

# Thurston Climate Adaptation Plan

## Action Table

### Habitat, Animals, Plants, and Agriculture

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#### Action 5

Expand biological control and manual removal of invasive plants and insects.

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- 10 Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
- 16 Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 106 Warmer winters increase the range and survival of pests and diseases that affect crops

#### Action 18

Increase the urban canopy with drought-tolerant and pest-resistant vegetation. [conserves water, provides cooling shade, as well as improves air and water quality, flood storage/infiltration, and pedestrian experience]

Source: Columbia Basin Trust Adaptation Resource Kit

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 54 Warmer summers increase water temperatures
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90 Population change increases strain on social and emergency services.
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 23 Population change increases pressure on existing parks and open space
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 46 Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations
- 50 Intensifying precipitation raises the cost of development (flooding and runoff mitigation measures)
- 111 Warmer summers increase atmospheric CO<sub>2</sub>, which decreases the nutritional quality of forage and pasture lands for livestock and wild animals

## Action 62

Establish agricultural resource and critical habitat protection goals/benchmarks.

Source: Modified ST Action C-4.1

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 10 Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
- 11 Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
- 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 14 Warmer winters cause salmon to remain active during winter and deplete their store of energy/health.
- 16 Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 79 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 83 Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational shellfisheries
- 102 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 103 Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational fisheries
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 15 Warmer summers decrease climatic suitability of areas that currently support Garry oak and prairie habitat
- 38 Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 39 Warmer water thermally stresses salmonids, which support economically important fisheries
- 42 Warmer winters reduce snowpack and alter stream volume and temperature, impacting long-term productivity of anadromous fish populations and fisheries
- 105 Increasing drought raises the risk of lower crop yield or failure
- 106 Warmer winters increase the range and survival of pests and diseases that affect crops
- 109 Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
- 139 Warmer summers decrease climatic suitability of areas that currently support Douglas fir
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 96 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 110 Warmer summers increase the heat stress risk for dairy cows and other large livestock
- 113 Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 63

Increase opportunities for urban agriculture.

Source: ST Action C-3.10

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- 85 Warmer winters shift life cycle of fish and wildlife, which could reduce populations that support subsistence and recreational hunting
- 38 Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 105 Increasing drought raises the risk of lower crop yield or failure
- 107 Warmer summers accelerate the risk of food spoilage before it reaches market
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 113 Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 70

Offer financial incentives for reducing environmental impacts.

Source: ST Action H-1.4

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 32** Sea-level rise raises the cost of new development and redevelopment
- 61** Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
- 62** Sea-level rise inundates former industrial sites, which could mobilize pollutants in the soil and degrade water quality
- 65** Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 120** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 60** Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)
- 116** Increasing drought raises pollutant concentrations in shallow wells and surface waters
- 4** Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 47** Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 50** Intensifying precipitation raises the cost of development (flooding and runoff mitigation measures)
- 51** Warmer summers increases extreme heat events, which could result in project delays and increased costs (e.g., in the construction industry)
- 97** Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)
- 113** Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.
- 119** Intensifying precipitation increases volume of urban runoff and flooding, which decrease groundwater recharge

## Action 74

Encourage less water-intensive agriculture processes.

Source: Modified ST Action F-1.6

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 10** Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
- 13** Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 16** Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 18** Warmer winters shifts the timing of flowering and abundance of pollinators, which could reduce some species of plants throughout the region
- 38** Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 105** Increasing drought raises the risk of lower crop yield or failure
- 106** Warmer winters increase the range and survival of pests and diseases that affect crops
- 110** Warmer summers increase the heat stress risk for dairy cows and other large livestock
- 135** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

## Action 75

Encourage less land-intensive farming models such as aquaculture and vertical gardening.

Source: Modified ST Action ST F-1.5

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- 13** Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 38** Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 105** Increasing drought raises the risk of lower crop yield or failure
- 106** Warmer winters increase the range and survival of pests and diseases that affect crops
- 107** Warmer summers accelerate the risk of food spoilage before it reaches market
- 4** Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 113** Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 78

Encourage and educate waterfront property owners on the benefits of voluntary oyster seeding and other shellfish production.

Source: Modified ST Action F-2.10

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- 20** Sea-level rise increases wave action effects, which could degrade coastal habitat
- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 59** Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 83** Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational shellfisheries
- 85** Warmer winters shift life cycle of fish and wildlife, which could reduce populations that support subsistence and recreational hunting
- 103** Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational fisheries
- 104** Ocean acidification reduces the food available for and survival of salmon and other marine life
- 41** Ocean acidification reduces food available for and survival of salmon and other marine life
- 109** Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
- 45** Warmer water increases the risk of marine water stratification and hypoxia, which could alter the timing of spring plankton blooms that support the marine food web (including salmon and other economically important fish)

### **Action 99**

Protect and enhance marine vegetation such as seaweed and eelgrass. [helps clean water, sequester carbon dioxide, improve fish habitat and survival, and stabilize shorelines] [Note: The the Alliance for a Healthy South Sound's draft South Sound Strategy does not propose a local target for eelgrass beds; in Thurston County, such beds in or near the Nisqually Estuary.]

