



## Section 6

# Sustainability and resilience

Invest in infrastructure to maintain reliable service in a changing climate and reduce environmental impact.

Sustainability and resilience are integral to WSDOT and WSF operations. WSDOT's vision statement is that "Washington travelers have a safe, sustainable and integrated multimodal transportation system." Furthermore, safety and sustainability are two of the agency's key values, along with engagement, innovation, integrity and leadership.

Sustainability is a broad term that can be applied to nearly every aspect of WSF's service operations. As a division of WSDOT, WSF operates within the agency's guiding framework of providing a sustainable transportation system that "supports the economy, preserves the environment and enhances equity and quality of life in our communities."\* In this Plan, sustainability strategies are focused on environmental stewardship.

Resilience is also a component of a sustainable system. Resilience requires strategic investments to ensure that Washington travelers continue to have a safe transportation system into the future. This Plan focuses on resilience related to climate change and other abrupt disruptive events.

Sustainability and resilience is identified as an underlying theme of the Plan and is therefore an interwoven concept throughout each of the other Plan elements, and the recommended strategies within them. This section of the Plan focuses on two corresponding topics: environmental sustainability and system infrastructure and operational resiliency.

The Plan's goals are to:

- Green the fleet and reduce WSF's environmental footprint through sustainable practices and environmental stewardship.
- Plan for emergencies and climate change to sustain reliable service through 2040.

These overarching goals are outlined in more detail in the sections below with specific strategies identified to meet these goals.

\*<http://www.wsdot.wa.gov/sustainabletransportation>, <http://www.wsdot.wa.gov/about/secretary/results-wsdot>

# Sustainability and environmental stewardship

This Plan views sustainability through a holistic lens as it relates to decision-making and focuses on ways to reduce WSF’s environmental impacts. Sustainability practices have continued to evolve throughout this Plan’s development. For example, in January 2018, Governor Jay Inslee signed Executive Order 18-01, which directed WSF to move toward a zero-emissions fleet. As of July 2018, WSF became the first ferry operator in the United States to join Green Marine, an environmental certification program for the North American marine industry that establishes benchmarks and a monitoring accountability program.

Internally WSF continues to integrate decision making to ensure the consideration of the “three Es” of sustainability (economy, environment and equity). WSF has formed strategic working groups to analyze operational improvements that would reduce fuel consumption. Although WSF has made strides, its organizational structure is not set up in a way that elevates this oversight. Rather it is another responsibility added to full job descriptions, perhaps not allowing for the attention and oversight needed to keep up with requirements.

WSF designs its terminals within the framework of Washington state environmental regulations, which are some of the most stringent in the country. Beyond those requirements, WSF continues to explore ways to reduce energy consumption, with goals of reducing environmental effects and also reducing costs. In 2017, WSF completed an audit that outlined strategies for energy and water use optimization at each terminal and is working to implement these strategies.





## Plan recommendations

Many of the recommendations included in this section are described previously in the report, as they focus on the goals of providing reliable service, enhancing customer experience, and managing growth, with sustainability in mind. Sustainability recommendations apply to WSF vessels and terminals, as well as to the management framework in which they are operated. These recommendations can be summarized to include:

- Highlight sustainability through organizational structure, decision making and reporting.
- Reduce vehicle emissions by optimizing terminal operational efficiencies and employing adaptive management strategies that spread out peak demand and minimize wait times.
- Promote mode shift through investments in technology and infrastructure that promote walk-on and bike-on passengers and improve multimodal connections.
- Design future vessels and terminals to be more environmentally friendly and flexible in design to accommodate new technology, changing transportation modes and increased passenger ridership.

### Highlight sustainability through organizational structure, decision making and reporting

Because regulations in the realm of sustainability change frequently, WSF faces challenges with maintaining its service and complying with reporting requirements in a constrained financial environment. Other maritime organizations typically manage their sustainability operations at the departmental level.

Elevating a WSF role or department focused on sustainability initiatives would allow for better cross-departmental integration of strategies. It would also focus the responsibility for various required tracking and reporting, which is helpful for continuous improvement toward WSF's goals. Technology investments could streamline tracking and reporting processes, and investing in dedicated personnel could support cross-departmental reporting. WSF could assign dedicated personnel to stay up to date on international sustainability programs in the maritime industry, such as the World Ports Climate Initiative or the Global Reporting Initiative, and provide expertise on best practices and advancements in vessels, terminal design, operational efficiencies and technologies. The Plan recommends the following strategy:

- **Dedicate resources to sustainability:** Create a dedicated role or department within WSF that focuses on sustainability through cross-departmental strategies and development of data tracking and reporting.



