RECOMMENDED TREE LIST & SISTER CLIMATE CITY ASSESSMENT

In support of the City of Camas, Washington's

2024 PARKS & OPEN SPACE MANAGEMENT PLAN

Last updated: January 2024

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CLIMATE IMPACTS IN CAMAS, WA

Urban areas around the world are facing dramatically intensifying extreme weather and climate impacts including drought, long-term water shortages, flooding, extreme weather events, and prolonged heat. Urban trees can play a significant role in making Camas, Washington resilient to weather and climate extremes, and in protecting human and ecosystem health and safety.

Increased temperatures and prolonged heat have a dramatic effect on urban trees. Urban trees already face many struggles of the urban environment, including competition for space, elements of an urban environment, vandalism, and harmful pests and diseases. Some of Camas's established trees are unlikely to survive the changes in the climate and weather patterns over the next 50-75 years. Planting the right trees for Camas today and in the future will play a vital role in the resiliency of the City's urban forest as well as overall community sustainability.

In pursuit of a sustainable and resilient urban forest, the City of Camas may seek to apply climate adaptation strategies to urban forest management planning. Building toward this objective, the City maintains a recommended tree list of small, medium, and large trees and trees that are prohibited for planting in public areas or through private development projects as a requirement of City Code. This report provides a summary of the changing climate, an analysis of urban tree species vulnerability to changing climate, and considerations for new tree species to integrate into Camas's urban forest over time.

Key Impacts of Climate Change in the Pacific Northwest

Source: Climate Change Response Framework (NIACS)

- Temperatures in the Northwest are projected to increase by 4.9 to 8.5 degrees Fahrenheit by late-century (2071-2100).
- By the middle of the century, the Northwest region is expected to experience 3 to 18 more days per year with a maximum temperature exceeding 95 degrees F, and the hottest day of the year is projected to warm by 6.25°F.
- The Northwest region is expected to experience between 5 and 30 fewer days per year with a minimum temperature below 10 degrees Fahrenheit by the middle of the century, and the coldest day of the year will warm is projected to warm by 7.33°F.
- Climate conditions will continue to increase wildfire risks in in the Northwest by the end of the century.
- By the end of the century, average annual precipitation is projected to increase slightly in the Northwest, along with increased year-to-year variability in precipitation.
- The number of days per year with more than 1 inch of precipitation will increase across the Northwest by the middle of the century.
- The freeze-free season is expected to increase by 20 to 40 days in the Northwest by the middle of the century.
- Warmer temperatures, reduced snowpack, and greater water demand for agriculture may reduce available water for natural ecosystems.
- Climate change will amplify many existing stressors to forest ecosystems in the Northwest, such as insect pests, tree diseases, and wildfire.
- Many tree species and ecosystems in the Northwest may decline under climate change.
- The urban heat island effect can exacerbate the effects of increasing temperatures.
- Impervious cover can exacerbate the effects of increased heavy precipitation events in urban areas.
- Low-diversity systems are at greater risk from climate change.

View Appendix A for the climate change report generated from the Climate Change Response Framework for the northwest United States.

Purpose of Climate Impact Studies

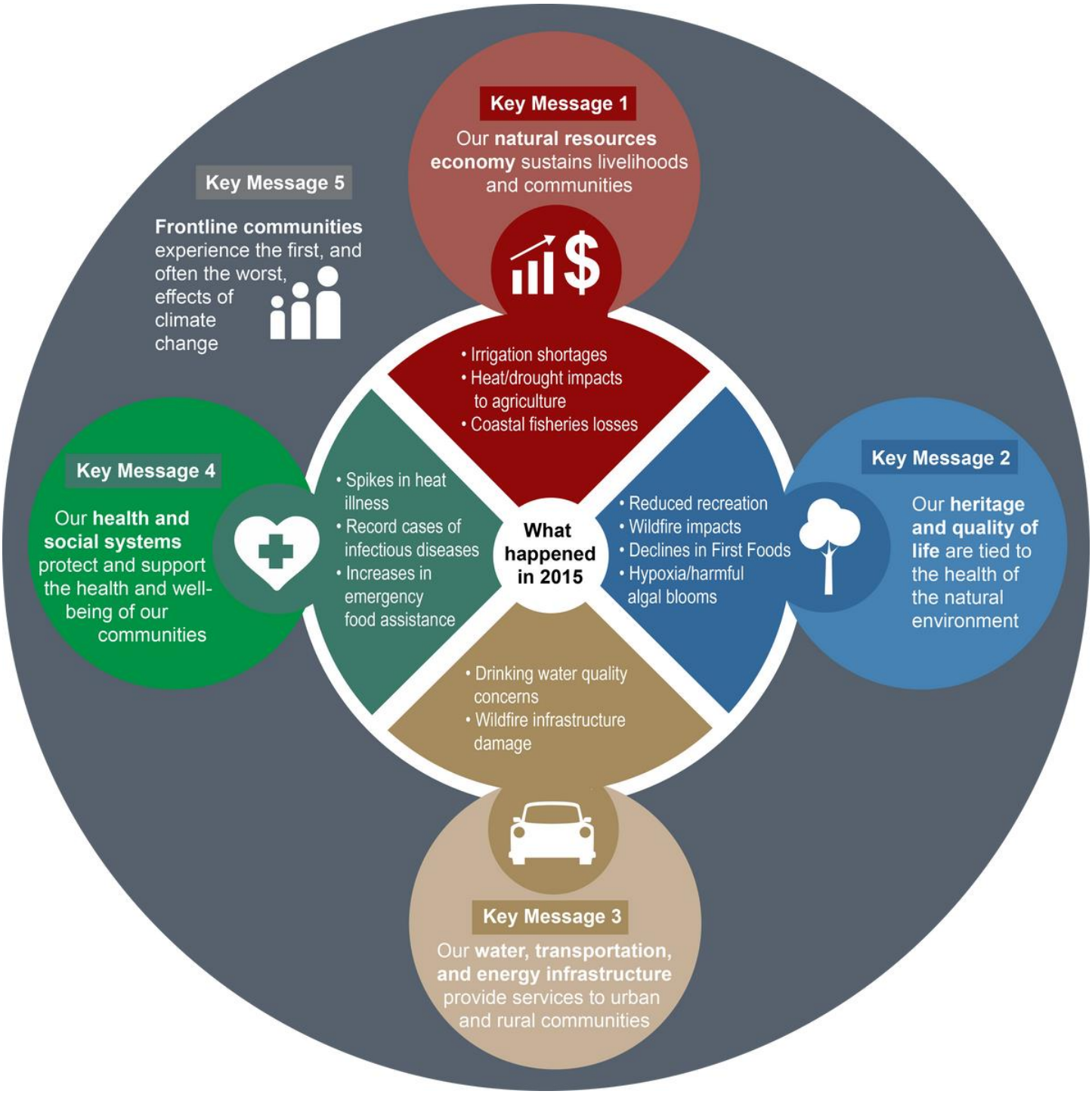


Figure 1. Climate change impacts and key messages (Source: Climate Change Response Framework, NIACS)

The climate-related events of 2015 provide a glimpse into the Northwest's future, because the kinds of extreme events that affected the Northwest in 2015 are projected to become more common. The climate impacts that occurred during this record-breaking warm and dry year highlight the close interrelationships between the climate, the natural and built environment, and the health and well-being of the Northwest's residents. Source: USGCRP.