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- 20** Sea-level rise increases wave action effects, which could degrade coastal habitat
- 59** Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 79** Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 83** Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational shellfisheries
- 103** Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational fisheries
- 104** Ocean acidification reduces the food available for and survival of salmon and other marine life
- 41** Ocean acidification reduces food available for and survival of salmon and other marine life
- 47** Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents

### **Action 106**

Increase funding, education and incentives for private landowners so that they may practice land management in a way that enhances ecological and economic resilience. [protecting and restoring forests, prairies and shoreline/riparian areas]

*Source: Hybrid of Action 1.1a from NRF adaptation plan and Action 5 from Deschutes River Watershed project*

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- 22** Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 85** Warmer winters shift life cycle of fish and wildlife, which could reduce populations that support subsistence and recreational hunting
- 15** Warmer summers decreases climatic suitability of areas that currently support Garry oak and prairie habitat
- 139** Warmer summers decrease climatic suitability of areas that currently support Douglas fir
- 112** Sea-level rise turns coastal marshes and forests into mudflats that alters nesting habitat
- 113** Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

### **Action 112**

Implement early detection/rapid response for invasive species treatment on land and in water.

*Source: NFS/NPS Climate Adaptation Library*

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- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 13** Warmer summers stresses sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 16** Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 19** Warmer water expands the range for invasive aquatic species
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens

### **Action 113**

Maintain permits for aggressive treatment of invasive species (e.g., burning and herbicide).

*Source: Action from NFS/NPS Climate Adaptation Library*

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- 13** Warmer summers stresses sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 16** Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens

### **Action 114**

Consider assisted migration of vulnerable plant and animal species to suitable habitat.

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 10 Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
- 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 15 Warmer summers decrease climatic suitability of areas that currently support Garry oak and prairie habitat
- 139 Warmer summers decrease climatic suitability of areas that currently support Douglas fir

### **Action 116**

Monitor cause and extent of changes in native and invasive plant distribution.

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 16 Warmer winters increase the range and survival of invasive species, pests and diseases that threaten native flora and fauna.
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens

### **Action 121**

Identify stream crossings that impede fish movements and prioritize culvert replacement.

Source: Modified action from NFS/NPS Climate Adaptation Library

- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.

### **Action 122**

Increase efficiency of crop irrigation and soil water-retention techniques.

Source: Modified action from NFS/NPS Climate Adaptation Library

- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 38 Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 96 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

### **Action 123**

Plant vegetation to increase shading of wetlands and microhabitats.

Source: Action from NFS/NPS Climate Adaptation Library

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- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens

### **Action 124**

Create a health impacts of climate change website, hosted by Thurston County Health & Social Services, and update the site with information about drought, air quality, extreme heat, disease vectors, and other threats.

*Source: Modified action from draft Thurston County drought planning effort*

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- 55** Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 78** Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 82** Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 92** Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 116** Increasing drought raises pollutant concentrations in shallow wells and surface waters
- 4** Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 46** Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations

### **Action 131**

Expand education and outreach about how forests, prairies and streams support ecosystem services and climate resiliency (providing habitat for fish and wildlife, mitigating erosion, etc.) so as to encourage sustainable land-use practices by residents.

*Source: Modified action from Alliance for a Healthy Sound's draft (2016) South Sound Strategy*

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- 11** Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
- 79** Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 85** Warmer winters shift life cycle of fish and wildlife, which could reduce populations that support subsistence and recreational hunting
- 39** Warmer water thermally stresses salmonids, which support economically important fisheries
- 113** Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

### Action 22

Explore "on-bill" financing of distributed renewable energy generation systems that spread out capital costs over time. (e.g., building- and district-scale solar power). [reduces grid/utility dependence and greenhouse gas emissions, saves money]

Source: Modified version of ST Action EN-1.1

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- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

### Action 23

Expand and retrofit the region's energy distribution, monitoring and storage infrastructure to support renewable and distributed energy generation.

Source: Modified version of ST Goal EN-2

- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
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### Action 32

Establish energy usage goals/benchmarks for all new buildings.

Source: *Smart Growth Fixes for Climate Adaptation and Resilience*, pg. v, 68

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- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

### **Action 37**

Explore incentives for the installation of distributed generation equipment, such as rooftop solar panels.

Source: *ST Action EN-1.3*

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 120** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97** Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)
- 136** Intensifying precipitation increases use of polluting generators following storm-induced power outages

### **Action 38**

Investigate the feasibility of large-scale renewable energy projects (e.g., large-scale solar arrays) in Thurston County.

Source: *Modified ST Action EN-1.4*

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29** Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
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- 91** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security

### **Action 39**

Investigate a legislative solution to permit Property Assessed Clean Energy (PACE) in Washington State. Advocate if solution is identified. [PACE financing supports energy efficiency and renewable energy projects by providing up-front capital that is subsequently paid back through a special assessment on participants' property taxes.]

Source: *ST Action EN 1.5*

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29** Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91** Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97** Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

## Action 40

Explore the viability of energy generation at solid waste facilities. [This could include exploring the Environmental Protection Agency's RE-Powering America's Land Program.]

Source: ST Action EN-1.6

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
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- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security

## Action 41

Adopt uniform building codes and permitting practices in jurisdictions to make the installation of solar panels, or other distributed-generation technologies, easier and faster.

Source: ST Action EN-1.7

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 136 Intensifying precipitation increases use of polluting generators following storm-induced power outages

## Action 42

Create a lifeline transportation route GIS map for the Thurston Region and integrate the data into the Thurston County Emergency Operations Plan and other local planning needs.