**Reduce vehicle emissions by optimizing terminal operational efficiencies and employing adaptive management strategies that spread out peak demand and minimize wait times**

WSF can promote sustainability and reduce environmental impact at terminals by employing strategies that reduce the time cars spend in traffic and waiting in line at terminals. In addition to reduced idling and fuel use, easing terminal congestion will benefit the community in a multitude of ways that range from higher productivity to improved air quality and lower greenhouse gas emissions.

Terminal operational efficiencies like overhead loading, reducing traffic congestion impacts, and queue detection can all contribute to minimizing wait and dwell times. Overhead loading allows walk-on passengers to load simultaneously with vehicles, thus reducing the time vehicles must wait or idle while passengers are loaded or unloaded. Traffic congestion impacts caused by poorly-timed traffic signals or pedestrian crossings can cause backups that result in cars idling for longer periods of time. For example, at the Edmonds terminal, an at-grade railroad crossing frequently conflicts with loading and unloading of ferries, causing vehicles to wait while a train crosses. Improving queue detection capabilities at terminals could communicate the expected wait time to customers, which could reduce instances of customers idling their vehicles if they think the queue line will be moving shortly.

Adaptive management strategies that focus on sustainability aim to reduce the effects of customer vehicles traveling to and from, and waiting, at WSF terminals. Expanding the reservations system and implementing demand-based pricing are adaptive management strategies currently being explored to reduce congestion and spread peak demand. Technology can play an important role in reducing terminal congestion by the use of enhanced user information to spread peak loads and limit the time vehicles dwell in congestion around terminals. Technology improvements such as fare collection upgrades or automatic passenger counting systems that will process customers more quickly through the terminal are also being proposed in this Plan in the Customer experience section.

The Plan proposes some schedule adjustments to spread peak ridership through an expanded or elongated summer season, to be implemented when there are enough vessels in the fleet to allow for enhanced service hours with sufficient time for required vessel maintenance. This will reduce congestion during peak hours and the associated greenhouse gas emissions from idling vehicles.

This Plan recommends the following strategies to optimize terminal operations, which also appear and are explained in more detail in the ManageGrowth section, and to promote sustainability at terminals through adaptive management strategies, also included in the Customer experience section.



- **Add overhead loading:** Construct overhead loading at terminals, which allows passengers to load simultaneously with vehicles and reduces the time vehicles must wait or idle while passengers are loaded or unloaded. Improvement projects that will add overhead loading are currently programmed for Friday Harbor and Clinton terminals, and an existing overhead loading walkway at the Bainbridge Island terminal will be replaced to increase passenger throughput and improve safety.
- **Improve traffic at terminals:** Assess traffic around terminals, and partner with local transportation agencies to reduce causes of conflict with loading and unloading ferries such as timing of traffic signalization or pedestrian crossings. Explore options for operational improvements at the Edmonds terminal.
- **Invest in vehicle queue detection:** Improve vehicle queue detection capabilities at terminals to communicate wait times to passengers.
- **Optimize terminal operations:** Employ adaptive management strategies, such as expanded vehicle reservations and demand-based pricing, that will spread demand to reduce vehicle idling and associated emissions at terminals.
- **Enhanced customer information:** Provide customers with more real-time information in an easily accessible way to help customers make informed travel decisions, encouraging off-peak travel and opportunities to process more quickly through the terminal.

### Promote mode shift through investments in technology and infrastructure that promote walk-on and bike-on passengers, and improve multimodal connections

Enhancing user information can also promote mode shift, which gets customers out of their cars to become a walk-on or bike-on customer. Strategies to increase mode shift include better aligning schedules with partner transit organizations and prioritizing the loading and movement of people and bicycles.

Terminal improvements can also encourage more walk-on and bike-on passengers. Improvements include overhead passenger loading walkways, which allow walk-on passengers and vehicles to load simultaneously, and improving accessibility and connections to the terminal for walk-on and bike passengers. As detailed in the Customer experience section, the following strategies also support sustainability:

- **Improve customer information:** Improvements to real-time user information, customer alerts, and wayfinding can be used to encourage customers to walk or bike onto the vessel rather than drive.
- **Enhance transit connections:** Partner with other transit agencies to synchronize schedules and make transit connections easier.
- **Improve terminal access:** Look for opportunities to incorporate improved bike and pedestrian infrastructure in terminal preservation and improvement projects through connecting to local trail and path systems.