Climate Stressors Affecting Vulnerable Infrastructure

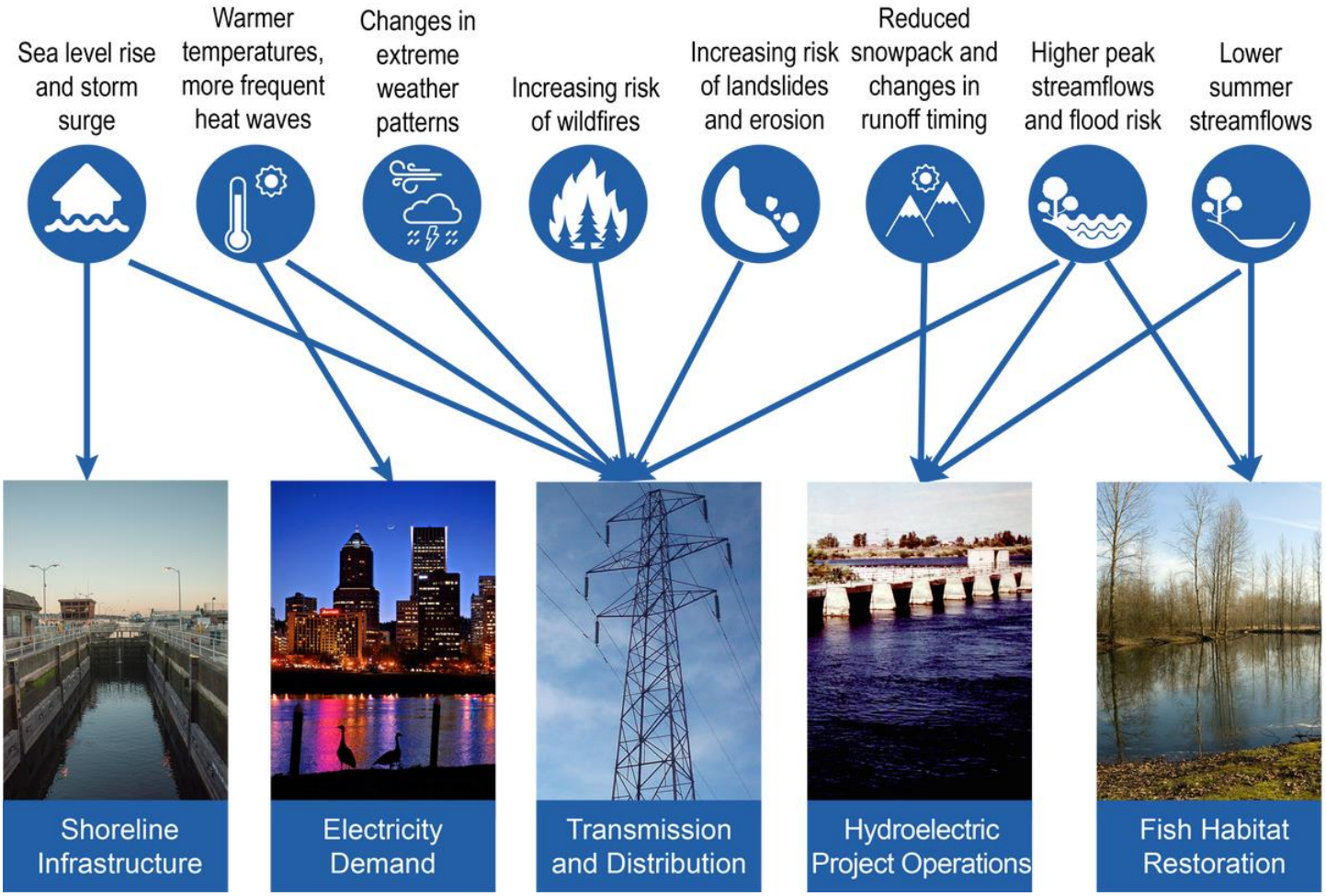


Figure 2. Climate stressors affecting vulnerable city infrastructure (Source: Climate Change Response Framework, NIACS)

Extreme events such as floods, heat waves, wildfires, landslides, and drought play an important role in the vulnerability of infrastructure. The figure, from Seattle City Light's Vulnerability Plan, illustrates how the utility's assets, operations, and management goals are affected by a broad range of climate impacts and extreme events. Adaptation strategies to increase the resilience of the energy system must focus on multiple potential risks as well as environmental considerations. Source: Raymond, C. L., Seattle City Light climate change vulnerability assessment and adaptation plan. Seattle City Light, Seattle, WA, 97 pp. URL.

POTENTIAL STRATEGIES AND APPROACHES FOR URBAN AREAS

For the City's consideration, the strategies from the Climate Change Response Framework (NIACS) for Pacific Northwest communities are listed below. The City should consider a Master Tree Planting Plan or Urban Forest Management Plan to develop strategies specific to Camas.

- Strategy 1: Sustain or restore fundamental ecological functions
  - Maintain or restore soils and nutrient cycling in urban areas
  - Maintain or restore hydrology
  - Maintain or restore riparian areas
  - Reduce competition for moisture, nutrients, and light
  - Restore or maintain fire in fire-adapted ecosystems
- Strategy 2: Reduce the impact of biological stressors
  - Maintain or improve the ability of forests to resist pests and pathogens
  - Prevent the introduction and establishment of invasive plants and remove existing invasive species
  - Manage herbivory to promote regeneration, growth, and form of desired species
- Strategy 3: Reduce the risk and long-term impacts of severe disturbances
  - Alter forest structure or composition to reduce risk or severity of wildfire
  - Maintain trees and remove hazards to reduce severity or extent of wind and ice damage
- Strategy 4: Maintain or create refugia
  - Prioritize, maintain, and restore unique sites
  - Prioritize and maintain sensitive or at-risk species or communities
  - Establish artificial reserves for at-risk and displaced species
- Strategy 5: Maintain and enhance species and structural diversity
  - Promote diverse age structure
  - Maintain and restore diversity of native species
  - Retain biological legacies
  - Establish reserves to maintain ecosystem diversity
- Strategy 6: Increase ecosystem redundancy across the landscape
  - Manage habitats over a range of sites and conditions
  - Expand or buffer the boundaries of reserves to increase diversity
- Strategy 7: Promote landscape connectivity
  - Reduce landscape fragmentation
  - Maintain and create habitat corridors through reforestation or restoration
- Strategy 8: Maintain and enhance genetic diversity
  - Use seeds, germplasm, and other genetic material from across a greater geographic range
  - Favor existing genotypes that are better adapted to future conditions
  - Use new genotypes that are better adapted to future threats and conditions
- Strategy 9: Facilitate composition adjustments through species transitions
  - Favor or restore native species that are expected to be adapted to future conditions
  - Establish or encourage new mixes of native species
  - Select tree species to match current and future site conditions
  - Protect future-adapted seedlings and saplings
  - Disfavor species that are distinctly maladapted
  - Manage for species or genotypes with wide moisture and temperature tolerances
  - Introduce species that are expected to be adapted to future conditions
  - Move at-risk species to locations that are expected to provide habitat
- Strategy 10: Realign urban ecosystems after disturbance
  - Promptly revegetate sites after disturbance
  - Prioritize remediation of remaining trees following disturbance
  - Realign significantly disrupted ecosystems to meet expected future conditions

Urban Forest Strategy – Building a Resilient Tree Planting Program

Tree Planting Program

1. Selecting the Right Trees

The first step towards a climate-resilient tree planting program in Camas involves choosing the right tree species. Native trees adapted to the local climate and soil conditions are the best choice as they require less water and maintenance and are more likely to survive and thrive in the face of changing weather patterns. Additionally, diversity is key. Planting a variety of tree species helps spread the risk of disease and pest outbreaks and ensures the overall success of the program.

Camas could involve local experts, like arborists and ecologists, to identify suitable species. Factors like drought tolerance, heat resistance, and resistance to pests and diseases should be considered. Some potential native trees for Camas include Douglas fir, western red cedar, Oregon white oak, and Pacific madrone.

2. Planting for the Future

Once suitable tree species are selected, the planting process itself needs to be carefully planned to ensure long-term success. Planting trees in diverse locations throughout the City, including parks, streetscapes, and private properties, not only enhances the urban landscape but also creates vital wildlife corridors and improves air quality.

Camas could incentivize residents and businesses to participate in the program through educational workshops, subsidies for tree purchases, and assistance with planting. Additionally, partnering with local organizations like schools, community centers, and environmental groups can increase community engagement and foster a sense of ownership of the program.

3. Adapting to Change

As the climate continues to change, monitoring and adapting the tree planting program will be crucial for its long-term success. Regular assessments of the planted trees should be conducted to identify any issues and take necessary corrective measures. This could involve adjusting watering schedules, providing additional care during extreme weather events, and replanting trees that fail to thrive.

Camas could establish a dedicated team or partner with existing organizations to monitor and manage the program. Utilizing technology like remote sensing and data analysis tools can aid in effectively tracking the health and progress of the planted trees. By continuously adapting to the changing environment, Camas can ensure the sustainability and success of its tree planting program, contributing to a greener and more resilient future for the City.

The Danger of Single Species Planting

Historically, the use of a single species of street trees has had negative consequences. In the early 1900s, the American Chestnut, a popular and heavily planted street tree, was devastated by the chestnut blight. The blight caused large swaths of trees in the American streetscape to perish and left large gaps in the American landscape. A similar incident occurred with the spread of Dutch Elm disease. Due to the monoculture planting of elm trees as street trees, the impact was even more noticeable on streetscapes throughout the country. For these reasons and other global issues with plant disease, pests and pathogens, Camas should implement a diverse palette for tree plantings on public property and encourage private landowners to support this effort on their own property. Using native species trees is vital because it benefits the local ecosystem and saves the City money and time. Native species are well suited for the climate and prosper in the region's soils because they originated here.

City of Camas's Current Tree Species Lists

According to the City of Camas Plant Materials resource, the City has a list of tree species for narrow spaces, small trees, medium to large size trees, and prohibited trees (in addition to small to medium sized shrubs, accent shrubs, ornamental grasses, and ground covers that are outside of the scope of this study). The following provides a recreation of the tree lists from this resource. For a complete list of attributes by tree species, visit the City's Plant Materials resource hyperlinked above. Note, the following was copied from the City's list and does not infer correct spellings or nomenclature.

Trees for Narrow Spaces

Plant 15' to 25' apart, compatible with mature trees size. Typical size at time of planting is 2" minimum caliper (ball & burlap or B&B or container)

Table 1. Approved list of street trees for narrow spaces (Source: City of Camas Plant Materials list)

Common Name	Botanical Name	Height	Spread	Min. Planter Width (ft.)	Form
Adirondack Crabapple	*Malus 'Adirondack'*	18	10	4	Columnar
Amanogawa cherry	*Prunus serrulata 'Amanogawa'*	20	6	4	Columnar
American smoketree	*Cotinus obovatus*	30	30	4	Globe
Beauty plum semi- dwarf	*Prunus salicinia*'Beauty'	15	15	4	Globe
Big Cis plum	*Prunus* x *cistena 'Schmidtcis'*	14	12	4	Globe
Black hawk mountain ash	*Sorbus aucuparia 'Black hawk'*	25	15	4	Columnar
Black Hawthorne	*Crataegus douglasii*	25	20	4	Oval
Butterfly Japanese Maple	*Acer palmatum 'Butterfly'*	12	6	4	Umbrella
Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	35	12	4	Pyramidal
Centurion Crabapple	*Malus 'Centurion'*	20	15	4	Oval
Chinese Pistache	*Pistachia chinensis*	25	25	4	Globe
Chonosuki Crabapple	*Malus tschonoskii*	30	15	4	Oval
Cleveland Select Pear (Chanticleer)	*Pyrus calleryana 'Chanticleer'*	30	20	4	Pyramidal
Columnar goldenchain	*Laburnum anagyroides* 'Columnaris'	20	10	4	Vase
Columnar Siberian Crabapple	*Malus baccata 'Columnaris'*	30	10	4	Columnar
Cornelian cherry dogwood	*Cornus mas*	20	20	4	Umbrella
Crimson Cloud Hawthorn	*Crataegus laevigata 'Crimson Cloud'*	25	18	4	Oval
Flame maple	*Acer ginnala* 'Flame'	20	20	4	Oval