Source: CW-MH4 Countywide Hazard Mitigation Initiative

- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 51

Factor climate change (i.e., natural hazard vulnerability and emissions mitigation benefits) into consideration of local transportation projects submitted for federal transportation funding. [credit given for reducing region's carbon footprint, credit subtracted for vulnerability to climate impacts such as flooding and landslides]

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 53

Consider complementary local government ordinances that support solar orientation for all new construction.

Source: Modified ST Action EN-3.3

- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

## Action 54

Continue to work with businesses to increase the energy efficiency of processes and facilities.

Source: ST Action EN-3.4

- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security

## Action 55

Offer incentives for the use of ductless and high-efficiency heat pumps.

Source: ST Action EN-3.5

- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

## Action 56

Work regionally to adopt uniform energy-efficient building standards and engage in continuous improvement.

Source: ST Action EN-3.8

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- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

## Action 57

Consider adopting policies that require residential and commercial properties to undertake an energy audit at the time of sale during substantial remodel, including, if deficiencies are found, encouraging energy retrofits to upgrade properties to a specified level.

Source: ST Action EN-3.10

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- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

## Action 58

Utilize incentives to improve financial viability for infill and redevelopment projects.

Source: ST Action C-1.5

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 61 Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90 Population change increases strain on social and emergency services.
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 36 Population change puts more strain on transportation (roads, transit, etc.)
- 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 113 Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 71

Consider the effect of land-use decisions on air quality. [Reduce the region's vehicle miles traveled by focusing more job and housing density where there is access to services as well as safe and viable choices for travel.]

Source: Modified ST Action E-1.1

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- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 36 Population change puts more strain on transportation (roads, transit, etc.)
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)

## Action 72

Focus on education about the opportunities and choices to be made regionally, locally and by households to reduce air pollution.

Source: ST Action E-1.2

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- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 36 Population change puts more strain on transportation (roads, transit, etc.)
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)

## Action 73

Continue to monitor air quality and take actions to reduce air pollution.

Source: ST Action E-1.3

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- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 36 Population change puts more strain on transportation (roads, transit, etc.)
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)

## Action 98

Offer rebates or utility bill credits for rate-payers to weatherize their home, install renewable energy systems, and purchase energy-efficient appliances (including air conditioners). [incentives could be increased for low-income people]

- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 90 Population change increases strain on social and emergency services.
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 46 Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations
- 97 Warmer summers raise home cooling costs (e.g., buying, installing, and using air-conditioning)

### **Action 109**

Downzone parcels and decrease impervious surface limits near waterbodies with nutrient-loading problems.

*Source: Modified Actions 11, 12 and 13 from Deschutes River Watershed project*

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- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 55** Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 56** Increasing drought increases the concentration of pollutants in first-flush runoff

### **Action 132**

Update the Thurston Climate Adaptation Plan on a regular basis with new information, evaluate implementation efforts and effectiveness, and amend strategies and actions as necessary.

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 82** Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 83** Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational shellfisheries

### **Action 133**

Implement infrastructure operation and maintenance programs that consider full life-cycle costs and climate change impacts on municipal assets.

*Source: Modified action from King County Strategic Climate Action Plan*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)

### **Action 134**

Integrate estimates of the magnitude and timing of climate change impacts into capital planning, siting, design, and construction.

*Source: Action from King County Strategic Climate Action Plan*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 95** Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services

### **Action 135**

Develop the technical expertise and skills of municipal staff in preparing and responding to climate change impacts.

*Source: Modified action from King County Strategic Climate Action Plan*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 95** Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services

### **Action 136**

Align land use, hazard mitigation, transportation, capital improvement, and other plans so that they are working toward the same goals.

*Source: Modified action from Smart Growth Fixes for Climate Adaptation & Resilience*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 95** Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services

### **Action 138**

Incorporate sea-level rise impacts into all future land-use and water-system planning and regulations, using projections rather than past trends.

*Source: Modified action from Smart Growth Fixes for Climate Adaptation & Resilience*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 58** Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 114** Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation

### **Action 141**

Elevate, reinforce or relocate important electrical equipment that is within areas at risk coastal or inland flooding and/or landslides.

*Source: Modified action from "Power Failure," a 2014 report by the Union of Concerned Scientists*

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).

## Stormwater, Flooding, Erosion, and Landslides

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### Action 1

Move existing homes, roads and other infrastructure away from the most vulnerable shorelines and prohibit construction of new infrastructure in such hazard areas.

- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents

### Action 2

Require additional setbacks and vegetated buffers for new construction adjacent to shorelines vulnerable to accelerated erosion exacerbated by sea-level rise.

- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents

### Action 3

Limit installation of new coastal seawalls and rip-rap, as well as consider removing or retrofitting existing armoring to accommodate natural shoreline translation. [Such a “managed retreat” could entail replacing steep seawalls with gradual slopes, native vegetation, gravel and driftwood to slow erosion.] [Note: The Alliance for a Healthy South Sound's draft South Sound Strategy sets numerical targets for protecting coastal "feeder" bluffs, as well as targets for protecting intact shorelines/restoring modified shorelines].