**Design future vessels and terminals to be more environmentally friendly and flexible in design to accommodate new technology, changing transportation modes and increased passenger ridership**

WSF is the largest consumer of diesel fuel in Washington state at over 18 million gallons each year. Because of this, WSF operations are the largest generator of carbon and other greenhouse gas emissions within the state transportation system. This Plan recommends that WSF leverage the need for new vessels to meet and exceed carbon dioxide emissions reduction requirements under state law. To cut fuel consumption, the Plan recommends building new vessels to use hybrid propulsion technology instead of full diesel engines. The use of this propulsion technology has benefits of reduced engine noise and vibration, lessening effects on orcas and other marine life.

In April 2018, Governor Inslee approved \$600,000 in funding to study conversion of WSF’s three Jumbo Mark II Class vessels to hybrid-electric propulsion. These three vessels account for the highest fuel consumption and emissions in the fleet. Completing these conversions will reduce the carbon emissions from the current fleet by 25 percent.

Once WSF implements the capital investments in vessel and terminal infrastructure identified in this Plan, by 2040 the agency will have replaced 13 existing diesel vessels with hybrid-electric vessels—some capable of full electric operation—and will have converted 6 vessels to plug-in hybrids. The table below shows the planned fleet composition over time. During the development of new vessel contracting requirements, the Plan recommends that a design charrette be held with technical design experts and departments within WSF to outline design elements of a future vessel to be most efficient and environmentally friendly.

**Recommended fleet composition by 2040**

	2019	2023	2030	2040
Plug-in hybrid	0	5	12	22
Diesel	23	18	13	4
Total fleet size	23	23	25	26

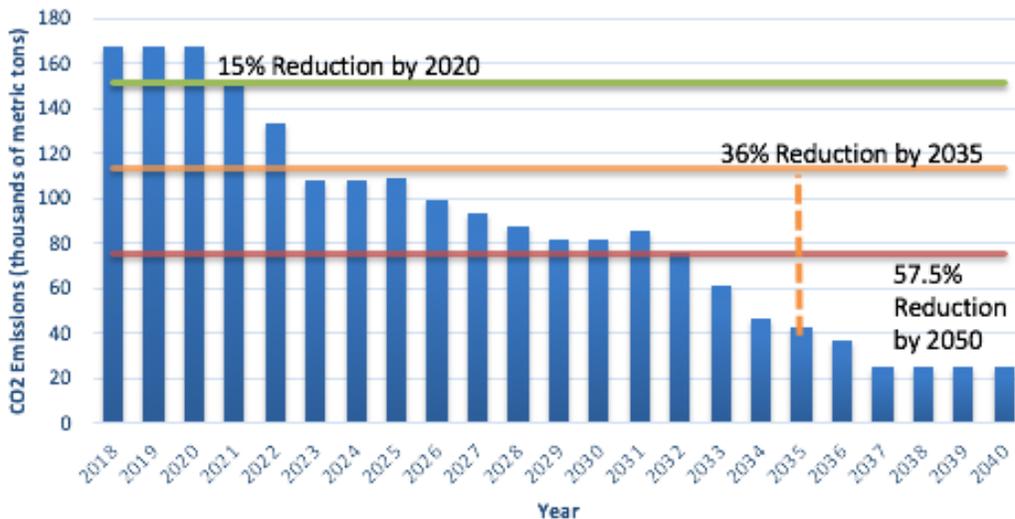
2018 fuel consumption  
**17** million gallons  
2040 fuel consumption  
**4** million gallons

With this new make-up, the WSF fleet would achieve a 75 percent reduction in emissions and annual fuel consumption as compared to today, from about 17 million gallons in 2018 to about 4 million gallons in 2040. Not only does this have positive environmental effects, but also cost savings, as discussed in more detail in the Implementation, investments and financial outlook section of the Plan.



The figure below shows the corresponding change in carbon emissions, which include meeting and exceeding state law requirements of a 36 percent reduction by 2035 and a 57.5 percent reduction by 2050. The Jumbo Mark II Class vessel conversions represent the initial 25 percent reduction in emissions.

#### Projected carbon emissions in the WSF system, 2018-2040



While vessel fuel consumption, emissions and noise are a large focus of the strategies and investments related to vessels in this Plan, other smaller endeavors will make a difference. WSF should also consider waste management and waste diversion, the practice of trying to divert as much waste as possible out of the landfill by recycling and composting. Although there are currently no set targets for this practice, WSF could develop goals, implement programs and track progress. The ongoing effort involved in managing a sustainability program, including setting baselines, measuring data and reporting may require additional dedicated staff, which is outlined in the first strategy of this section.