Flowering Dogwood	*Cornus florida*	25	25	4	Vase
Flowering Plum	*Prunus x blireana*	20	20	4	Globe
Fragrant Snowbell Tree	*Styrax obassia*	35	25	4	Globe
Fraser's Photinia	*Photina fraseri*	12	10	4	Globe
Globe locust	*Robinia pseudoacacia 'Inermis'*	20	20	4	Globe
Golden Desert Ash	*Fraxinus excelsior 'Golden Desert'*	20	20	4	Globe
Golden Raindrops crabapple	*Malus 'Schmidtcutleaf'*	20	15	4	Vase
Grace smoketree	*Cotinus coggygria* x *obovatus 'Grace'*	20	15	4	Globe
Ivory Silk Tree Lilac	*Syringa reticulata 'Ivory Silk'*	20	15	4	Oval
Japanese Snowbell	*Styrax japonicus*	25	25	4	Globe
Japanese Stewartia	*Stewartia pseudocamellia*	25	25	4	Umbrella
Japanese Tree Lilac	*Syringa reticulata*	20	15	4	Oval
Korean Stewartia	*Stewartia sinensis*	25	20	4	Pyramidal
Kousa Dogwood	*Cornus kousa*	25	25	4	Globe
Merrill Magnolia	*Magnolia* x *loebneri 'Merrill'*	25	25	4	Pyramidal
Mt Fuji flowering cherry	*Prunus serrulata 'Shirotae' (Mt Fuji)*	25	25	4	Vase
Paperbark Maple	*Acer griseum*	25	20	4	Globe
Portugal laurel	*Prunus lusitanica*	15	15	4	Globe
Prariefire Crabapple	*Malus 'Prairie Fire'*	20	20	4	Pyramidal
Purple Prince crabapple	*Malus* 'Purple Prince'	20	20	4	Globe
Red Barron Crabapple	*Malus 'Red Barron'*	18	8	4	Columnar
Red Jewel™ Crabapple	*Malus 'Jewelcole'*	15	12	4	Pyramidal
Roughbark maple	*Acer triflorum*	20	20	4	Globe
Sango Kaku Japanese Maple	*Acer palmatum 'Sango Kaku'*	18	14	4	Umbrella
Saucer Magnolia	*Magnolia x soulangeana*	25	25	4	Pyramidal
Serviceberry	*Amelanchier* x *grandiflora*	25	15	4	Oval
Shirofugen flowering cherry	*Prunus serrulata 'Shirofugen'*	25	25	4	Vase
Snowcone Japanese snowbell	*Styrax japonicus* 'JFS- D'	20	20	4	Globe
Snowdrift crabapple	*Malus 'snowdrift'*	25	25	4	Globe
Southern Magnolia	*Magnolia grandiflora* 'Victoria' or 'Little Gem'	25	25	4	Globe
Spire cherry	*Prunus* x *hilleri*	30	10	4	Columnar
Summer Sprite linden	*Tilia cordata* 'Halka'	20	15	4	Globe
Tall Stewartia	*Stewardia montadelpha*	25	20	4	Globe
Wedding Bells silverbell	*Halesia carolina 'Wedding Bells'*	20	15	4	Oval
Western Serviceberry	*Amelanchier alnifolia*	20	20	4	Oval
Winter Flowering Cherry	*Prunus subhirtella 'Autumnalis'*	25	25	4	Vase

Note: The scientific / botanical names and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Small Trees

Suitable under utility wires. Plant 20' to 30' apart, compatible with mature tree size. Typical size at time of planting is 2" minimum caliper (B&B or container)

Table 2. Approved list of small street trees (Source: City of Camas Plant Materials list)

Common Name	Botanical Name	Height	Spread	Min. Planter Width (ft.)	Form
Akebono Flowering Cherry	*Prunus x yedoensis 'Akebono'*	25	25	4	Vase
American Hornbeam	*Carpinus caroliniana*	25	20	4	Oval
Amur maackia	*Maackia amurensis*	25	20	4	Oval
Apollo™ Maple	*Acer saccharum 'Barrett Cole'*	25	10	4	Columnar
Arnold tuliptree	*Liriodendron tulipifera* 'Arnold'	30	10	4	Columnar
Autumn Blaze Pear	*Pyrus calleryana 'Autumn Blaze'*	30	25	4	Globe
Autumn Brilliance Serviceberry	*Amelanchier x grandiflora 'Autumn Brilliance'*	20	15	4	Oval
Beijing Gold tree lilac	*Syringa pekinensis 'Zhang Zhiming'*	20	20	4	Vase
Butterflies Magnolia	*Magnolia acuminata x denudada*	20	20	4	Pyramidal
Canada Red Chokecherry	*Prunus virginiana 'Canada Red'*	25	20	4	Globe
Canadian serviceberry	*Amelanchier canadensis*	25	10	4	Oval
Cascade Snow Cherry	*Prunus 'Cascade Snow'*	25	20	4	Vase
Cherry Plum	*Prunus cerasifera*	20	20	4	Globe
Chinese Dogwood	*Cornus kousa 'Chinensis'*	25	25	4	Globe
Chinese fringetree	*Chionanthus retusus*	25	25	4	Globe
Chojuro Asian pear	*Pyrus pyrifolia*'Chojuro'	30	15	4	Oval
City Sprite zelkova	*Zelkova serrata* 'City Sprite'	24	18	4	Oval
Columnar Sargent Cherry	*Prunus sargentii 'Columnaris'*	30	10	4	Vase
Common Chokecherry	*Prunus virginiana*	25	20	4	Oval
Crimson Pointe plum	*Prunus cerasifera 'Cripoizam'*	25	10	4	Oval
Cumulus Serviceberry	*Amelanchier laevis 'Cumulus'*	25	8	4	Oval
Eastern Redbud	*Cercis canadensis*	25	30	4	Globe
Eddie's White Wonder Dogwood	*Cornus* 'Eddies White Wonder'	25	20	4	Pyramidal
Edith Bogue magnolia	*Magnolia grandiflora 'Edith Boque'*	30	15	4	Pyramidal
Elizabeth magnolia	*Magnolia acuminata 'Elizabeth'*	25	15	4	Pyramidal
Flowering Cherry 'Kwanzan'	*Prunus 'Kwanzan'*	30	20	4	Vase
Galaxy Magnolia	*Magnolia liliflora x sprengeri*	30	15	4	Pyramidal
Giant Dogwood	*Cornus contoroversa*	30	40	4	Vase

Gloryblower Tree	*Clerodendrum trichotomum*	20	20	4	Globe
Henry Maple	*Acer henryi*	25	25	4	Globe
Hosui Asian pear	*Pyrus pyrifolia 'Hosui'*	15	10	4	Columnar
Japanese black pine	*Pinus thunbergiana*	30	20	4	Pyramidal
Japanese hornbeam	*Carpinus japonica*	25	25	4	Globe
June Snow Dogwood	*Cornus controversa 'June Snow'*	30	35	4	Vase
Lavalle Hawthorne	*Crataegus x lavallei*	28	20	4	Oval
Leprechaun™ Ash	*Fraxinus pennsylvanica 'Johnson'*	18	6	4	Oval
Marilee crabapple	*Malus* 'Jarmin'	24	10	4	Oval
Mayflower	*Crataegus laevigata*	25	18	4	Globe
Mt. St. Helens plum	*Prunus* 'Frankthrees'	20	20	4	Vase
National Chinese dogwood	*Cornus kousa 'National'*	25	25	4	Vase
Newport Plum	*Prunus cerasifera 'Newport'*	20	20	4	Globe
Oregon Myrtle	*Umbellularia californica*	30	40	4	Oval
Pacific Sunset Maple	*Acer truncatum x A. platanoides 'Warrenred'*	30	25	4	Globe
Pacific Sunset Maple	*Acer truncatum x platanoides 'Pacific Sunset'*	30	25	4	Oval
Paul's Scarlet hawthorn	*Crataegus laevigata 'Paul's Scarlet'*	22	20	4	Oval
Pink Flair™ Cherry	*Prunus sargentii 'JFS-KW58'*	25	15	4	Columnar
Princess Diana Serviceberry	*Amelanchier x grandiflora 'Princess Diana'*	25	15	4	Globe
Professor Sprenger Crabapple	*Malus 'Professor Sprenger+A86'*	20	20	4	Oval
Purple Fountain beech	*Fagus sylvatica 'Purple Fountain'*	25	15	4	Columnar
Red Horse Chestnut	*Aesculus x carnea*	30	35	4	Globe
Robinson Crabapple	*Malus 'Robinson'*	25	25	4	Globe
Royal Burgundy Cherry	*Prunus serrulata 'Royal Burgundy*	30	20	4	Vase
September Goldenrain	*Koelreuteria paniculata 'September'*	30	25	4	Globe
Shiro plum semi-dwarf	*Prunus salicinia*	25	25	4	Oval
Snow Goose cherry	*Prunus* 'Snow Goose'	20	20	4	Vase
Snow Goose Cherry	*Prunus 'Snow Goose'*	20	20	4	Vase
Snowcloud Serviceberry	*Amelanchier laevis 'Snowcloud'*	25	15	4	Oval
Stellar Pink Dogwood	*Cornus kousa x florida*	20	20	4	Globe
Strawberry Tree	*Arbutus 'Marina'*	30	30	4	Umbrella
Sugar Tyme Crabapple	*Malus 'Sutyzam'*	18	15	4	Oval
Summer Charm tree lilac	*Syringa pekinensis 'Summer Charm'*	20	20	4	Oval
Tatarian maple	*Acer tataricum*	25	15	4	Oval

