project progress against schedule	No change
Green House Gas (GHG) emissions reduction ratio	No change, aligns with the Energy Cost Adjustment Factor
Energy Efficiency (EE) ratio (%)	No change, aligns with the Energy Cost Adjustment Factor
Budget vs actual ($M) for the overall EE portfolio	No change, aligns with the Energy Cost Adjustment Factor
Levelized EE program costs ($/kWh)	No change, aligns with the Energy Cost Adjustment Factor

Power Key Performance Indicators	Recommendation
New - Reliability Performance vs PSRP targets (SAIFI, SAIDI, CAIDI)	Guidehouse recommended new metric; Intentionally track progress LADWP is making with the PSRP program.

6.3 Joint

In an effort to reduce ITS vacancies to 50 or less by the end of the fiscal year and support hiring and retention practices, Resolution No. 022 040 added a Joint System labor-related metric, “Number of Full Time Equivalents (FTEs) for Information Technology Services (ITS) as compared to plan.” Resolution No. 022 040 also creates two additional Joint System information technology-related metrics: the "Budget vs. Actual ($M) for Cyber Security Capital Projects" and the "Budget vs. Actual ($M) for Customer Information System (CIS) Upgrades, Enhancements and System Integrations" metrics. The projects tracked by these metrics are priorities for the LADWP's information technology strategy.

Guidehouse does not deem that any further Joint System metrics are necessary at this time.

Table 6-3. Joint System Key Performance Indicators and Recommendations

Joint Key Performance Indicators	Recommendation
Human Resources Total FTEs Against Plan	No change, aligns with hiring and retention goals
Financial and Human Resources Replacement Project Total Spending Against Plan	No change, aligns with hiring and retention goals
Financial and Human Resources Replacement Project Progress Against Schedule	No change, aligns with hiring and retention goals
Budget vs Actual ($M) for Cyber Security Capital Projects	NEW per Res. NO. 022 040
Budget vs Actual ($M) for Customer Information System (CIS) Upgrades, Enhancements and System Integrations	NEW per Res. NO. 022 040
Number of Full Time Equivalents (FTEs) for Information Technology Services (ITS) as compared to plan	NEW per Res. NO. 022 040
LADWP Employee Cost Budget vs. Actual ($M)	No change, aligns with budget
Total Number of Water Distribution Employees per Water Customer Meter	NEW per Res. NO. 022 040
Total Number of Power Distribution Employees per Power Customer Meter	NEW per Res. NO. 022 040
Total Number of Water and Power Employees per Customer Meter	No change, aligns with hiring and retention goals

6.4 Equity

In August 2016, the LADWP Board approved Resolution No. 017-036, establishing LADWP's Equity Metrics to assess the Department's efforts to serve all customers with fairness and equity. Since their creation, the Corporate Performance Group has been responsible for tracking and reporting against the Equity Metrics.

In October 2020, the LADWP Board reaffirmed the metrics and requested that the Department expand them and relate them to performance goals. Further, the Board led outreach efforts by organizing two stakeholder meetings to gain input into enhancing the Equity Metrics. During the meetings, the external stakeholders were active participants and provided key insights into the Equity Metrics, including methods of enhancing communications within their communities. Based on the feedback gathered during the meetings, the Department developed 25 recommended actions and new metrics for consideration, though these new metrics have not yet been formally accepted and incorporated.

The Department also shared a web-based data visualization mapping tool with external stakeholders. The tool enables stakeholders to view data geographically, interact with the data, and analyze the progress and impact of the Equity Metrics in their communities.

In 2021, the Department hired its first Chief Diversity, Equity, and Inclusion Officer to oversee the Workforce Development, Supplier Diversity, Community Engagement & Economic Development, Equity Metrics, and UPCT Program Administration divisions. The Department expects that this position will lead the effort on proceeding with the external stakeholder recommendations on the Equity Metrics. Guidehouse agrees that the Department should implement the recommendations from the external stakeholders to the extent practicable and offers the following recommendations on the existing Equity KPIs. Accordingly, Guidehouse recommends no change at this time. Given the flux associated with ongoing onboarding of the new Chief DEI Officer on these metrics and delegating responsibilities as appropriate, Guidehouse recommends that the subsequent IEA survey reconsider the Equity Metrics and any additions made on the basis of external stakeholder feedback.