To promote vessel sustainability, this Plan recommends the following strategies, which are explained in more detail in the Reliable service section, which outlines future vessel programming:

- **Invest in hybrid-electric propulsion:** Invest in converting six existing diesel propulsion vessels to hybrid-electric, and design new vessels to use hybrid-electric propulsion in order to achieve a significant reduction in fleet emissions. In the years leading up to full vessel replacement, WSF could increase from biodiesel B5 to B10 or higher, or other renewable diesel to reduce carbon emissions.
- **Reduce vessel noise:** Pursue materials and methods to maximize energy efficiency and provide opportunities for quieter operations to protect marine life.

- **Plan a vessel design charrette:** Convene different disciplines and technical experts for a vessel design charrette prior to design and construction to ensure they have evaluated all components of future vessels and their systems for minimizing environmental effects.
- **Increase energy efficiency and waste reduction:** Continue to look for ways to encourage waste management and waste diversion, and reduce energy consumption on vessels.

Terminal design standards should continue to assess WSF's environmental impact and look for opportunities to increase sustainability. Potential improvements include developing an inventory and testing program for terminal stormwater systems, integration of pervious pavement to improve the watershed ecosystems in which WSF terminals are located, and investment in high-efficiency water fixtures in terminals to reduce water use.

WSF has been working over the past 20 to 25 years to replace timber structures treated with creosote, a water-contaminating material, with steel and concrete structures to make the waters cleaner. The Plan recommends that Terminal Design Standards be continually assessed to make sure they are compatible with rapidly advancing technologies to be more efficient and environmentally conscious. For example, in the near term, drop-offs by autonomous vehicles could allow customers to walk on to the ferry instead of using their own vehicles. To reduce WSF's environmental footprint related to terminals, this Plan recommends the following strategies:

- **Continue to assess Terminal Design Standards:** Allow for flexibility within the Terminal Design Standards to accommodate new technologies.
- **Increase efficiency:** Continue to look for ways to reduce environmental impact and energy consumption at the terminals.
- **Monitor stormwater at terminals:** Create an inventory of stormwater systems and develop a stormwater testing program.
- **Continue creosote removal:** Continue to prioritize the replacement of creosote-treated timber with more environmentally-friendly materials to reduce water contamination.

## Performance measures

The Plan recommendations include the addition of performance measures that will lead to the tracking of wait times, capital conditions assessment, mode shift, and energy consumption.



## Resilience

WSF terminal assets are located in areas that are vulnerable to abrupt seismic events and emerging risks, such as sea-level rise and increasing intensity of storms. All of these conditions affect terminals and service. Existing terminals and the Eagle Harbor Maintenance Facility will require enhancements to withstand both abrupt and emerging infrastructure vulnerabilities.

When resiliency planning for infrastructure, the Plan recommends incorporating flexibility into terminal and vessel designs to accommodate future uses and rapidly-evolving technologies. WSF may choose to design more flexible spaces or reconsider the useful life design standards of infrastructure, which refers to the timeframe for designing infrastructure and planning for maintenance and replacement projects.

The WSF system consists of vessels and terminals that provide essential functions in the event of an emergency. In planning for emergency preparedness, it is essential that WSF has enough assets, including vessels and terminals, maintained to standards that can support emergency response.

### Plan recommendations

The Plan recommends the following strategies that focus on the identification and prioritization of capital investments to support the resilience of the ferry system.

- Develop an emergency response plan to enhance preparedness and aid in response and recovery efforts, and develop a prioritization of terminal capital projects for emergency response.
- Prioritize terminal maintenance needs with the most seismic risk, vulnerability to sea level rise and “lifeline routes\*” that provide access to major population centers or critical facilities.
- Increase the number of relief vessels to support regional emergency response.

\*<http://geo.wa.gov/datasets/WSDOT::wsdot-climate-impact-vulnerability-assessment-state-routes>



**Develop an emergency response plan to enhance preparedness and aid in response and recovery efforts and develop a prioritization of terminal capital projects for emergency response**

The Plan recommends that WSF develop a comprehensive disaster response and preparedness plan that aligns with and supplements other regional plans at the state and local agency level. The disaster response and preparedness plan should clearly define WSF's role as a maritime entity in disaster recovery. The plan should also include an evaluation of response time assumptions, fuel supply access, damage assessment, and staffing and communication protocols.

Emergency response and preparedness plans for other ferry systems or maritime organizations, such as the Water Emergency Transportation Authority in San Francisco Bay and Staten Island Ferries in New York City, provide good examples of partnerships, infrastructure planning and funding opportunities related to the potential role of ferries in regional disaster response and recovery. Alternate funding resources might help WSF improve disaster preparedness and resilience, similar to the federal grant funding New York City received to protect its ferry system against flood damage and add emergency ferry landings.