Thornless Cockspur Hawthorn	*Crataegus crus-galli*	25	25	4	Globe
Thundercloud plum	*Prunus cerasifera 'Thundercloud'*	20	20	4	Globe
Trinity Pear	*Pyrus calleryana 'Trinity'*	30	25	4	Oval
Vanessa Persian ironwood	*Parrotia persica 'Vanessa'*	30	15	4	Oval
Venus Dogwood	*Cornus kousa x nutalli*	25	20	4	Globe
Washington hawthorn	*Crataegus phaenopyrum*	25	20	4	Oval
Western Juniper	*Juniperus Occidentalis*	25	50	4	Globe
Wireless™ Zelkova	*Zelkova serrata 'Schmidtlow'*	24	36	4	Vase
Yoshino Cherry	*Prunus x yeodoensis*	30	30	4	Umbrella
Zebrina Himalayan pine	*Pinus wallinchiana 'Zebrina'*	30	20	4	Oval
Zumi Calocarpa Crabapple	*Malus x zumi*	20	25	4	Globe

Note: The scientific / botanical names and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Medium to Large Trees

Not for under or adjacent to overhead utility lines. Plant 30' to 50' apart, compatible with mature tree size. Typical size at time of planting is 2" minimum caliper (B&B or container)

Table 3. Approved list of medium to large street trees (Source: City of Camas Plant Materials list)

Common Name	Botanical Name	Height	Spread	Min. Planter Width (ft.)	Form
Accolade™ Elm	*Ulmus japonica x wilsonia*	70	60	6	Vase
American Beech	*Fagus grandifolia*	50	40	8	Oval
American Hophornbeam	*Ostrya virginiana*	35	25	4	Oval
American Linden	*Tilia americana*	60	30	6	Globe
American Yellowwood	*Cladrastis kentuckia*	35	35	4	Globe
Amur Corktree	*Phellodendron amurense*	40	30	6	Globe
Aristocrat Pear	*Pyrus calleryana 'Aristocrat'*	40	28	4	Pyramidal
Armstrong Maple	*Acer rubrum 'Armstrong'*	45	15	6	Columnar
Atlas cedar	*Cedrus atlantica*	65	40	10	Pyramidal
Austrian pine	*Pinus nigra*	55	40	10	Pyramidal
Autumn Blaze Maple	*Acer x freemanii 'Jeffersred'*	50	30	6	Columnar
Autumn Flame red maple	*Acer rubrum* 'Autumn Flame'	50	40	6	Oval
Autumn Gold Ginkgo	*Ginkgo biloba 'Autumn Gold'*	45	35	4	Globe
Bald Cypress	*Taxodium distichum*	55	30	8	Pyramidal
Bigleaf Maple	*Acer macrophyllum*	70	60	10	Globe
Bonfire Maple	*Acer saccharum 'bonfire'*	50	40	8	Globe
Bowhall Maple	*Acer rubrum 'Bowhall'*	40	15	4	Columnar
Brandywine Maple	*Acer rubrum 'Brandywine'*	40	35	8	Oval
Bur oak	*Quercus macrocarpa*	65	50	8	Oval
Callery Pear	*Pyrus calleryana*	35	12	4	Columnar
Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	35	12	3	Pyramidal
Canoe or Paper Birch	*Betula papyrifera*	50	35	8	Oval
Canyon Live Oak	*Quercus chrysolepsis*	60	45	6	Vase

Cascara	*Rhamnus purshiana*	50	50	6	Globe
Catalpa	*Catalpa speciosa*	60	40	8	Globe
Chancellor™ Linden	*Tilia cordata 'Chancole'*	35	20	4	Pyramidal
Coast Redwood	*Sequoia sempervirens*	100	60	8	Pyramidal
Colorado Spruce	*Picea pungens*	65	20	10	Pyramidal
Columnar English Oak	*Quercus robur 'Fastigiata'*	45	15	4	Columnar
Commemoration Maple	*Acer saccharum 'commemoration'*	50	35	8	Oval
Continental Appeal Linden	*Tilia americana 'Continental Appeal'*	50	28	6	Oval
Corinthian linden	*Tilia cordata 'Corzam'*	45	15	4	Columnar
Crimean Linden	*Tilia x euchlora*	40	35	6	Pyramidal
Crimson spire oak	*Quercus alba* x *Q. robur 'Crimschmidt'*	45	15	4	Columnar
David Odom Afterburner tupelo	*Nyssa sylvatica 'David Odom'*	45	20	6	Pyramidal
Dawn Redwood	*Metasequoia glyptostroboides*	70	25	8	Pyramidal
Dawyck purple beech	*Fagus sylvatica 'Dawyck Purple'*	40	15	4	Columnar
Deodar cedar	*Cedrus deodara*	80	40	10	Pyramidal
Douglas Fir	*Pseudotsuga menziesii*	100	60	8	Pyramidal
Dove Tree	*Davidia involucrata*	35	30	6	Globe
Embers Red Maple	*Acer rubrum 'Embers'*	40	35	6	Globe
Emerald Sunshine elm	*Ulmus propinqua*'JFS-Bieberich'	35	25	4	Vase
Engelmann Spruce	*Picea engelmannii*	100	30	10	Pyramidal
English Oak	*Quercus robur*	50	40	8	Globe
European Beech	*Fagus sylvatica*	50	40	8	Oval
European Hophornbeam	*Ostrya carpinifolia*	40	25	6	Globe
European Hornbeam	*Carpinus betulus*	35	25	4	Globe
Fairmont Maidenhair tree	*Ginko biloba 'Fairmount'*	75	25	4	
Fastigiate white pine	*Pinus strobus 'Fastigiata'*	40	10	6	Pyramidal
Forest Green™ Oak	*Quercus frainetto 'Schmidt'*	50	30	4	Columnar
Fragrant Snowbell Tree	*Styrax obassia*	35	25	3	Globe
Frans Fontaine hornbeam	*Carpinus betulus* 'Frans Fontaine'	40	30	4	Columnar
Frontier Elm	*Ulmus Americana 'Frontier'*	40	30	6	Globe
Fruitless Mulberry	*Morus alba*	35	40	6	Globe
Giant sequoia	*Sequoiadendro n giganteum*	100	40	10	Pyramidal
Glenleven Linden	*Tilia cordata 'Glenleven'*	45	30	6	Pyramidal
Glen's Form Chanticleer Pear	*Pyrus calleryana 'Glen's form'*	40	15	4	Pyramidal
Goldenrain Tree	*Koelreuteria paniculata*	35	35	4	Globe
Grand Fir	*Abies grandis*	100	40	10	Pyramidal
Green Mountain™ Maple	*Acer saccharum 'Green Mountain'™*	45	35	6	Oval
Green Vase™ Zelkova	*Zelkova serrata 'Green Vase'™*	50	40	6	Vase

Greenspire™ Linden	*Tilia cordata 'Greenspire™ '*	40	30	6	Pyramidal
Hackberry	*Celtis occidentalis*	40	30	6	Globe
Halka ginkgo	*Ginko biloba 'Halka'*	45	40	6	Globe
Halka™ Honeylocust	*Gleditsia tricanthos 'Christie'*	55	40	6	Columnar
Halka™ Zelkova	*Zelkova serrata 'Halka'™*	50	30	6	Vase
Hardy rubber tree	*Eucommia ulmoides*	50	50	8	Globe
Harvest Gold linden	*Tilia cordatax mongolica 'Harvest Gold'*	40	30	6	pyramidal
Heritage river birch	*Betula nigra 'Heritage'*	45	30	8	Oval
Hinoki falsecypress	*Chamaecyparis obtusa*	50	20	10	Pyramidal
Honeylocust	*Gleditsia triacanthos var. inermis*	45	35	6	Globe
Incense-Cedar	*Calocedrus decurrens*	80	20	10	Columnar
Jack pear	*Pyrus calleryana 'Jackzam'*	40	15	4	pyramidal
Jacquemontii Birch	*Betula utilis var. jacquemontii*	40	30	4	Oval
Katsura	*Cercidiphyllum japonicum*	40	35	4	Pyramidal
Kentucky Coffeetree	*Gymnocladus dioicus*	70	40	8	Globe
Kobus Magnolia	*Magnolia kobus*	40	30	4	Globe
Lacebark elm	*Ulmus parvifolia*	60	50	10	Umbrella
Lacebark pine	*Pinus bungeana*	50	30	10	Pyramidal
Legacy Maple	*Acer saccharum 'legacy'*	50	35	8	Oval
Little leaf linden 'Olympic'	*Tilia cordata 'Olympic'*	40	30	4	Oval
Lodgepole pine	*Pinus contorta var. latifolia*	50	25	8	Pyramidal
London Planetree	*Platanus x acerifolia 'Bloodgood'*	50	40	8	Pyramidal
Magnifica Hackberry	*Celtis occidentalis 'Magnifica'*	45	35	6	Oval
Maidenhair Tree	*Ginkgo biloba*	60	45	8	Columnar
Morgan Maple	*Acer rubrum 'Morgan'*	45	40	6	Oval
Mountain Silverbells	*Halesia monticola*	40	25	6	Globe
Musashino Zelkova	*Zelkova serrata 'Musashino'*	45	20	4	Columnar
New World Maple	*Acer rubrum 'New World'*	40	20	4	Columnar
Northwood Maple	*Acer rubrum 'Northwood'*	40	35	6	Oval
Norway Spruce	*Picea abies*	100	30	10	Pyramidal
Norwegian Sunset Maple	*Acer truncatum x A. platanoides 'Keithsform'*	35	25	4	Oval
Norwegian Sunset Maple	*Acer truncatum x platanoides 'Norwegian Sunset'*	35	25	6	Oval
October Glory red maple	*Acer rubrum 'October Glory'*	45	45	6	Globe
October Glory™ Maple	*Acer rubrum 'October Glory'™*	40	35	6	Oval
Oregon White Oak	*Quercus garryana*	65	45	10	Globe
Pacific Dogwood	*Cornus nuttallii*	50	20	10	Oval
Pacific willow	*Salix lucida ssp. Lasiandra*	40	30	6	Oval
Pacific yew	*Taxus brevifolia*	40	30	6	Oval
Palo Alto sweetgum	*Liquidambar styrciflua 'Palo Alto'*	40	20	4	Pyramidal