Source: (Johannessen and MacLennan, 2007)

- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents

## Action 4

Establish a goal for restoring a certain percentage of riparian vegetation along freshwater and marine shorelines. [stabilizes banks, provides shade and flood storage, slows and filters polluted runoff, stores carbon emissions and enhances air quality] [Note: The Alliance for a Healthy South Sound's draft South Sound Strategy sets acreage targets and identifies locations for protecting and restoring freshwater and marine riparian habitat, including estuaries.]

Source: Modified ST Action E-4.10

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- 7 Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
  - 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
  - 11 Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
  - 20 Sea-level rise increases wave action effects, which could degrade coastal habitat
  - 54 Warmer summers increase water temperatures
  - 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
  - 56 Increasing drought increases the concentration of pollutants in first-flush runoff
  - 79 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
  - 102 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
  - 39 Warmer water thermally stresses salmonids, which support economically important fisheries
  - 42 Warmer winters reduce snowpack and alter stream volume and temperature, impacting long-term productivity of anadromous fish populations and fisheries
  - 64 Warmer water increases periods of low dissolved oxygen and hypoxic conditions in both freshwater and marine areas

## Action 6

Relocate or retrofit low-lying roads vulnerable to sea-levels rise. [Transferred actions could include encouraging the federal government to raise Interstate 5 at the Nisqually Estuary and U.S. Highway 101 at Mudd Bay.]

Source: Modified Action 3-2B from NRF climate adaptation plan

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- 12 Sea-level rise increases the frequency, depth and duration of inundation of low-lying coastal areas, which could turn marshes, estuaries and other upland areas into mudflats (dams limit sedimentation at Nisqually Delta)
  - 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut of access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 32 Sea-level rise raises the cost of new development and redevelopment
  - 112 Sea-level rise turns coastal marshes and forests into mudflats that alters nesting habitat

## Action 16

Designate alternative travel routes when roads must be closed because of natural hazards (floods, landslides, wildfires).

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
  - 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
  - 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut of access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
  - 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services

## Action 17

Prohibit construction of new buildings and roads in areas where flood and landslide risks are highest.

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 19

Make low-impact development (LID) the preferred and commonly used approach to site development, and educate commercial and residential building owners about proper maintenance of such stormwater-treatment facilities.

[reduces stormwater runoff, flooding, water pollution]

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- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 56 Increasing drought increases the concentration of pollutants in first-flush runoff
- 58 Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 59 Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)
- 50 Intensifying precipitation raises the cost of development (flooding and runoff mitigation measures)
- 119 Intensifying precipitation increases volume of urban runoff and flooding, which decrease groundwater recharge

## Action 20

Decouple combined storm and sewer systems. [adds capacity, mitigates back-ups and outbreaks of water-borne disease]

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- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows

## Action 25

Prioritize brownfield clean-up strategies/planned actions for low-lying sites that are most vulnerable to sea-level rise.

Source: Modified version of ST Action EC-5.6

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- 62 Sea-level rise inundates former industrial sites, which could mobilize pollutants in the soil and degrade water quality

## Action 35

Help property owners manage stormwater and flooding through education and incentives.

Source: *Smart Growth Fixes for Climate Adaptation and Resilience*, pg. iii, 33

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- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 138 Intensifying precipitation necessitates retrofitting stormwater and wastewater infrastructure to mitigate flooding and backups that threaten water quality and human health and welfare
- 119 Intensifying precipitation increases volume of urban runoff and flooding, which decrease groundwater recharge

## Action 49

Map transportation infrastructure that is subject to frequent flooding or is prone to landslides.

Source: *CW-MH10 Countywide Hazard Mitigation Initiative*

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 89

Evaluate adding a vegetation restoration surcharge to stormwater utility rates to help restore and protect shoreline and stream riparian areas.

Source: *Modified ST Action E-4.10*

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 7 Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 11 Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
- 20 Sea-level rise increases wave action effects, which could degrade coastal habitat
- 54 Warmer summers increase water temperatures
- 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 56 Increasing drought increases the concentration of pollutants in first-flush runoff
- 79 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 102 Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 39 Warmer water thermally stresses salmonids, which support economically important fisheries
- 42 Warmer winters reduce snowpack and alter stream volume and temperature, impacting long-term productivity of anadromous fish populations and fisheries
- 64 Warmer water increases periods of low dissolved oxygen and hypoxic conditions in both freshwater and marine areas

### **Action 97**

Conduct stormwater retrofit studies for all Thurston County basins, and establish funding to retrofit existing development to improve stream flows and water quality.

Source: ST Action E-4.4

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- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities

### **Action 101**

Require that the finished floors of new buildings near shorelines are raised sufficiently to accommodate sea-level rise.

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- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 32 Sea-level rise raises the cost of new development and redevelopment
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

### **Action 102**

Install flood gates on stormwater outfalls that are connected to Puget Sound. [helps prevent back-ups during high tide/heavy rain events]

- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

### **Action 103**

Regrade low-elevation areas and build floodwalls around critical facilities and along shorelines.

- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 98 Sea-level rise reduces shoreline recreation opportunities
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

### **Action 104**

Design new culverts and other drainage infrastructure to accommodate higher peak flows.

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- 7 Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities

## Action 105

Where flood-protection measures are not feasible or desired, alter zoning and relocate structures (buildings and roads) in areas that are most vulnerable to sea-level rise and/or inland flooding.

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- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 32 Sea-level rise raises the cost of new development and redevelopment
  - 109 Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
  - 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 107

Restore coastal estuaries as needed to reflect changes in sea levels.

