Seattle Public Utilities

2021-2026 STRATEGIC PRIORITY

PRIORITY/ACTION TITLE: Water Line of Business, Asset Management/Aging Infrastructure

Branch/Division: Water
Executive Sponsor: Rick Scott
Project Manage/Lead:

Priority/Action Type:
☐ 2018-2023 Existing Action Plan with **continued** funding for 2021-2026
☐ 2018-2023 Existing Action Plan with **increased** funding for 2021-2026
☐ New Priority requiring new funding
☒ Priority with existing funding

Summary of the priority or issue.

This priority area focuses on the Water Line of Business' (LOB) current and future approach to sustainable long-term asset management. In the next six years, the asset management approach will continue to result in an ongoing capital projects list that addresses water system infrastructure needs in a long-term sustainable manner.

Asset management is performed by the Water LOB from two perspectives.

The first is to look at each asset class and to:

1. *Catalog all assets and their condition*
2. *Establish what levels of service the assets are providing*
3. *Rank assets by criticality*
4. *Assess the optimal blend of O&M and CIP for the assets to result in lowest life-cycle cost*
5. *Plan for O&M and CIP funding to support the management of the assets.*

The second is to take a high-level, strategic approach to managing all asset classes together, since together they comprise the entire drinking water system.

The graph below shows the total CIP needs for Water LOB, based on this high-level approach to asset management. All anticipated needs are shown for the next 20 years. The graph is a summary of many detailed spending projections from the staff who are the asset managers for Water LOB.

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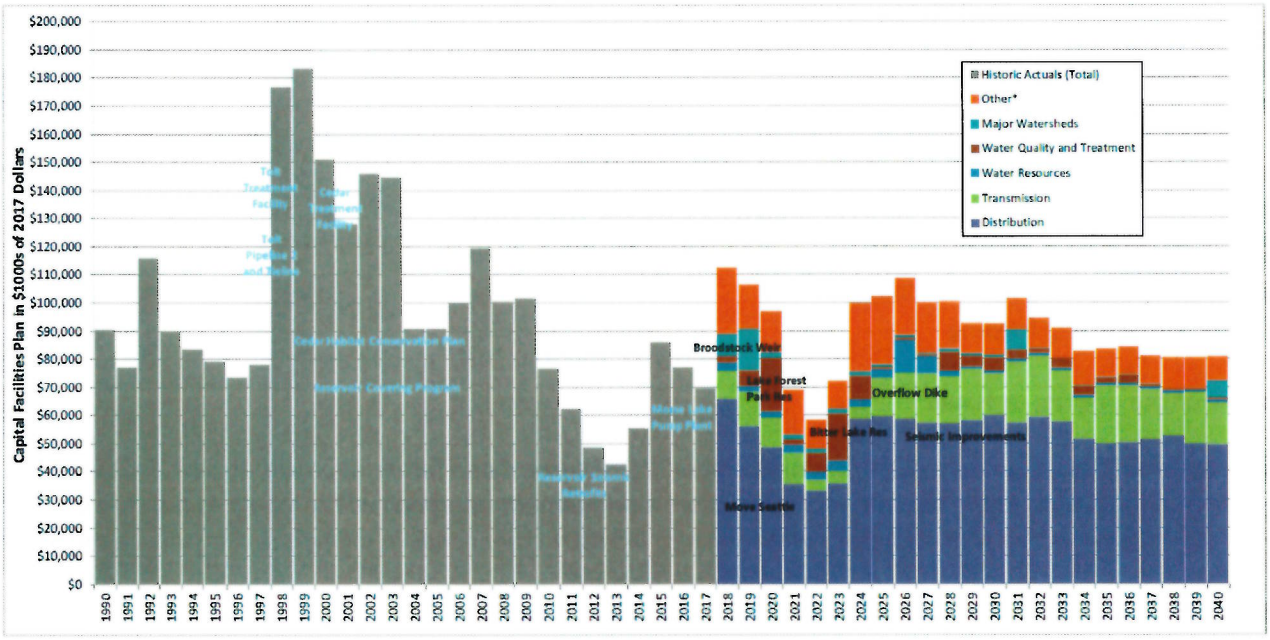
Historic and Proposed Capital Facilities Plan Spending through 2040
(2018-2023 Adopted CIP, plus 2024-2040 Estimate, in thousands of 2017 dollars)



* Other includes Fleets, Facilities, Security, Information Technology, SCADA and other miscellaneous projects.