Patriot elm	*Ulmus*'Patriot'	50	40	6	Vase
Persian Parrotia	*Parrotia persica*	35	20	4	Pyramidal
Pin oak	*Quercus palustris*	65	30	10	Globe
Pioneer elm	*Ulmus*'Pioneer'	50	50	8	Vase
Ponderosa Pine	*Pinus ponderosa*	100	30	10	Pyramidal
Port-Orford- cedar	*Chamaecyparis lawsoniana*	75	20	10	Pyramidal
Princeton Sentry™ Ginko	*Ginko biloba 'Princeton Sentry'*	40	15	4	Pyramidal
Prospector elm	*Ulmus wilsoniana*	40	30	6	Vase
Purple Rivers Beech	*Fagus sylvatica 'Riversii'*	60	40	8	Oval
Pyramidal European Hornbeam	*Carpinus betulus 'Fastigiata'*	40	25	4	Oval
Queen Elizabeth™ Maple	*Acer campestre 'Evelyn'*	35	30	4	Oval
Rancho Linden	*Tilia cordata 'Rancho'*	40	30	6	Vase
Rancho Pear	*Pyrus calleryana 'Rancho'*	35	30	6	Columnar
Red Maple	*Acer rubrum*	50	45	8	Globe
Red Oak	*Quercus rubra*	65	50	8	Globe
Red Oak	*Quercus rubra*	60	45	8	Oval
Red Sunset Maple	*Acer rubrum 'Franksred'*	45	35	6	Oval
Red Sunset red maple	*Acer rubrum 'Red Sunset'*	45	30	4	Columnar
Redmond Bigleaf Linden	*Tilia americana x euchlora 'Redmond'*	35	25	6	Pyramidal
Redpointe Maple	*Acer rubrum 'redpointe'*	45	30	6	Pyramidal
Redspire Pear	*Pyrus calleryana 'Redspire'*	35	25	4	Pyramidal
Regal Prince Oak	*Quercus robur x bicolor 'Long'*	45	18	6	Columnar
'Regent' Scholar Tree	*Sophora japonica 'Regent'*	45	35	4	Oval
Rivers purple beech	*Faguas sylvatica 'Riversii'*	50	40	8	Oval
Saratoga Ginkgo	*Ginkgo biloba 'Saratoga'*	35	30	4	Globe
Sawtooth oak	*Quercus acutissima*	40	40	6	Umbrella
Scanlon Red Maple	*Acer rubrum 'Scanlon'*	40	15	6	Columnar
Scarlet Oak	*Quercus coccinea*	50	40	6	Oval
Scarlet Sentinel™ Maple	*Acer rubrum 'Scarsen'*	40	20	4	Columnar
Schlesinger Maple	*Acer rubrum 'Schlesingeri'*	45	35	6	Vase
Scotch Pine	*Pinus sylvestris*	50	40	8	Pyramidal
Shademaster' Thornless honeylocust	*Gleditsia triacanthos 'Shademaster'*	70	70	6	Oval
Shingle Oak	*Quercus imbricaria*	50	40	8	Oval
Shore Pine	*Pinus contorta*	50	25	8	Pyramidal
Shumard Oak	*Quercus shumardii*	50	40	6	Oval
Silver Fir	*Abies amabilis*	50	40	10	Pyramidal
Sitka Spruce	*Picea sitchensis*	120	40	10	Pyramidal
Skyline™ Honeylocust	*Gleditsia triacanthos 'Skyline'*	45	35	6	Pyramidal
Skymaster™ Oak	*Quercus robur 'Skymaster™'*	50	25	6	Oval
Sourwood	*Oxydendrum arboreum*	35	20	6	Pyramidal
Spring Flurry Serviceberry	*Amelanchier laevis 'Spring Flurry'*	35	20	4	Oval
State Street™ Maple	*Acer miyabei 'Morton'*	45	30	6	Oval
Sterling Silver Linden	*Tilia tomentosa 'Sterling'*	45	35	4	Pyramidal

Sugar Maple	*Acer saccharum*	100	50	10	Oval
Sun Valley Maple	*Acer rubrum 'Sun Valley'*	40	35	6	Oval
Sunset Maple	*Acer truncatum x Acer platanoides*	35	25	6	Globe
Swamp white oak	*Quercus bicolor*	60	25	6	Globe
Sycamore Maple	*Acer pseudoplatanus*	50	40	6	Oval
Tricolor Beech	*Fagus sylvatica 'Roseo-marginata'*	35	25	4	Oval
Triumph Elm	*Ulmus japonica x pumila x wilsoniana 'Triumph'*	55	45	6	Vase
Triumph™ Elm	*Ulmus 'Morton Glossy'*	70	60	6	Oval
Tulip Tree	*Liriodendron tulipifera*	80	35	8	Oval
Tupelo	*Nyssa sylvatica*	45	20	4	Pyramidal
Village Green zelkova	*Zelkova serrata 'Village Green'*	50	40	6	Vase
Weeping nootka cypress	*Chamaecyparis nootkatensis 'Pendula'*	45	15	4	Pyramidal
Western Hemlock	*Tsuga heterophylla*	100	40	10	Pyramidal
Western Red Cedar	*Thuja plicata*	100	30	10	Pyramidal
Western White Pine	*Pinus monticola*	85	50	10	Pyramidal
Whitehouse Flowering Pear	*Pyrus calleryana 'Whitehouse'*	40	15	4	Columnar
Willow Oak	*Quercus phellos*	60	45	8	Pyramidal
Wineleaf Sycamore Maple	*Acer pseudoplatanu s 'Spaethii'*	40	30	6	Pyramidal
Yulan Magnolia	*Magnolia denudata*	35	30	4	Pyramidal
Zelkova	*Zelkova serrata*	65	50	6	Oval

Note: The scientific / botanical names and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Prohibited Trees

The following trees are prohibited from being planted as street trees. Substitute varieties are subject to approval by the City of Camas. Submit a "characteristic" card from a nursery including information on mature height, spread, and root system (deep or shallow) when requesting a substitute.

Table 4. List of tree species prohibited from street tree plantings (Source: City of Camas Plant Materials list)

Common Name	Botanical Name	Tree Type	Reasons to Exclude
Arborvitae	*Thuja plicata & Thuja occidentalis*	Evergreen	Sight obstruction
Cleveland Norway Maple	*Acer platanoides 'Cleveland'*	Broadleaf Deciduous Medium	Possible invasive
Columnar Norway Maple	*Acer platanoides 'Columnare'*	Broadleaf Deciduous Medium	Possible invasive
Crimson King Maple	*Acer platanoides'C rimson King'*	Broadleaf Deciduous Medium	Possible invasive
Crimson Sentry Norway Maple	*Acer platanoides 'Crimson Sentry '*	Broadleaf Deciduous Small	Possible invasive
Easy Street™ Maple	*Acer platanoides 'Ezestre'*	Broadleaf Deciduous Medium	Possible invasive

Emerald Queen™ Norway Maple	*Acer platanoides 'Emerald Queen '*	Broadleaf Deciduous Large	Possible invasive
Flowering Ash	*Fraxinus omus*	Broadleaf Deciduous Medium	
Globe Norway Maple	*Acer platanoides 'Globosum'*	Broadleaf Deciduous Small	Possible invasive
Hedge Maple	*Acer campestre*	Broadleaf Deciduous Medium	Possible invasive
Japanese maple	*Acer palmatum*	Broadleaf Deciduous Small	sidewalk issue
Lavalle Hawthorne	*Crataegus x lavallei*		High Maintenance Trees
Madrone	*Arbutus menziesii*	Broadleaf Evergreen Large	Not recommended
Mayflower	*Crataegus laevigata*		High Maintenance Trees
Moraine Sweetgum	*Liquidambar styraciflua 'Moraine'*	Broadleaf Deciduous Large	Not recommended
Olmstead Maple	*Acer platanoides 'Olmstead+A 55'*	Broadleaf Deciduous Medium	Possible invasive
Parkway™ Norway Maple	*Acer platanoides 'Columnarbro ad'*	Broadleaf Deciduous Medium	Possible invasive
Paul's Scarlet hawthorn	*Crataegus laevigata* 'Paul's Scarlet'		High Maintenance Trees
Red Alder	*Alnus rubra*	Broadleaf Deciduous Large	Possible invasive
Rotundiloba Sweetgum	*Liquidambar styraciflua*	Broadleaf Deciduous Medium	Not recommended
Skyline™ Beech	*Fagus grandifolia 'Skycole'*	Broadleaf Deciduous Medium	Can't find this tree
Skyrocket™ Oak	*Quercus robur* 'Fastigiata' var. Skyrocket™+ A106	Broadleaf Deciduous Medium	Can't find this tree
Southern Magnolia	*Magnolia grandiflora*	Broadeaf Evergreen Medium	Not recommended
Southern Magnolia	*Magnolia grandiflora 'Edith Bogue'*	Broadleaf Deciduous Medium	Not recommended
Summershade Maple	*Acer platanoides 'Summershade'*	Broadleaf Deciduous Medium	Possible invasive
Superform Maple	*Acer platanoides 'Superform'*	Broadleaf Deciduous Medium	Possible invasive
Sweetgum	*Liquidambar sp.*	Broadleaf Deciduous Large	Not recommended
Valley Forge Elm	*Ulmus americana*	Broadleaf Deciduous Large	Not recommended
Variegated Norway Maple	*Acer platanoides 'Drummondii'*	Broadleaf Deciduous Medium	Possible invasive
Washington hawthorn	*Crataegus phaenopyrum*		High Maintenance Trees