Table 6-4. Joint Key Performance Indicators and Recommendations

Equity Key Performance Indicators	Recommendation
Water Quality Complaints	No change.
Water System probability of Failure & Planned Replacement	No change.
System Average Interruption Duration Index (SAIDI) & System Average Interruption Frequency Index (SAIFI)	No change.
Power System Reliability Program - Pole, Transformer, Cable Replacements	No change.
Rain Barrel/Cistern/Water Tank Rebates	No change.
Turf Removal Rebates	No change.
Tree Canopy Program – City Plants	No change.
Commercial Direct Install	No change.
Home Energy Improvement Program (HEIP)	No change.
Refrigerator Exchange Program	No change.
Consumer Rebate Program	No change.
Electric Vehicle Infrastructure	No change.
Low Income & Lifeline Programs Discount Metric	No change.
Procurement	No change.
Personnel	No change.

6.5 Recommendations for Summary Metrics

As shown above, numerous metrics are tracked and reported to the Board on a bi-annual or more frequent basis. In addition, metrics are tracked and reported in other places as well, including the Mayor's Open Portal and individual KPI reports produced by the Power, Water, and Joint systems. The Board and executives at the Department may benefit from a leadership dashboard that presents the results of a few key metrics for each system. Suggested metrics for this summary could largely be pulled from the existing reports and could include:

- O&M spending per customer served (Power, Water, and Joint)
- PSRP replacement actual vs. budget for each major category (generation, transmission and distribution)
- Reliability performance vs. target (SAIFI, SAIDI, CAIDI)
- RPS Percentage actual vs. target
- Water infrastructure spending actual vs. budget for each major category (mainline, trunk line, meters)
- Water Leaks per 100 miles Actual vs. Target

7. Conclusions

The 2022 IEA Survey provides an operational and strategic assessment of the Water, Power, and Administrative Infrastructure at the Department. Guidehouse's major findings from the assessment are highlighted below. Throughout the Survey, we recognize the significant challenges currently facing the Department as it pursues a goal of 100 percent clean energy, modernizes the power supply and delivery infrastructure, seeks secure and diverse water supplies, and contends with retirement, procurement, and budget constraint issues. In this challenging environment, Guidehouse identified several notable achievements:

- The Department has a comprehensive long-term water supply strategy that considers the impacts of climate change and includes significant investments over the next 20 years to increase local water supply through Operation NEXT, groundwater storage, stormwater capture, and conservation. The Department has also committed significant resources to tracking and mitigating water loss in the City's distribution system through the formation of the Water Loss Task Force and Action Plan.
- The Water System has improved its Asset Management strategy and planning documentation since the last Survey with an established Steering Committee that meets regularly and approved Policy, Strategy, and Asset Management Plans for each major asset type.
- LADWP continues to take significant steps to decarbonize its power generation portfolio through various clean energy initiatives, including eliminating coal-fired generation, expanding renewable energy, developing energy storage systems, investing in distributed energy resources such as solar photovoltaics, and encouraging a switch to electric vehicles. These strategies have significantly reduced GHG emissions and are the building blocks for the City of Los Angeles' clean energy future.
- LADWP has made substantial progress in reducing wildfire risk to its system through the application of prudent and methodical measures across its service area through capital investment, operations and maintenance, and programmatic procedures and policies.
- In August 2021, LADWP brought on a new Chief Information Technology Officer. It is clear that there are additional plans for continued improvement in the areas of cybersecurity threat monitoring and response and technology staffing, including decisions around insourcing and outsourcing work.
- LADWP has made significant progress in many areas of improving its physical and cyber security programs by implementing executive-level positions to address security, an Enterprise Cyber Security Plan, risk criteria and physical risk assessments, and 24x7 threat monitoring.
- LADWP has made significant progress in many areas of improving its emergency preparedness program by implementing detailed continuity plans to sustain and restore operation if a disruption occurs.

While Guidehouse recognizes the improvements made by the Department, Guidehouse also observed a number of global issues that challenge the Department's ability to execute ongoing and planned activities, including:

- **Hiring and Staffing:** The Department faces challenges around hiring and retention of employees due to civil service practices and union representation. Accordingly, every area that Guidehouse analyzed reported issues related to hiring appropriate skillsets,

outsourcing unavailable skillsets, retaining quality employees, and other hiring and staffing concerns. These concerns are amplified by the massive ongoing and future infrastructure projects the Department plans to undertake

- **Aging infrastructure:** Infrastructure is aging in both the water and power systems, which could impact service reliability and long-term costs if not appropriately addressed.
- **Capital Program Size and Complexity:** The sheer size and complexity of the capital programs required to address the obligations driven by sustainability targets, regulatory change, and aging infrastructure pose significant challenges to the Department. Many of the capital programs lack detailed implementation plans and will demand significant program management acumen.
- **Information Technology Infrastructure:** Ongoing and future IT projects necessitate skillsets and personnel requirements that are beyond the Department's current capacity. The continued use of consultants in these areas, paired with documented processes for knowledge transfer to build up Department expertise over time, will be the most prudent approach to fill this gap.
- **Equity:** As the Department moves forward with transformative efforts such as LA100, it will be critical to consider social and environmental impacts to ensure equity in the distribution of burdens and benefits to LADWP communities throughout project planning and implementation. Initiatives such as the LA100 Equity Study will be essential to this effort.
- **Public Trust:** Recent FBI and DOJ indictments have undermined public trust and may hinder the Department's ability to carry out its strategic objectives.