The two tables below summarize the approximate state of all assets, with notes about how their status might affect rates in the next 3-6 years. Note that the two tables are separated into assets that are discrete (like a building or a storage tank) and distributed (many assets over a large area, like buried pipes). The reason for that separation is that the discrete assets tend to be easier to inspect and manage one-by-one, while the distributed assets are more difficult to inspect, distributed over a large area, and often need to be managed in a more complex manner.

The tables attempt to show the general condition of each asset class, as well as how certain we are in its state based on inspection results. The notes below each table give more detail on why certain asset classes are in a "yellow" or "red" condition, as well as how capital planning in the next 6 years and beyond will address their status.

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Discrete Assets (Easier to Inspect)

Asset	Condition	Certainty	Notes
Cedar Watershed Reservoirs and Dams			
Tolt Watershed Reservoirs and Dams			
Lake Youngs Reservoir and Dams			*Cascades Dam*
Transmission-Area Buildings			*Older buildings*
In-Town Buildings			*Older buildings*
Landsburg Buildings			
Water Treatment Plants			
Concrete Reservoirs (Treated Water)			
Steel Water Tanks and Standpipes			*Coatings, seismic*
Water Pump Stations			

Notes:

- *Cascades Dam is a water quality / seismic driven capital project that will be vetted in the near future.*
- *Facilities (building) asset management is being discussed separately with the Customer Review Panel.*
- *Steel water tanks and standpipes have fallen behind on their re-coating schedule, so additional re-coating work is anticipated in the next 6 years.*

Distributed Assets (More Difficult to Inspect)

Asset	Condition	Certainty	Notes
Cedar Watershed Transportation System			
Tolt Watershed Transportation System			
Water Transmission Pipes and Appurtenances			*More inspection needed, difficult*
Water Distribution Pipes			*Cannot inspect easily*
Water Utilidors			*More inspection needed, difficult*
Water Meters (Wholesale and Retail)			*Testing frequency*
Water Valves			*Deferred maintenance*
Water Hydrants			*Deferred maintenance*

Notes:

- *Distribution pipes are shown below as an example of how asset management approaches are applied to asset classes that cannot be inspected easily, so their condition is not well known.*
- *Water utilidors are underground tunnels carrying water pipes. They still need to be cataloged and an asset management plan written about them.*