Source: Modified Action 3.1a from NRF adaptation plan

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- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
  - 10 Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
  - 11 Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
  - 12 Sea-level rise increases the frequency, depth and duration of inundation of low-lying coastal areas, which could turn marshes, estuaries and other upland areas into mudflats (dams limit sedimentation at Nisqually Delta)
  - 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
  - 20 Sea-level rise increases wave action effects, which could degrade coastal habitat

## Action 108

Minimize development, disturbance and vegetation removal on or near steep slopes (>25% gradient) adjacent to waterbodies.

Source: Modified Action 10 from Deschutes River Watershed project; action also in Columbia Basin Trust adaptation toolkit

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- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
  - 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 57 Intensifying precipitation contaminates water (turbidity and sedimentation) due to landslides

## Action 117

Stabilize banks with vegetation, rip-rap or other materials near important historical or cultural sites.

Source: Modified action in NFS/NPS Climate Adaptation Library

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)

## Action 118

Retrofit, reroute or abandon trails and pedestrian/bicycle bridges near waterbodies with the highest flood risk.

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
  - 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
  - 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).

### **Action 137**

Acquire properties at risk of flooding, use the land for infiltration, and help the property owners resettle in the community.

*Source: Modified action from Smart Growth Fixes for Climate Adaptation & Resilience*

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- 25** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).

### **Action 142**

Evaluate at a watershed scale natural and constructed flood-storage options upstream of concentrated development areas that are at risk of flooding.

*Source: Modified action from Central Vermont climate resilience plan*

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- 25** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30** Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities

## Water Use and Water Conservation

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### **Action 12**

Develop a comprehensive drought-response strategy.

Source: Andrew Kinney

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 10** Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
- 29** Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 105** Increasing drought raises the risk of lower crop yield or failure
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 96** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 125** Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129** Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions
- 135** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

### **Action 13**

Increase incentives for water conservation during drought periods.

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 105** Increasing drought raises the risk of lower crop yield or failure
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 96** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 125** Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129** Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions
- 135** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

## Action 14

Increase treatment and reuse of greywater (i.e., gently used water from your bathroom sinks, showers, tubs, and washing machines) for irrigation.

- 
- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 10 Increasing drought stresses sensitive plants and habitat, which could reduce long-term viability of preserved and restored areas
  - 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 15

Expand septic system operation and maintenance education and outreach programs.

Source: *Modified Action 3 from Deschutes Watershed project*

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- 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
  - 61 Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
  - 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)

## Action 24

Increase the energy efficiency of the region's water infrastructure (includes replacing pumps and other drinking, waste and storm water systems that consume large amounts of energy).

Source: *Modified version of ST EN-3.7*

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- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
  - 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
  - 90 Population change increases strain on social and emergency services.
  - 126 Sea-level rise increases energy consumed to pump wastewater and stormwater
  - 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 26

Implement a water impact fee that reflects each property's water consumption.

Source: *Smart Growth Fixes for Climate Adaptation and Resilience, pg. v, 66*

- 
- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
  - 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths

## Action 28

Require new commercial construction to include rainwater harvesting facilities (this could be particularly applicable in Olympia/Tumwater/Lacey where urban runoff has less of an impact on groundwater recharge; but it may increase rate of saltwater intrusion?).

Source: *Smart Growth Fixes for Climate Adaptation and Resilience*, pg. vi, 69

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 138 Intensifying precipitation necessitates retrofitting stormwater and wastewater infrastructure to mitigate flooding and backups that threaten water quality and human health and welfare
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 119 Intensifying precipitation increases volume of urban runoff and flooding, which decrease groundwater recharge

## Action 29

Increase the use of water-efficient plumbing fixtures.

Source: *Smart Growth Fixes for Climate Adaptation and Resilience*, pg. v, 66, 68

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 30

Establish water usage goals/benchmarks.

Source: *Smart Growth Fixes for Climate Adaptation and Resilience*, pg. v, 68

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths

### **Action 31**

Require water metering for all wells.

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 129** Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

### **Action 45**

Purchase and retire water rights.

*Source: Action 20 from Deschutes River Watershed project*

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths

## Action 90

Identify and secure a consistent funding source to support long-term monitoring of ground and surface water quality in the region's basins.

Source: ST Action E-4.12

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- 7** Intensifying precipitation increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could degrade sensitive riparian areas
- 8** Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 11** Warmer winters degrade critical habitat (rivers and streams) due to greater winter runoff
- 30** Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 55** Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 56** Increasing drought increases the concentration of pollutants in first-flush runoff
- 57** Intensifying precipitation contaminates water (turbidity and sedimentation) due to landslides
- 58** Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 59** Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 61** Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
- 62** Sea-level rise inundates former industrial sites, which could mobilize pollutants in the soil and degrade water quality
- 63** Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 78** Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 102** Warmer water threatens the survival of salmon, which support cultural and economic practices and ecosystem services
- 114** Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation
- 64** Warmer water increases periods of low dissolved oxygen and hypoxic conditions in both freshwater and marine areas
- 45** Warmer water increases the risk of marine water stratification and hypoxia, which could alter the timing of spring plankton blooms that support the marine food web (including salmon and other economically important fish)
- 66** Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
- 67** Warmer summers increase recreational activity in waterbodies and risk of boat fuel spills

## Action 91

Use social marketing and other tools to educate and encourage behavior changes that reduce energy and water use.