Currently, WSF vessels are equipped to load and unload from either end of the vessel, which requires a terminal facility where the vessel can safely tie up. The ability to load and unload from the side of the vessel could expand options for passenger loading and unloading during an emergency situation. To pursue this option, the Plan recommends WSF perform an engineering analysis to determine the best location and method for providing side-loading capabilities to WSF vessels.

The Plan recommends the following strategies to increase WSF's preparedness for emergency situations:

- **Develop a disaster response and preparedness plan:** Develop a comprehensive disaster response and preparedness plan that coordinates with other regional and agency plans.
- **Assess the potential for emergency side-loading:** Assess the current fleet and new vessel design for side-loading capability if a different terminal is used that will allow walk-on customers to exit the vessel if tied up in an alternative landing site during emergency situations.
- **Identify alternative landing sites:** Identify and practice landings at alternative sites other than current terminals to know where each vessel is capable of landing if the terminal is unavailable.



- **Fuel/energy access plans:** Prepare alternative plans for how diesel fueling would be accessed if current means are unavailable in an emergency. Once the fleet is more reliant on electricity, redundancy plans will need to be made to allow for ongoing operations if charging facilities are damaged.

To cope with potential situations where multiple terminals or vessels sustain damage in the region, WSF should consider establishing vessel, terminal, and route priorities in advance to aid emergency decision-making. Establishing priorities would also allow WSF to allocate and focus limited resources to the critical components of the system. These priorities might be tied to competing factors, such as major population centers or isolated island communities, and should be considered in advance of an emergency to be prepared if an event occurs.

The Plan recommends the following strategies, in conjunction with development of an emergency response plan, for prioritizing projects related to emergency preparedness:

- **Plan for disruptive events:** Prepare for and determine how to restore ferry service if an abrupt, disruptive event leads to significant staff shortages and limited resources.

### **Prioritize terminal maintenance needs with the most seismic risk, vulnerability to sea level rise and “lifeline routes” that provide access to major population centers or critical facilities.**

Terminals require sufficient maintenance and upgrades to maintain operations in abrupt disruptive events and adapt to sea level rise. Incorporating emergency preparedness when prioritizing maintenance projects would better equip the WSF system to respond to an event. Risks from seismic events, sea-level rise and increasing intensity of storms should be assessed and included in the prioritization of terminal maintenance and preservation projects. WSF should use current coastal flooding standards to evaluate the design elevations at each terminal.

WSDOT is currently reviewing lifeline routes that prioritize the highways that are most critical to response and recovery during emergency situations. Lifeline routes are defined as an interstate or major highway that is the sole access to a population center or critical facility. Because WSF routes are part of the state highway system, its emergency planning should be linked to those identified landside lifeline routes. WSF should work with local agencies to determine how to maintain lifelines from Interstate 5 to ferry terminals as an overall integrated system.

The following strategies are recommended for prioritization of terminal maintenance and preservation projects to maintain a resilient system:

- **Prioritize maintenance:** Work within the existing asset management model to prioritize maintenance for terminals with higher seismic risk and sea-level rise vulnerabilities, as well as lifeline routes.
- **Assess seismic risk:** Continue to assess and prioritize necessary upgrades to terminals to protect against seismic risks.
- **Prepare for climate change and sea level rise:** Evaluate the effects of climate change and sea level rise on terminal assets and develop a plan to mitigate those potential effects and prioritize capital investments.
- **Incorporate coastal design standards:** Review coastal design standards to identify future ferry terminal construction work that would provide the most resilient design, both for terminal structures and for mechanical, electrical and hydraulic equipment.
- **Identify lifeline routes:** Use identification of emergency lifeline routes, in coordination with WSDOT emergency plans, to inform maintenance plans and establish priority terminals and routes that will be the focus of resources in response to an emergency event.

### **Increase the number of relief vessels to support regional emergency response**

Vessels provide a unique transportation connection because they travel via waterways, which do not experience the same damage as roadways in an emergency event. Currently, WSF does not have a sufficient number of spare vessels to respond to a regional event. In order to strengthen WSF's ability to respond to an emergency situation, the Plan recommends the following fleet planning element, outlined in more detail in the Reliable service section of the Plan:

- **Grow the relief fleet:** Maintain a sufficient relief fleet to allow WSF to respond to an emergency event without removing vessels from everyday service. The Plan recommends expanding the relief fleet to a total of six vessels over the 20-year planning horizon.

The next section of the Plan outlines the implementation, investment and financial outlook for the next 20 years as WSF implements the Plan's goals and strategies. This section focuses on implementation of strategies in the near, medium and long term over this 20-year period. The section outlines costs for capital investments and the operating costs associated with service levels identified in the Plan.