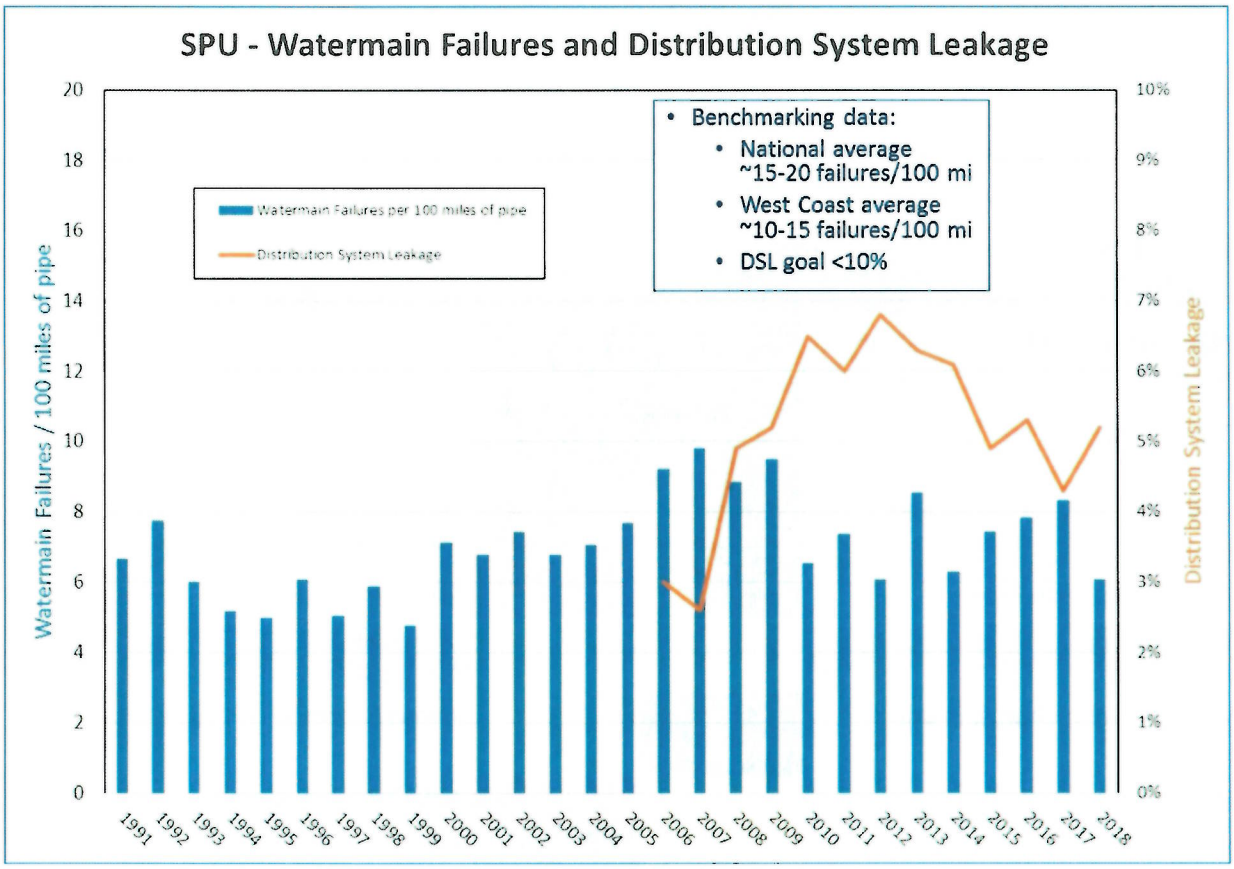
- *Water meters have a testing and calibration program that is currently being monitored and evaluated for improvements, such as better targeted efforts with available staff resources.*
- *Water valves and hydrants are described separately, as an SBP Action Plan (deferred maintenance).*

Watermains (buried pipes) are an example of how not all assets have good condition information on which to base future replacement plans. Watermains cannot be inspected without being dug up, and they must be taken out of service to inspect the interior, since they're normally full and pressurized when serving customers.

For assets like this, the asset management approach is:

- *Monitor and trend indirect indicators, such as watermain break and leakage data, as indications of how the asset class is performing.*
- *Project out watermain replacement many decades into the future, to ensure that future costs have some predictability over a long period of time.*
- *Test newer technologies for better inspection data, as well as less expensive rehabilitation or replacement of watermains.*

The graph below shows SPU's data for indirect indicators of watermain condition, watermain failure rates and water system leakage rates. The graph shows that SPU remains better than the benchmark in both categories.



In terms of replacement rate, the graph below projects watermain replacement rates for the next 150+ years, making assumptions about remaining useful life of different types of pipe materials:

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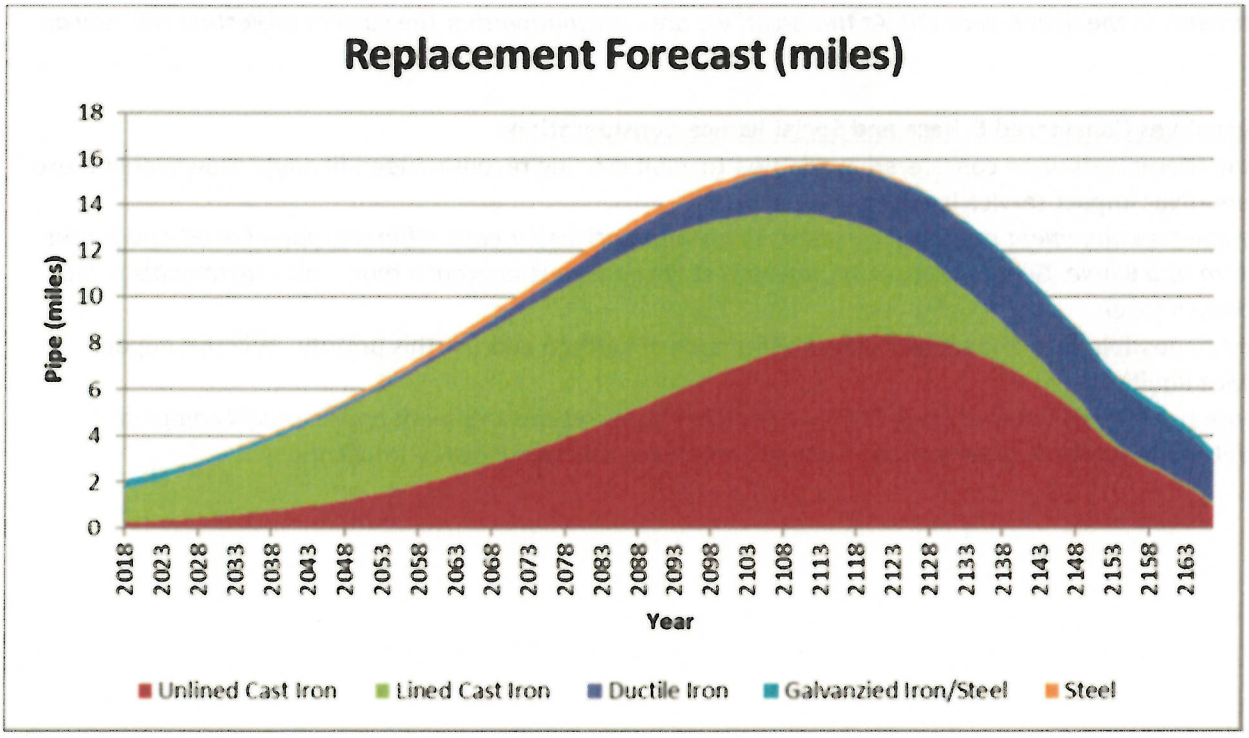

The graph shows that the replacement forecast is around 2 miles per year currently, ramping up to 15 miles per year about 100 years from now.

From an asset management standpoint, the best practice is to plan for pipe replacement now, using best information, and combine those short-term replacement plans with trends of watermain failure and leakage data, to adjust long-term replacement plans as time goes by. The current plan is to ramp up from the current goal of 1 mile/year to 2 miles per year in the next 6 years.

Part 2. Targeted Commitments and Performance Measures (next 3-6 years).

- What are we doing, or will we do to address the priority problem or issue?
- What are the short and long-term metrics for measuring progress? How will you measure whether the action has been successful?

In the next 3-6 year SBP timeframe, the following will be done:

- *Continue to show trends of watermain failure and water system leakage data.*
- *Report on the annual replacement rates for watermains, as well as future forecasts for replacement rates.*
- *Report on how any newer technologies are making pipe inspection more feasible and/or pipe replacement more cost-effective.*

Part 3. Baseline Activities and Anticipated Rate Impact

- Short description of activities already in the baseline, incremental work.
- What is the anticipated additional rate impact of what we're planning on doing (if any)?

The 6-year combined CIP forecast already includes our best strategic thinking about which assets should be replaced in the next 6 years. In the next 3 years, we will continue to monitor asset condition and criticality, and will

make adjustments in the next 6-year CIP. At this point, we are anticipating that the current projection will stay as is.

Part 4. Alternatives Considered & Race and Social Justice Considerations

- What alternatives were considered in addition to what is being recommended (if any)? How would these alternatives impact service levels?
  The asset management approach considers many alternatives for each different type of asset and for the system as a whole. Generally speaking, the lowest life cycle cost approach that is also sustainable is the approach taken.
- Identify possible race and social justice implications of work to address this priority. Will this impact service equity?
  Future capital projects that are recommended from the asset management approach will complete a racial equity toolkit in order to assess any potential race and social justice implications.