Source: Modified ST Action E-2.5

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 29 Increasing drought reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 120 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which — depending on the energy source — may increase carbon emissions
- 38 Warmer summer raises the risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence
- 91 Warmer summers increase summer peak energy demand for cooling residential and commercial buildings, which could place more demand on grid and reduce energy security
- 105 Increasing drought raises the risk of lower crop yield or failure
- 116 Increasing drought raises pollutant concentrations in shallow wells and surface waters
- 125 Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 92

Assess drinking water wells' vulnerability to sea-level rise inundation and saltwater intrusion, and develop adaptation measures (e.g., relocating wells).

- 114 Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation

## Action 93

Identify a local entity to provide technical assistance to private well owners regarding conserving water and detecting leaks and pollution.

Source: Modified ST Action E-3.3

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 114 Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 116 Increasing drought raises pollutant concentrations in shallow wells and surface waters
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 94

Change state law to limit groundwater withdrawals from new exempt wells.

Source: ST Action E-3.5

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 8 Increasing drought degrades critical habitat (lakes, rivers, streams and watersheds) due to changes in water volume and temperature.
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 114 Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 116 Increasing drought raises pollutant concentrations in shallow wells and surface waters
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 95

Change state water law or adopt common local land-use regulations that prohibit individual exempt wells within Urban Growth Areas (UGAs) when municipalities or private suppliers can provide drinking water.

Source: ST Action E-3.6

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).

## Action 96

Implement groundwater banking. [Thurston County could take a leadership role in allowing farming communities to share and swap water rights by working with local nonprofits to create systems that protect water access for both fishing and agriculture by acquiring and managing water rights. This could be funded through a water district levee authority and impact fees.]

Source: ST Action E-3.7

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 110

Implement a mandatory septic system operation and maintenance program countywide.

Source: Modified Action 14 of Deschutes River Watershed project

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- 61 Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
- 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)

## Action 120

Consider constructing new large water-storage systems, such as reservoirs and water towers.

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).

## Action 125

Predict drought and flood conditions by tracking soil moisture, streamflow, precipitation, groundwater levels, tide levels, well levels, reservoir levels and weather forecasts.

Source: Modified action from draft Thurston County drought plan

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- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 25** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 33** Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 105** Increasing drought raises the risk of lower crop yield or failure
- 109** Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
- 133** Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 94** Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 95** Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 96** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 99** Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 110** Warmer summers increase the heat stress risk for dairy cows and other large livestock
- 135** Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

## Action 126

Recommend actions residents may take to decrease water consumption and loss of water to evaporation and transpiration during drought periods. [Actions include: water no more than three days a week; do not water lawns between 10AM and 6PM; do not waste water by allowing it to pool in gutters, streets and alleys; do not waste water by letting it spray on impervious surfaces; repair leaking sprinkler systems within 10 days; do not water while it is raining or windy; curtail outdoor water use--except for trees and shrubs--before restricting indoor use; increase the use of reclaimed water; encourage the use of water-efficient appliances; encourage planting drought-tolerant vegetation]

Source: Modified action from draft Thurston County drought plan

- 1** Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52** Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117** Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80** Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 5** Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 125** Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129** Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 127

Post signs in public and commercial areas encouraging water conservation.

Source: Action in draft Thurston County drought plan

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 125 Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 129

Promote public programs to set conservation goals and monitor individual/family/commercial water usage.

Source: Action in draft Thurston County drought plan

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 125 Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

## Action 130

Set action levels for different drought stages.

Source: Action from draft Thurston County drought plan

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 52 Increasing drought reduces groundwater recharge (drinking water and in-stream flows)
- 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
- 80 Increasing drought reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels and raise the cost of pumping water from greater depths
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 125 Increasing drought lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases
- 129 Increasing drought necessitates moving water farther distances, which consumes more energy/causes more greenhouse gas emissions

# Wildfire and Hazard Response

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## Action 7

Extend the rural burn ban season during droughts.

- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 66 Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 94 Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 8

Downzone areas with highest risk of wildfire.

- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 66 Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 94 Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 113 Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 9

Encourage private forestland owners and residents living in Wildland-Urban Interface (WUI) areas to use Firewise practices.

*Source: Modified action from NFS/NPS Climate Adaptation Library*

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- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
  - 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
  - 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
  - 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
  - 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
  - 66 Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
  - 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
  - 94 Increasing drought raises the risk of wildfires, which could damage utility infrastructure
  - 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
  - 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 11

Enhance training and support for wildfire response.

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- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 66 Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 94 Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 21

Designate cooling centers and open them during heat waves.

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- 90 Population change increases strain on social and emergency services.
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 46 Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations

## Action 43

Strengthen interjurisdictional asset-management capabilities.

Source: CW-MH7 Countywide Hazard Mitigation Initiative

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities

## Action 44

Develop and maintain a countywide hazards mitigation public outreach strategy.

Source: Modified CW-MH6 Countywide Hazard Mitigation Initiative

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- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 78 Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 114 Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 96 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 46

Map the region's high-risk wildland urban interface communities and locations of wildfires.

Source: Modified CW-WH1 Countywide Hazard Mitigation Initiative

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- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 47

Inventory essential facilities and assets to support hazard mitigation planning and emergency management.