Following the 2015 IEA Survey, Guidehouse recommended that the Joint Administrators collaborate with LADWP's Corporate Performance group to oversee progress against recommendations. While the program management practices implemented were a significant improvement on previous IEA Surveys, the process should be further refined in response to this survey. Guidehouse recommends implementing process rigor, accountability, and standard work for progress reports to mature the Department's implementation of IEA Survey Recommendations. Further, the Department should report on progress each year following the publication of this 2022 IEA Survey, including the year of a new IEA Survey, rather than suspend tracking for that year. By doing so, in the next iteration of the IEA Survey, the survey team will be able to review the most updated progress information to-date to assess progress against 2022 recommendations.

We believe the findings and subsequent recommendations made for each focus area of the 2022 IEA Survey can help the Department overcome obstacles to execution of critical, transformative projects discussed in this report. Major recommendations revolve around developing robust program management, detailed project plans, and staffing plans to meet the transformational goals set forth for the Department; implementing and maintaining the supporting infrastructure and systems to deliver on the current transformational plans, including IT systems, data collection, asset management, and others; improving documentation, reporting, and accountability; and establishing an enterprise approach to risk management and threat identification and mitigation. The Department is aligned on working to implement goals that will mitigate the impacts of climate change on its operations and its customers. To do so, the Department must transform those goals into concrete plans that can be staffed and implemented in a cost-effective, equitable, and comprehensive way.

Interview List

Interviewee Titles
Joint Administrator – Office of the Chief Legislative Analyst
Joint Administrator – Office of the Mayor
Joint Administrator – Officer of the Controller
General Manager
Senior Assistant General Manager – Power System, Engineering, Planning, & Technical Services
Senior Assistant General Manager – Power Construction, Maintenance, & Operations
Deputy Senior Assistant General Manager - Power Transmission and Distribution Division
Senior Assistant General Manager – Water System
Senior Assistant General Manager – Corporate Services
Senior Assistant General Manager of External and Regulatory Affairs; Chief Sustainability Officer
Interim Chief Administrative Officer
Chief Financial Officer
Chief Diversity, Equity, and Inclusion Officer
Chief Information Technology Officer
Director of Corporate Performance
Director of Power Engineering and Technical Services Division
Director of Power Resource Planning, Development, and Programs Division
Director of Power Transmission Planning, Regulator, and Innovation Division
Director of Power System Energy Control and Grid Reliability Division
Director of Power Construction and Maintenance Division
Director of Water Engineering & Technical Services (WETS)
Director of Water Distribution
Director of Water Operations
Director of Water Resources
Director of Security Services
Asst Director of Information Systems II - Network, GIS and Web Applications
Asst Director of Information Systems II - Data Center & Infrastructure
Power Project Management & Controls Lead
WETS – Asset Management/Capital Improvement Program Lead
Water Operations – Aqueduct Conservation & Northern District Operations Lead
Emergency Preparedness Coordinator
Manager of CIP Compliance

Acronym Glossary

Acronym	Definition
AB	Assembly Bill
ACE	Area Control Error
Action Plan	Water Loss Task Force Action Plan
ADMS	Advanced Distribution Management Systems
AF	Acre-Feet
AFY	acre-feet per year
AGC	Automatic Generation Control
AM	Asset Management
AMG	Asset Management Group
AMP	Asset Management Plans
AMSC	Asset Management Steering Committee
ATRW	Advanced Treated Recycled Water
AVEK	Antelope Valley-East Kern
AWWA	American Water Works Association
BA	Balancing Area; Balancing Authority
BC	Business Continuity
BCMP	Business Continuity Management Plan
BES	Bulk Electric System
BIA	Business Impact Analysis
BTM	Behind-the-Meter
CAO	Chief Administrative Officer
CESP	Community Energy Storage Program
CIP	Capital Improvement Program (in Section 2.2.1 only)
CIP	Critical Infrastructure Protection
CIS	Customer Information System
CITO	Chief Information Technology Officer
CMMS	Computer Maintenance Management System
CNRA	California Natural Resources Agency
COOP	Continuity of Operations Plan
CPMO	Corporate Program Management Office
CPS	Construction Productivity System
CPUC	California Public Utilities Commission
CY	Calendar Year
DDW	Department of Drinking Water
DER	Distributed Energy Resources
DERIS	Distributed Energy Resource Integration Study