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2021-2026 STRATEGIC PRIORITY

PRIORITY/ACTION TITLE: Water Line of Business, Seismic Resilience Planning

Branch/Division: Water
Executive Sponsor: Rick Scott
Project Manage/Lead:

Priority/Action Type:
☐ 2018-2023 Existing Action Plan with **continued** funding for 2021-2026
☐ 2018-2023 Existing Action Plan with **increased** funding for 2021-2026
☐ New Priority requiring new funding
☒ Priority with existing funding

1. Summary of the priority or issue.

This priority area focuses on the Water Line of Business' (LOB) implementation of a recently completed seismic study. The study made prioritized recommendations over the next 50 years, and this writeup focuses on the next six years of that 50-year program. In the next six years, short-term recommendations will be completed, such as additional stockpiling of emergency pipe repair materials. Long-term recommendations for capital upgrades will be initiated, with focus on the highest-priority items. This includes transmission and distribution pipe seismic upgrades, as well as seismic upgrades of water tanks and reservoirs.

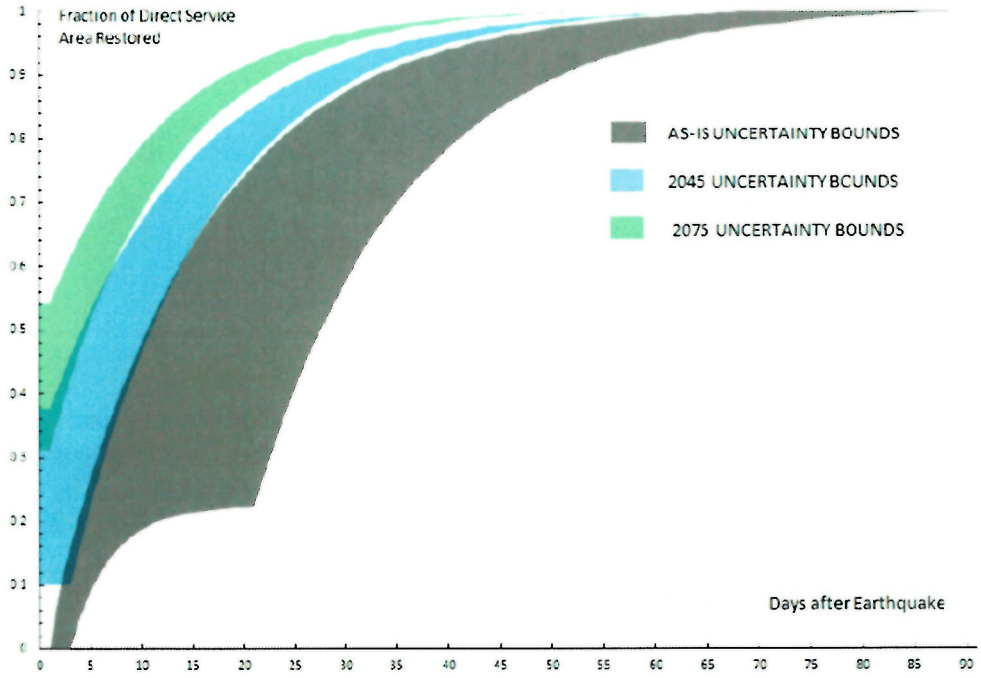
Seismic Study
Water Line of Business' recently completed a water system seismic study. The study recommended several short-term and long-term improvements, in the name of increasing SPU's resilience against earthquakes.

The study was completed in 2018. It examined such issues as:

- *How would the water system respond in two earthquake scenarios—a 7.0 Seattle Fault Zone (SFZ) earthquake and a 9.0 Cascadia Subduction Zone (CSZ) earthquake—that exceed the magnitude of shaking previously considered in previous seismic studies, based on more recent seismic analysis;*
- *What breaks would occur and where;*
- *Most likely impacts on the water system operations;*
- *Post-earthquake level of service goals and mitigation strategies to achieve those goals;*
- *Improved seismic design standards for water system facilities.*

The USGS estimates that there is a 15% to 20% chance of a catastrophic earthquake such as M6.5 or greater Seattle Fault or M9.0 Cascadia Subduction event occurring in the next 50 years. If a catastrophic event were to strike, SPU would completely lose water pressure within 16 to 24 hours, discontinuing service. Further, the report estimated that it would take between 10 to 25 days after the earthquake to restore 50% of service, and likely more than two months to reach the 99% plus service restoration level. As the figure below shows, seismic upgrades could significantly cut down the time needed for service restoration by 2045 and even more by 2075. By 2045, 10% to 30% of SPU's customers would not even lose service after a catastrophic earthquake. The percentage of customers that don't lose water service would rise to 40% to 50% by 2075. In a hundred years or more, only isolated pockets of water service outages would be expected after a catastrophic earthquake.