Note: The scientific / botanical names and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Tree List Selection Criteria

Selecting tree species for planting at various locations results in unique challenges. The overall criteria for considering trees for planting should include:

- Native or native cultivars first
- Trees tolerant of pollution, drought and harsh conditions (salt/sand from winter and winds)
- Trees that create litter problems or produce large fruit are not used as street trees
- Tree shape – to ensure limbs are not too low and could create a visibility issue
- Small trees under power lines
- Trees with seasonal interest: fall color or blooms
- Amount of sun and shade in the existing conditions
- Speed of traffic
- Pedestrian intensity
- Visibility for traffic
- Maintenance issues
- Pest problems
- Longevity of the tree
- Type of Street Tree location:
    - Urban tree well
    - Large median (over six feet wide)
    - Small median (usually the green space between a curb and sidewalk, less than six feet wide)

Street Tree Planting Scenarios

Urban Tree Well

Trees planted in urban tree wells have the most difficulty surviving and thriving for several reasons: the structured soils do not offer the same nutrients as a forest; space for the root systems is limited; and exposure to pollutants. The tree's shape also has to be considered for pedestrian visibility, automobile visibility, and not interfering with buildings.

Large Medians

Large median spaces may vary in size from six to 10 feet wide. The space is adequate for most trees, and staff should consider maintenance needs when choosing a tree to be planted in the medians. Trees that produce less litter and fruit are ideal for large medians. Finally, visibility is another characteristic when choosing a large median tree. City staff should select trees that allow for visibility under and through the canopy to increase vehicular safety.

Small Medians - Trees between Curb and Sidewalk (Tree Lawn less than Six feet)

Small medians are the green spaces between the curb and the sidewalk, typically less than six feet wide. In these cases, staff should prioritize maintaining the structural integrity of the sidewalk and curb. Other factors in choosing the right species for this condition should include sightline visibility for vehicles and pedestrians, sun and shade conditions, the appropriate size for location in the neighborhood (residential, commercial, downtown), watering needs, amount of litter produced, and environmental benefits.

This list does not contain every tree used in Camas. City staff should consider other trees not listed as viable options and will examine all proposed trees. There are construction techniques that allow larger trees in small locations. Staff should consider these techniques with appropriate construction details.

URBAN FOREST CLIMATE VULNERABILITY

Camas's Sister Climate City Analysis

The Future Urban Climates tool, created and maintained by University of Maryland Center for Applied Sciences, is a mapping tool that matches and displays similar climates for cities across the United States. The comparisons are based on minimum and maximum temperatures and seasonal precipitation in each city.

The closest area to Camas where current climate data is available is the Portland, Oregon area, just 20 miles southwest of Camas. Results for a high emissions scenario show that the climate in 2080 for the Camas area will feel most like today's climate near Lincoln, California—approximately 30 miles northeast of Sacramento, California. The typical winter in Lincoln is 6.6 degrees Fahrenheit (3.6 degrees Celsius) warmer and 35.6% drier than winter in Portland. In the following sections, the City of Sacramento is utilized and referred to as the "Sister Climate City" given the resources and information that are available and applicable to this study. After online research, no recommended tree list exists or was found for Lincoln's urban forestry program although a "Master Tree List" is referenced in Lincoln's Code of Ordinances (Chapter 15.28.140 Landscaping Regulations). The actual list nor a City of Lincoln landscaping manual was found. Therefore, the City of Sacramento's recommended tree list was utilized given Sacramento is only 30 miles from Lincoln and the urban forestry consultants conducting this Sister Climate City Analysis or SCCA study have extensive experience in the Sacramento area (view the map on the following page for distances between the cities).

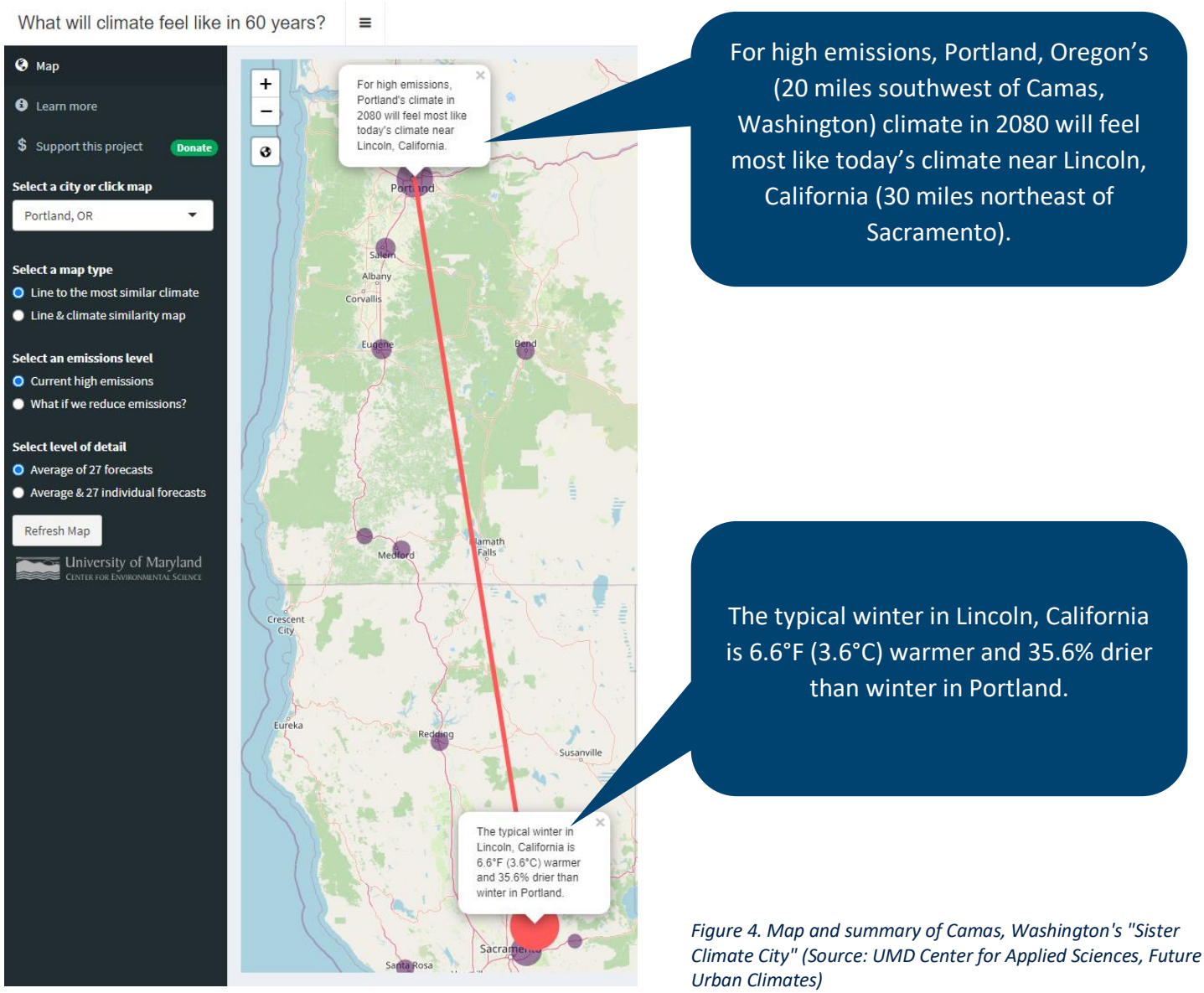


Figure 4. Map and summary of Camas, Washington's "Sister Climate City" (Source: UMD Center for Applied Sciences, Future Urban Climates)

As summarized on the previous page, Sacramento was selected for the Sister Climate City rather than Lincoln. Based on the climate projections, Sacramento, CA (Sister Climate City) currently has a climate that is similar to Camas's projected climate and plant hardiness zone (see the Vulnerability of Urban Trees in the Pacific Northwest to Climate Change for details). The Sister Climate City's approved tree planting list was researched and compared with the City of Camas Plant Materials resource. The map below illustrates the distance between the two California cities and the following tables examine the Sister Climate City's tree list, Camas's Plant Materials list, and climate vulnerability ratings for urban trees.