Source: CW-MH1 Countywide Hazard Mitigation Initiative

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)

## Action 48

Inventory and assess sheltering facilities.

Source: CW-MH11 Countywide Hazard Mitigation Initiatives

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
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- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 50

Strengthen the capabilities of the Disaster Medical Coordination Center (DMCC) hospital.

Source: CW-MH8 Countywide Hazard Mitigation Initiative

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
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- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 59

Convene the region's health, social service, and public safety partners to seek opportunities to bridge the area's safety gaps.

Source: ST Action PS-1.1

- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 57 Intensifying precipitation contaminates water (turbidity and sedimentation) due to landslides
- 59 Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 61 Intensifying precipitation contaminates water (nutrients) from septic systems due to high groundwater flooding
- 63 Intensifying precipitation contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows
- 78 Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90 Population change increases strain on social and emergency services.
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 132 Warmer summers increase production of surface ozone (VOCs interacting with Nox) and accumulation of fine particulate matter (PM2.5)
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 96 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 135 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

## Action 60

Modify building codes where necessary to address emergency service radio communications, fire sprinkler systems in all new residential and commercial construction, and access and egress issues to emergency response and equipment.

Source: ST Action PS-1.5

- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90 Population change increases strain on social and emergency services.
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 61

Upgrade all emergency services radio communications equipment and infrastructure to a robust countywide platform that is responsive to changes in technology.

Source: ST Action PS-1.6

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
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- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
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- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 4 Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 135 Increasing drought parches farm fields and other open spaces, which could erode and release windblown dust (e.g., PM10) that degrades air quality

## Action 64

Explore the feasibility of expanding opportunities to share resources or consolidate (functional or administrative) law enforcement, fire protection, or emergency medical service agencies to determine if service level improvements or cost savings could be achieved.

Source: ST Action SP-1.8

- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90 Population change increases strain on social and emergency services.

## Action 65

Assess the adaptive capacity and address the needs of people who might be particularly vulnerable or most affected by climate change (e.g., people who are elderly, socially isolated, and/or live in high-risk areas).

Source: Modified action from Smarth Growth Fixes for Climate Adaptation & Resilience

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- 55 Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 59 Ocean acidification decreases marine pH and, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality
- 78 Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 83 Ocean acidification makes it harder for calcifying organisms to form shells, and ultimately harms commercial and recreational shellfisheries
- 90 Population change increases strain on social and emergency services.
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 64 Warmer water increases periods of low dissolved oxygen and hypoxic conditions in both freshwater and marine areas
- 46 Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations

## **Action 67**

Prioritize relationship-building among public safety agencies and other entities to leverage response capabilities during disaster events.

Source: *ST Action PS-2.5*

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- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90** Population change increases strain on social and emergency services.
- 92** Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 46** Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations

## **Action 69**

Participate in regional emergency exercises and recovery planning processes.

Source: *ST Action PS-2.6*

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- 26** Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
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- 87** Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 90** Population change increases strain on social and emergency services.
- 92** Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 46** Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations

## Action 81

Convene recovery committees immediately after a disaster to prioritize restoration of vital public safety facilities and other essential community assets.

Source: ST Action PS-2.7

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 25 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and result in economic losses
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 58 Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 78 Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 87 Intensifying precipitation puts more strain on services (social, emergency, etc.)
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 109 Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
- 47 Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death
- 110 Warmer summers increase the heat stress risk for dairy cows and other large livestock

## Action 82

Train emergency personnel in preparation and response best practices, and evaluate lessons learned following natural disasters.

Source: Modified ST Action PS-2.8

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
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- 110 Warmer summers increase the heat stress risk for dairy cows and other large livestock

## Action 84

Build residents' capacity to respond to and recover from natural hazards (e.g., floods, wildfires, landslides) [This entails: broadly publicizing the locations and descriptions of community disaster shelters; encouraging residents to stock rations, medications, back-up heating and emergency supplies to maintain self-sufficiency for at least 72 hours, preferably 7-10 days; and, building relationships among neighbors to leverage skills and resources to assist people in need when public safety services are overextended during a disaster.]

Source: Modified ST Action PS-2.10

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- 109** Sea-level rise pushes saltwater farther into estuaries, which may inundate near-coastal farms and ranches
- 47** Sea-level rise increases the rate of erosion of unprotected coastal bluffs, which could threaten the property and safety of nearby residents
- 68** Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 74** Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 95** Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99** Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 85

Jurisdictions with adopted hazard-mitigation plans should actively pursue funding opportunities to implement their highest-priority mitigation actions.

Source: ST Action PS-2.15

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- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 86

Coordinate on strategies for containing urban wildfires.

Source: ST Action PS-2.16

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- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
- 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 87

Expand the eligibility of Federal Emergency Management Agency (FEMA) mitigation grant programs to allow replacement of aging structures [This includes facilities such as water infrastructure, fire stations, transportation infrastructure, emergency coordination shelters, and buildings used as emergency shelters that are better suited to serve communities in the future.]

Source: Modified ST Action PS-2.17

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- 3 Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 26 Sea-level rise raises the risk of coastal inundation and erosion, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 30 Intensifying precipitation increases volume of urban runoff and flooding, which could render inadequate some stormwater/flood-control facilities
- 58 Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 92 Warmer summers increase extreme temperatures, which could cause hyperthermia -- a major risk for elderly, homeless and other especially vulnerable populations
- 114 Sea-level rise makes coastal groundwater more vulnerable to saltwater intrusion and inundation
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 88

Develop a Disaster Debris Management plan with actions to efficiently dispose of or recycle materials (organic and artificial).