Additionally, according to a 2016 report by the Water Supply Forum, economic impacts of a catastrophic CSZ or SFZ earthquake and subsequent water system failure would be an estimated $810 million (CSZ) or $1.77 billion (SFZ), respectively.



Graph shows retail service area restoration estimates after catastrophic earthquakes: current condition, after 20+ years of seismic upgrades, and after 50+ years of seismic upgrades

Next Steps

In order to increase resiliency against earthquakes, the seismic study made several recommendations for next steps.

The short-term strategy is to implement short-term measures, such as improving emergency preparedness and response planning, and adopting isolation and control strategies, that can be used to mitigate the effects of seismic damage until expensive long-term infrastructure improvements can be made. The cost of these short-term measures would be on the order of $40 million over the next 15 to 20 years.

The long-term strategy is to use proven technologies and strategies that water utilities in the United States and Japan are implementing to mitigate and/or prevent water system damage. They include installing earthquake-resistant pipe, upgrading existing facilities to meet current seismic requirements, and ensuring there is adequate water storage to provide emergency water after a major earthquake. Implementing these technologies is expensive and could take decades. Long-term infrastructure improvements will cost over $800 million over approximately the next 50 years, followed by further investment for decades.

Part 2. Targeted Commitments and Performance Measures (next 3-6 years).

- What are we doing, or will we do to address the priority problem or issue?
- What are the short and long-term metrics for measuring progress? How will you measure whether the action has been successful?

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In the next 3-6 year SBP timeframe, the following will be done:

- *Report on the implementation status of short-term strategies.*
- *Report on the implementation status of long-term strategies.*

Part 3. Baseline Activities and Anticipated Rate Impact

- Short description of activities already in the baseline, incremental work.
- What is the anticipated additional rate impact of what we're planning on doing (if any)?

The 6-year combined CIP forecast already includes the recommended short-term and long-term strategies. At this point, we are anticipating that the current projection will stay as is.

As a reminder, seismic upgrades were recommended over the course of 50 years, with the highest risk and consequence items coming first. The seismic study Executive Summary, already provided to the CRP, shows the 50-year projections in a table on the last page. The 50-year projections are intended to be a starting point for budgetary planning, understanding that there may be changes made over the years. Since seismic upgrades are considered part of the overall CIP / asset management planning process, ongoing and continuous analysis of upcoming projects and programs may result in shifts in project prioritization – consistent with all CIP planning for SPU Water LOB.

The 6-year CIP projections are shown below. The numbers shown represent planning-level estimates that will be refined heavily after a detailed options analysis is completed for each project. This is typical of our CIP process.

Higher risk and consequence upgrades will generally go through options analysis tending towards higher cost, lower risk solutions. Lower risk and consequence upgrades will generally go through options analysis tending towards lower cost, higher risk solutions. Balancing system reliability as well as rate affordability is a key consideration, as it is for all CIP projects and planning.

2021-2026 SBP Seismic Capital Improvements (in $000)

Investment	2020	2021	2022	2023	2024	2025	2026	Total
Distribution System Seismic Improvements	$160	$1,500	$2,250	$4,000	$2,000	$ 2,000	$ 2,000	$ 13,910
Transmission System Seismic Improvements	$170	$1,350	$2,150	$3,000	$3,000	$12,500	$18,500	$ 40,670
North Operations Complex Seismic Bldg Assessment & Improvement	$100	$ 250	$ 800	$1,500	$1,350	$ -	$ -	$ 4,000
TOTAL	$430	$3,100	$5,200	$8,500	$6,350	$14,500	$20,500	$ 58,580

The capital projects that this table represents include:

- *Procurement of additional emergency repair materials for pipes that may fail after an earthquake.*
- *Additional valving to reduce water outages after an earthquake.*
- *A large capital project to seismically upgrade the Cedar River Pipelines in Renton, one of the highest priority areas identified for upgrades.*

- *Capital projects for seismic upgrades of the first water storage tanks and reservoirs listed in the seismic study's 50-year plan.*
- *Seismic upgrade (or replacement) of the North Operations Complex, a lightly-reinforced masonry building used by water operations crews in North Seattle.*

Part 4. Alternatives Considered & Race and Social Justice Considerations

- What alternatives were considered in addition to what is being recommended (if any)? How would these alternatives impact service levels?
  We considered alternatives that accelerated the seismic funding to less than 50 years. However, given the prioritization of various projects and the potential rate impacts, the recommended alternative was to spread the costs over a longer period of time, with higher priority projects going first.
- Identify possible race and social justice implications of work to address this priority. Will this impact service equity?
  The projects are spread out throughout the city limits (and beyond), focused on areas of potential seismic hazard. Each upcoming capital project will complete a racial equity toolkit in order to assess any potential race and social justice implications.

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2021-2026 STRATEGIC PRIORITY

PRIORITY/ACTION TITLE: Water Line of Business, Climate Change

Branch/Division: Water
Executive Sponsor: Rick Scott
Project Manage/Lead:

Priority/Action Type:
☐ 2018-2023 Existing Action Plan with **continued** funding for 2021-2026
☐ 2018-2023 Existing Action Plan with **increased** funding for 2021-2026
☐ New Priority requiring new funding
☒ Priority with existing funding

1. Summary of the priority or issue.

This priority area focuses on the Water Line of Business' (LOB) analysis of potential impacts associated with climate change. The two impacted areas include: water supply and watersheds. In the next six years, studies will be completed that assess potential impacts of climate change on water supply and on watersheds, as well as recommendations for potential adaptation strategies.

Water Supply
The Water LOB has studied climate change impacts on water supply for almost 20 years. Potential impacts of climate change include:

- *Lower snowpack in the winter and spring, making refill of reservoirs for the summer more difficult*
- *Hotter and drier summers, meaning that reservoir drawdown in the summer would be longer and faster*
- *Wetter winters, meaning that flood management and reservoir refill could be more challenging.*

Two previous rounds of climate change analysis used a small number of available global climate models to assess potential future impacts and concluded that the impacts to water supply, while measurable, could be mitigated with relatively-easily available tools, such as optimized system operations.

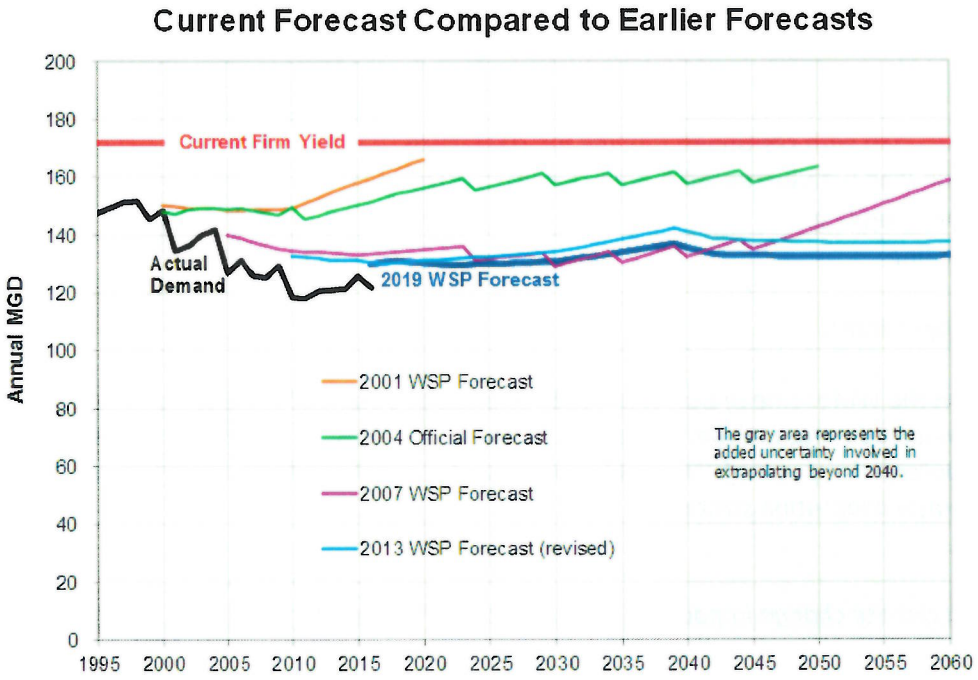
Water LOB is in the middle of a third round of climate change analysis, using additional global climate models and computer processing tools. This analysis will be complete in the next 1-2 years. Early indications are that use of multiple models may entail a wider spread of future potential impacts. Planning in the face of this anticipated uncertainty will be challenging.