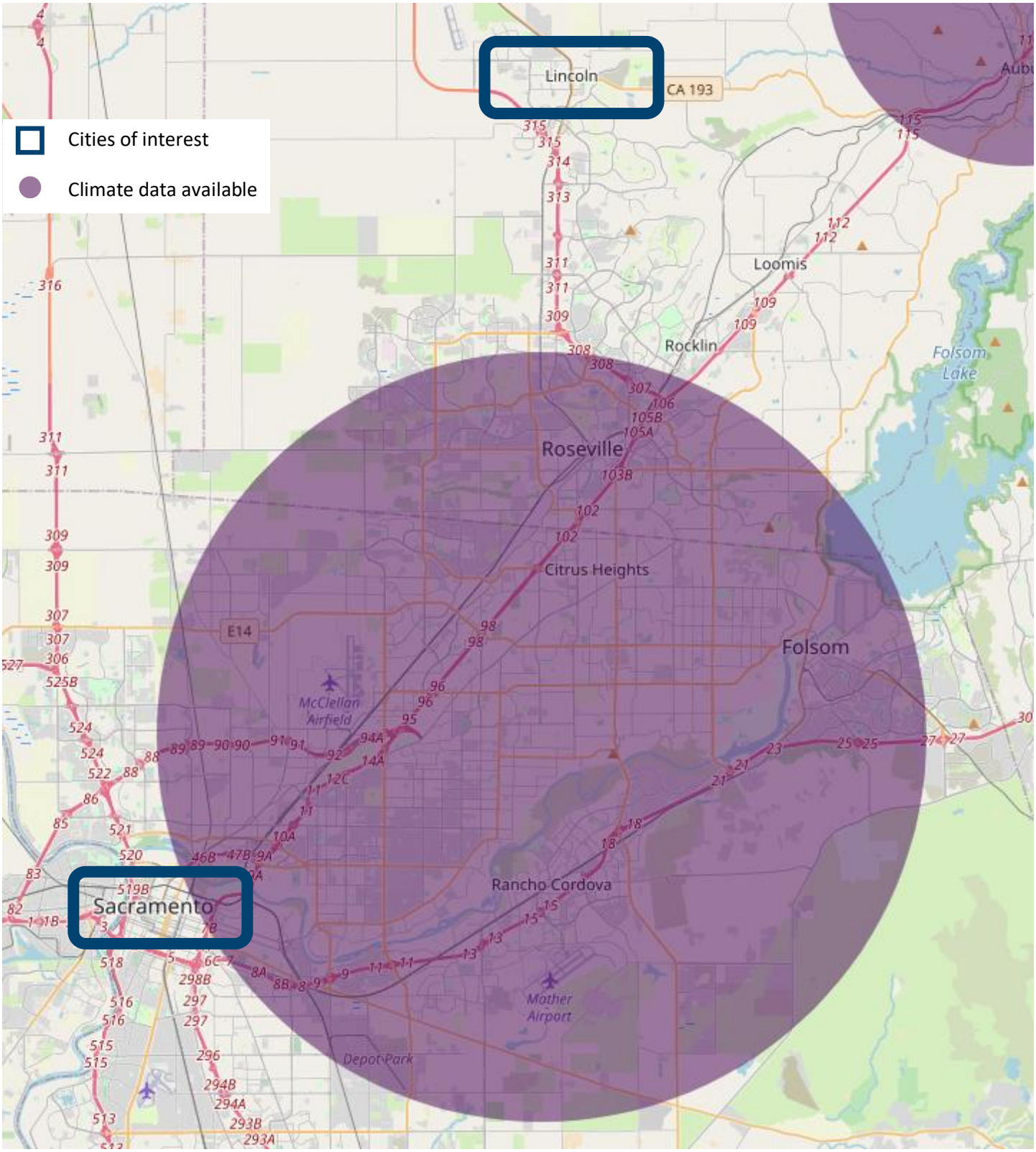


Figure 5. Map displaying the distance between the Sister Climate City of Lincoln, CA and the City of Sacramento, CA which was utilized for comparing recommended tree lists (Source: UMD Center for Applied Sciences, Future Urban Climates)

Sister Climate City Tree List Comparisons

City of Sacramento, CA Adopted Public Street Tree List

Table 5. Adopted public street tree list from the Sister Climate City of Sacramento, CA (Source: City of Sacramento, CA Public Works)

Scientific Name**	Common Name	Cultivar / Variety Recommendations	Tree Size	Minimum Recommended Planter Width
Acer buergeranum	Trident Maple	NA	Small Trees 15-25' Height	4'
Acer ginnala	Amur Maple	Flame	Small Trees 15-25' Height	4'
Cercis canadensis	Eastern Redbud	Forest Pansy	Small Trees 15-25' Height	4'
Chionanthus retusus	Chinese Fringe Tree	NA	Small Trees 15-25' Height	4'
Crataegus laevigata 'Crimson Cloud'	Crimson Cloud Hawthorne	Crimson Cloud*	Small Trees 15-25' Height	4'
Lagerstroemia indica or x *L. faurei*	Crape Myrtle (Single Trunk)	Dynamite, Natchez, Tuscarora, Watermelon Red	Small Trees 15-25' Height	4'
Magnolia grandiflora 'Dwarf'	Dwarf Southern Magnolia	Glen St. Mary*	Small Trees 15-25' Height	4'
Malus spp.	Flowering Crabapple	NA	Small Trees 15-25' Height	4'
Prunus spp.	Flowering Cherry	Akebono or Kwanzan	Small Trees 15-25' Height	4'
Prunus x *incam* 'Okame'	Okame Cherry	Okame*	Small Trees 15-25' Height	4'
Prunus spp.	Flowering Plum	Crimson Pointe or Krauter Vesuvious*	Small Trees 15-25' Height	4'
Syringa reticulata	Japanese Lilac	Ivory Silk	Small Trees 15-25' Height	4'
Tilia cordata	Littleleaf Linden	Summer Sprite*	Small Trees 15-25' Height	4'
Vitex agnus-castus	Chaste Tree	NA	Small Trees 15-25' Height	4'
Zelkova serrata	Japanese Elm	City Sprite*	Small Trees 15-25' Height	4'
Acer rubrum	Autmn Flame Maple	Autumn Flame*	Medium Trees 25-35' Height	6'
Acer truncatum	Shantung Maple	Norwegian Sunset or Pacific Sunset	Medium Trees 25-35' Height	6'
Aesculus x carnea	Red Horsechestnut	Briotii*	Medium Trees 25-35' Height	6'
Arbutus marina	Strawberry Tree	Marina	Medium Trees 25-35' Height	6'
Carpinus betulus 'Fastigiata'	European Hornbeam	Pyramidal hornbeam	Medium Trees 25-35' Height	6'
Koelreuteria paniculata	Goldenrain Tree	Summerburst	Medium Trees 25-35' Height	6'
Laurus nobilis	Bay Laurel	Bay Laurel	Medium Trees 25-35' Height	6'
Magnolia liliflora x *sprengeri*	Sprenger Magnolia	Galaxy*	Medium Trees 25-35' Height	6'
Nyssa sylvatica	Black Tupelo	Afterburner	Medium Trees 25-35' Height	6'
Pistacia chinensis	Chinese Pistache	Keith Davey* or Pearl Street*	Medium Trees 25-35' Height	6'
Prunus sargentii	Sargent Flowering Cherry	NA	Medium Trees 25-35' Height	6'

Tilia americana	American Linden	Lincoln or Redmond	Medium Trees 25-35' Height	6'
Ulmus parvifolia 'Emer I'	Athena Classic Elm	Athena*	Medium Trees 25-35' Height	6'
Ulmus propinqua	Chalkbark Elm	Emerald Sunshine Elm*	Medium Trees 25-35' Height	6'
Acer rubrum	Red Maple	October Glory*	Medium to Large 36-50' Height	8'
Acer rubrum	Red Maple	Redpointe*	Medium to Large 36-50' Height	8'
Celtis occidentalis	Common Hackberry	NA	Medium to Large 36-50' Height	8'
Fraxinus americana	American Ash	Autumn Purple*	Medium to Large 36-50' Height	8'
Fraxinus pennsylvanica 'Summit'	Summit Ash	Summit	Medium to Large 36-50' Height	8'
Ginkgo biloba	Maidenhair Tree	Autumn Gold	Medium to Large 36-50' Height	8'
Gymnocladus dioicus	Kentucky Coffee Tree	NA	Medium to Large 36-50' Height	8'
Koelreuteria bipinnata	Chinese Flame Tree	Chinese Flame Trees	Medium to Large 36-50' Height	8'
Magnoila grandiflora	Southern Magnolia	Samuel Sommers or Majestic Beauty	Medium to Large 36-50' Height	8'
Quercus acutissima	Sawtooth Oak	NA	Medium to Large 36-50' Height	8'
Quercus agrifolia	Coast Live Oak	NA	Medium to Large 36-50' Height	8'
Quercus buckleyi	Texas Red Oak	NA	Medium to Large 36-50' Height	8'
Quercus frainetto	Forest Green Oak	Forest Green*	Medium to Large 36-50' Height	8'
Quercus ilex	Holly Oak	NA	Medium to Large 36-50' Height	8'
Quercus robur	English Oak	NA	Medium to Large 36-50' Height	8'
Quercus suber	Cork Oak	NA	Medium to Large 36-50' Height	8'
Tilia cordata	Greenspire Linden	Greenspire	Medium to Large 36-50' Height	8'
Ulmus parvifolia	Allee Elm	Allee*	Medium to Large 36-50' Height	8'
Ulmus 'Frontier'	Frontier Elm	Frontier*	Medium to Large 36-50' Height	8'
Ulmus 'Patriot'	Patriot Elm	Patriot*	Medium to Large 36-50' Height	8'
Zelkova serrata	Japanese Elm	Green Vase or Village Green*	Medium to Large 36-50' Height	8'
Liriodendron tulipifera	Tulip Tree	Emerald City	Very Large >50' Height	10'
Quercus lobata	Valley Oak	NA	Very Large >50' Height	10'