Source: Modified ST Action SW-1.9

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- 13 Warmer summers stress sensitive plants and habitat, which could leave them vulnerable to extreme heat, pests or pathogens
- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
- 27 Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 5 Increasing drought stresses sensitive urban landscaping, which could leave them vulnerable to extreme heat, pests or pathogens
- 68 Sea-level rise raises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 71 Population change increases solid waste volume
- 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled

## Action 100

Assess climate change-induced migration within and to the Thurston Region. [This could entail assessing which of the region's residents are most vulnerable to temporary or permanent displacement (e.g., low-income or socially isolated residents who may be forced to move because of coastal or upland flooding) and what resources they might need. This could also entail assessing who is most likely to move to the region and how to accommodate them in ways consistent with community values. This could be done by studying "chain migration," the tendency of migrants to follow those of similar ethnicity, language or job skillset, as well as by evaluating migrants' needs and where/how much growth should occur so that it's consistent with local comprehensive plans.]

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- 1 Increasing drought makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 65 Population change increases transportation-related energy consumption, CO2 emissions, and other pollutants related to buildings and transportation.
  - 90 Population change increases strain on social and emergency services.
  - 117 Population change makes it harder to balance competing demands for water (for housing, industry, energy, agriculture, and the environment).
  - 23 Population change increases pressure on existing parks and open space
  - 36 Population change puts more strain on transportation (roads, transit, etc.)
  - 60 Population change increases pollution related to development (e.g., more septic systems and impervious surfaces)
  - 89 Population change puts more strain on schools (e.g., unplanned influx or loss of students)
  - 71 Population change increases solid waste volume
  - 113 Population change increases pressure to develop rural areas, which could reduce, fragment and/or degrade farms, forests, and prairies.

## Action 111

Require underground wiring and design sidewalks, boulevards and highways to act as firebreaks and evacuation routes.

Source: Modified Action 2.3 from Columbia Basin Trust adaptation toolkit

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- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
  - 82 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
  - 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
  - 122 Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
  - 133 Increasing drought raises the risk of wildfires and elevated levels of PM10 from smoke
  - 66 Increasing drought contaminates water (turbidity and sedimentation) due to wildfires
  - 74 Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
  - 94 Increasing drought raises the risk of wildfires, which could damage utility infrastructure
  - 95 Increasing drought raises the risk of wildfires, which could close roads and cut off access to vital goods and services
  - 99 Increasing drought raises the risk of wildfires, which could result in personal injury or death

## Action 115

Thin trees and prescribe managed burns in high-risk wildfire areas. [Reduces forest drought stress and wildfire vulnerability, increases tree regeneration/vigor].

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 22 Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
  - 33 Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy

### **Action 119**

Limit public access to parks and other outdoor recreation areas when natural hazards pose risks to public safety.

Source: Modified action from NFS/NPS Climate Adaptation Library

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- 3** Sea-level rise increases the frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which could damage or disrupt use infrastructure and result in loss of cultural resources (e.g., homes, roads, etc.)
- 27** Intensifying precipitation raises the risk of floods and landslides, which could damage private property and public infrastructure, endanger lives, and cut off access to goods and services (affects agriculture, buildings, roads, bridges, and other assets).
- 55** Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users

### **Action 139**

Require new developments to submit a fire-protection plan during site plan review.

Source: Action from Smart Growth Fixes for Climate Adaptation & Resilience

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- 22** Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
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- 33** Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
- 122** Increasing drought raises the risk of wildfires, which could destroy forests that serve as a net carbon sink
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- 74** Increasing drought raises the risk of wildfires, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled
- 94** Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 99** Increasing drought raises the risk of wildfires, which could result in personal injury or death

### **Action 140**

Adopt wildfire hazard overlay districts with development regulations based on factors like slope, structure, and fuel hazards.

Source: Action from Smart Growth Fixes for Climate Adaptation & Resilience

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- 22** Increasing drought raises the risk of wildfires, which could damage forests and other sensitive lands that provide habitat
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- 33** Increasing drought raises the risk of wildfires which could damage forests that are important to the region's economy
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- 94** Increasing drought raises the risk of wildfires, which could damage utility infrastructure
- 99** Increasing drought raises the risk of wildfires, which could result in personal injury or death

### **Action 143**

Increase resources to monitor climate change-exacerbated risks to human health -- including disease vectors, water contamination, and extreme heat -- and develop preventative and responsive measures.

*Source: Amended action from Central Vermont climate resiliency plan*

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- 55** Warmer water increases the growth and reach of pathogens (e.g., cyanobacteria and algal blooms) harmful to humans, fish and other water users
- 58** Sea-level rise increases coastal flooding of downtown Olympia and LOTT wastewater treatment plant assets, which could threaten the ability to treat and discharge water
- 78** Warmer summers introduce or exacerbate disease vectors (carriers), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats)
- 4** Warmer summers cause urban heat islands, which could affect livability/health in heavily developed centers and corridors
- 46** Warmer summers increases the risk for heat injuries due to rising temperatures, which will increase demand/cost for emergency medical services and hospitalizations