Acronym	Definition
DERMS	Distributed Energy Resource Management Systems
DMS	Distribution Management System
DOJ	Department of Justice
DPR	Direct Potable Reuse
DR	Disaster Recovery
DUMA	Digital Utility Maturity Assessment
DWR	Department of Water Resources
EAP	Emergency Action Plan
EE	Energy Efficiency
EP/MC	Emergency Preparedness/Management Coordinator
ERP	Emergency Response Plan
ERP	Enterprise Resource Planning (in Section 5 only)
ETAS	Enterprise Technology Advisory Services
FBI	Federal Bureau of Investigation
FRAP	Fire and Resource Assessment Program
FTE	Full Time Equivalent
FY	Fiscal Year
GCM	Global Climate Models
GDAP	Groundwater Development and Augmentation Plan
GFMAM	Global Forum on Maintenance and Asset Management
GIS	Geographic Information System
GO	General Order
GPCD	gallons per capita per day
GRC	Governance, Risk, and Compliance
HFTD	High Fire Threat District
HLTL	Haiwee to Los Angeles Transit Loss
HRDERP	Human Resource Division Emergency Response Plan
Hyperion WRP	Hyperion Water Reclamation Plant; Hyperion
IEA	Industrial, Economic, and Administrative
IPP	Intermountain Power Project
IPR	Indirect Potable Reuse
IROL	Interconnection Reliability Operating Limits
ISO	International Standards Organization
IT	Information Technology
ITA	Information Technology Agency
ITSD	Information Technology Services Division
KPI	Key Performance Indicator
LA100	Los Angeles 100 Percent Renewable Energy Study

Acronym	Definition
LAA	Los Angeles Aqueduct
LAAFP	Los Angeles Aqueduct Filtration Plant
LAASM	Los Angeles Aqueduct Simulation Model
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power; the Department
LAFD	Los Angeles Fire Department
LASAN	Los Angeles Sanitation and Environment
LAX	Los Angeles World Airport
LiDAR	Light Detection and Ranging
LRA	Local Responsibility Area
LTA	Long-Term Transmission Assessment
MLR	Mainline Replacement
MWD	Metropolitan Water District
NERC	North American Electric Reliability Corporation
NREL	National Renewables Energy Laboratory
O&M	Operations and Maintenance
OEIS	Office of Energy Infrastructure Safety
OEM	Office of Emergency Management
Operation NEXT	Operation NEXT Water Supply Program
OTC	Once Through Cooling
PBSD	Performance-Based Seismic Design (PBSD)
PCM	Power Construction and Maintenance
PMO	Project Management Office
POU	Publicly Owned Utilities
PPA	Power Purchase Agreements
PSERP	Power System Emergency Response Plan
PSPS	Public Safety Power Shutoff
PSRP	Power System Reliability Program
PSRPU	Power System Reliability Program Update
PTD	Power Transmission and Distribution
PUC	Public Utilities Code
PV	Photovoltaics
PVNGS	Palo Verde Nuclear Generating Station
R&C	Repair and Construction Group
RAM	Risk Assessment and Management
RAS	Remedial Action Schemes
RCAS	Responsibility Cost Accounting System

Acronym	Definition
RFI	Request for Information
RFP	Request for Proposal
RFW	Red Flag Warnings
ROW	Right of Way
RPS	Renewable Portfolio Standard
SAGM	Senior Assistant General Manager
SAMP	Strategic Asset Management Plan
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SCPPA	Southern California Public Power Authority
SEMS	Standardized Emergency Management System
SLA	Service Level Agreement
SLTRP	Strategic Long-Term Resource Plan
SME	Subject Matter Expert
SOC	Security Operation Center
SOW	Statement of Work
Sustainable City pLAn	2019 Los Angeles Green New Deal
SWP	State Water Project
SWRCB	State Water Resources Control Board
UWMP	Urban Water Management Plan
WaterGIS	Water System GIS
WDDERP	Water Distribution Division Emergency Response Plan
WECC	Western Electricity Coordinating Council
WETS	Water Engineering and Technical Services
WIN	Water Information Network
WIP	Water Infrastructure Plan
WMP	Wildfire Mitigation Plans
WODMERP	Water Operations Division Metro Emergency Response Plan
WSAB	Wildfire Safety Advisory Board

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