One way to incorporate uncertainty into decision-making is to look at trends that are common to many of the global climate model projections. For example, if the trend is for winter temperatures to be warmer, then SPU should focus efforts on water supply improvements that address a much lower snowpack in our watersheds.

The analysis will include what options SPU has for adapting to climate change impacts, as well as the cost and the value for each option.

A mitigating factor in this analysis is that at the current time, water consumption is around 130 million gallons per day (MGD), much lower than the water system's "firm yield," or ability to reliably provide water, which is 172

MGD. This gap between available supply and the lower amount of demand is attributable to people using less water per person, helped along by SPU's aggressive water conservation program that started in the late 1980's and continues today.



The graph above illustrates available supply ("Firm Yield") compared to the 2019 forecast of demands for water over the next 40+ years.

Without climate change, the long-term forecast is that demands will continue to remain well below available supply. The challenge is to accurately incorporate the uncertainty around the magnitude of climate change impacts into our long-term supply and demand forecasts.

Watersheds

At the same time, Water LOB has recognized the need to assess climate-change driven risks associated with wildfires in the watersheds. The water supply depends on SPU's owned and managed watersheds to provide a pure source of supply before treatment. Climate change impacts could include:

- *Hotter and drier summers, with a higher potential for wildfires in the watersheds that could compromise water quality. Wildfires could also negatively impact the forest ecology in the watersheds.*
- *Wetter winters, which could result in water quality impacts associated with increased erosion in the watersheds, contributing to sediment deposition in the source water before treatment.*

SPU has conducted an analysis for climate change risk in the watersheds using a GIS-based analysis of potential risks. From that analysis, several actions were recommended:

- *Continue targeted ecological thinning and vegetation planting as a proactive strategy for mitigating future risks.*

- *For streams, be ready to react to stream erosion with restabilization measures such as addition of large woody debris.*
- *Assess and increase the size of roads crossings for anticipated peak flows.*

As a related item, SPU is also in the middle of an assessment of the future potential for wildfires in the watersheds. The study is anticipated to be complete by the end of 2020.

Part 2. Targeted Commitments and Performance Measures (next 3-6 years).

- What are we doing, or will we do to address the priority problem or issue?
- What are the short and long-term metrics for measuring progress? How will you measure whether the action has been successful?

In the next 3-6 year SBP timeframe, the following will be done:

- *Report on the results of the study on climate change and water supply impacts, along with potential future alternatives for adaptation strategies.*
- *Report on the results of ecological thinning, stream crossings, and roads crossings projects in the watersheds, as well as the results of the monitoring to determine their effectiveness.*
- *Report on the study on climate change and watershed wildfire impacts, along with potential future alternatives for adaptation strategies.*

Part 3. Baseline Activities and Anticipated Rate Impact

- Short description of activities already in the baseline, incremental work.
- What is the anticipated additional rate impact of what we're planning on doing (if any)?

At this point, the focus is on using existing staff and O&M resources to conduct these studies. SPU is not anticipating that these studies will result in significant CIP recommendations in the next 3 to 6 years.

Part 4. Alternatives Considered & Race and Social Justice Considerations

- What alternatives were considered in addition to what is being recommended (if any)? How would these alternatives impact service levels?

  The recommended path forward is to perform more studies. No other alternatives were considered.

- Identify possible race and social justice implications of work to address this priority. Will this impact service equity?

  Future climate change-driven projects will complete a racial equity toolkit in order to assess any potential race and social justice implications.