Quercus rubra	Red Oak	NA	Very Large >50' Height	10'
Quercus shumardii	Shumard Oak	NA	Very Large >50' Height	10'
Ulmus americana 'Valley Forge'	Valley Forge Elm	Valley Forge*	Very Large >50' Height	10'
Ulmus japonica x *wilsoniana* 'Morton'	Accolade Elm	Accolade*	Very Large >50' Height	10'
Acer platanoides 'Crimson Sentry'	Crimson Sentry Maple	Crimson Sentry*	Trees for Narrow Spaces	8-10'
Acer rubrum	Armstrong or Bowhall Maple	Armtrong or Bowhall*	Trees for Narrow Spaces	8-10'
Ginkgo biloba	Maidenhair Tree	Princeton Sentry*	Trees for Narrow Spaces	8-10'
Liriodendron tulipifera 'Fastigiatum'	Columnar Tulip Tree	NA	Trees for Narrow Spaces	8-10'
Malus 'Red Barron'	Red Baron Flowering Crabapple	Red Barron*	Trees for Narrow Spaces	8-10'
Malus 'Jarmin'	Marilee Crabapple	Marilee*	Trees for Narrow Spaces	8-10'
Prunus sargentii 'Columnaris'	Columnar Sargent Cherry	NA	Trees for Narrow Spaces	8-10'
Quercus robur 'Fastigiata'	Skyrocket English Oak	Skyrocket*	Trees for Narrow Spaces	8-10'
Quercus robur x *Q. alba* 'JFS-KW1QX'	Streetspire Oak	Streetspire*	Trees for Narrow Spaces	8-10'
Tilia cordata 'Corzam'	Corinthian Linden	Corinthian*	Trees for Narrow Spaces	8-10'
Zelkova serrata 'Musashino'	Musashino Columnar Zelkova	Musashino*	Trees for Narrow Spaces	8-10'

*An asterisk (*) indicates that the cultivar deviates from the norm of the species in terms of size and should not be substituted without consulting an expert

**The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Camas, WA and Sacramento, CA Tree List Crosswalk - Results

Table 6. Summary of tree species in the Camas, WA and Sacramento, CA recommended or approved tree lists

Note: The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

COMPARISON OF CAMAS TREE LIST TO SISTER CLIMATE CITY TREE LIST (ordered by planting space size)*			
Space	**Common Name****	**Botanical Name**	**Sister Climate City of Sacramento, CA Street Tree?**
Medium to Large	Silver Fir	*Abies amabilis*	No
Medium to Large	Grand Fir	*Abies grandis*	No
Medium to Large	Queen Elizabeth™ Maple	*Acer campestre 'Evelyn'*	No
Medium to Large	Bigleaf Maple	*Acer macrophyllum*	No
Medium to Large	State Street™ Maple	*Acer miyabei 'Morton'*	No
Medium to Large	Sycamore Maple	*Acer pseudoplatanus*	No
Medium to Large	Wineleaf Sycamore Maple	*Acer pseudoplatanus 'Spaethii'*	No
Medium to Large	Red Maple	*Acer rubrum*	Yes
Medium to Large	Armstrong Maple	*Acer rubrum 'Armstrong'*	Yes
Medium to Large	Autumn Flame red maple	*Acer rubrum* 'Autumn Flame'	Yes
Medium to Large	Bowhall Maple	*Acer rubrum 'Bowhall'*	Yes
Medium to Large	Brandywine Maple	*Acer rubrum 'Brandywine'*	No
Medium to Large	Embers Red Maple	*Acer rubrum 'Embers'*	No
Medium to Large	Red Sunset Maple	*Acer rubrum 'Franksred'*	No
Medium to Large	Morgan Maple	*Acer rubrum 'Morgan'*	No
Medium to Large	New World Maple	*Acer rubrum 'New World'*	No
Medium to Large	Northwood Maple	*Acer rubrum 'Northwood'*	No
Medium to Large	October Glory red maple	*Acer rubrum 'October Glory'*	No
Medium to Large	October Glory™ Maple	*Acer rubrum 'October Glory'™*	No
Medium to Large	Red Sunset red maple	*Acer rubrum 'Red Sunset'*	No
Medium to Large	Redpointe Maple	*Acer rubrum 'redpointe'*	No
Medium to Large	Scanlon Red Maple	*Acer rubrum 'Scanlon'*	No
Medium to Large	Scarlet Sentinel™ Maple	*Acer rubrum 'Scarsen'*	No
Medium to Large	Schlesinger Maple	*Acer rubrum 'Schlesingeri'*	No
Medium to Large	Sun Valley Maple	*Acer rubrum 'Sun Valley'*	No
Medium to Large	Sugar Maple	*Acer saccharum*	No
Medium to Large	Bonfire Maple	*Acer saccharum 'bonfire'*	No
Medium to Large	Commemoration Maple	*Acer saccharum 'commemoration'*	No
Medium to Large	Green Mountain™ Maple	*Acer saccharum 'Green Mountain'™*	No
Medium to Large	Legacy Maple	*Acer saccharum 'legacy'*	No
Medium to Large	Norwegian Sunset Maple	*Acer truncatum x A. platanoides 'Keithsform'*	Yes
Medium to Large	Sunset Maple	*Acer truncatum x Acer platanoides*	No
Medium to Large	Norwegian Sunset Maple	*Acer truncatum x platanoides 'Norwegian Sunset'*	Yes
Medium to Large	Autumn Blaze Maple	*Acer x freemanii 'Jeffersred'*	No

Medium to Large	Spring Flurry Serviceberry	*Amelanchier laevis 'Spring Flurry'*	No
Medium to Large	Heritage river birch	*Betula nigra 'Heritage'*	No
Medium to Large	Canoe or Paper Birch	*Betula papyrifera*	No
Medium to Large	Jacquemontii Birch	*Betula utilis var. jacquemontii*	No
Medium to Large	Incense-Cedar	*Calocedrus decurrens*	No
Medium to Large	European Hornbeam	*Carpinus betulus*	Yes
Medium to Large	Pyramidal European Hornbeam	*Carpinus betulus 'Fastigiata'*	Yes
Medium to Large	Frans Fontaine hornbeam	*Carpinus betulus* 'Frans Fontaine'	No
Medium to Large	Catalpa	*Catalpa speciosa*	No
Medium to Large	Atlas cedar	*Cedrus atlantica*	No
Medium to Large	Deodar cedar	*Cedrus deodara*	No
Medium to Large	Hackberry	*Celtis occidentalis*	Yes
Medium to Large	Magnifica Hackberry	*Celtis occidentalis 'Magnifica'*	No
Medium to Large	Katsura	*Cercidiphyllum japonicum*	No
Medium to Large	Port-Orford- cedar	*Chamaecyparis lawsoniana*	No
Medium to Large	Weeping nootka cypress	*Chamaecyparis nootkatensis 'Pendula'*	No
Medium to Large	Hinoki falsecypress	*Chamaecyparis obtusa*	No
Medium to Large	American Yellowwood	*Cladrastis kentuckia*	No
Medium to Large	Pacific Dogwood	*Cornus nuttallii*	No
Medium to Large	Dove Tree	*Davidia involucrata*	No
Medium to Large	Hardy rubber tree	*Eucommia ulmoides*	No
Medium to Large	Rivers purple beech	*Faguas sylvatica 'Riversii'*	No
Medium to Large	American Beech	*Fagus grandifolia*	No
Medium to Large	European Beech	*Fagus sylvatica*	No
Medium to Large	Dawyck purple beech	*Fagus sylvatica 'Dawyck Purple'*	No
Medium to Large	Purple Rivers Beech	*Fagus sylvatica 'Riversii'*	No
Medium to Large	Tricolor Beech	*Fagus sylvatica 'Roseo-marginata'*	No
Medium to Large	Maidenhair Tree	*Ginkgo biloba*	Yes
Medium to Large	Autumn Gold Ginkgo	*Ginkgo biloba 'Autumn Gold'*	Yes
Medium to Large	Saratoga Ginkgo	*Ginkgo biloba 'Saratoga'*	Yes
Medium to Large	Fairmont Maidenhair tree	*Ginko biloba 'Fairmount'*	Yes
Medium to Large	Halka ginkgo	*Ginko biloba 'Halka'*	Yes
Medium to Large	Princeton Sentry™ Ginko	*Ginko biloba 'Princeton Sentry'*	Yes
Medium to Large	Shademaster' Thornless honeylocust	*Gleditsia triacanthos 'Shademaster'*	No
Medium to Large	Skyline™ Honeylocust	*Gleditsia triacanthos 'Skyline'*	No
Medium to Large	Honeylocust	*Gleditsia triacanthos var. inermis*	No
Medium to Large	Halka™ Honeylocust	*Gleditsia tricanthos 'Christie'*	No
Medium to Large	Kentucky Coffeetree	*Gymnocladus dioicus*	Yes
Medium to Large	Mountain Silverbells	*Halesia monticola*	No
Medium to Large	Goldenrain Tree	*Koelreuteria paniculata*	Yes

Medium to Large	Palo Alto sweetgum	*Liquidambar styrciflua 'Palo Alto'*	No
Medium to Large	Tulip Tree	*Liriodendron tulipifera*	Yes
Medium to Large	Yulan Magnolia	*Magnolia denudata*	No
Medium to Large	Kobus Magnolia	*Magnolia kobus*	No
Medium to Large	Dawn Redwood	*Metasequoia glyptostroboides*	No
Medium to Large	Fruitless Mulberry	*Morus alba*	No
Medium to Large	Tupelo	*Nyssa sylvatica*	Yes
Medium to Large	David Odom Afterburner tupelo	*Nyssa sylvatica 'David Odom'*	No
Medium to Large	European Hophornbeam	*Ostrya carpinifolia*	No
Medium to Large	American Hophornbeam	*Ostrya virginiana*	No
Medium to Large	Sourwood	*Oxydendrum arboreum*	No
Medium to Large	Persian Parrotia	*Parrotia persica*	No
Medium to Large	Amur Corktree	*Phellodendron amurense*	No
Medium to Large	Norway Spruce	*Picea abies*	No
Medium to Large	Engelmann Spruce	*Picea engelmannii*	No
Medium to Large	Colorado Spruce	*Picea pungens*	No
Medium to Large	Sitka Spruce	*Picea sitchensis*	No
Medium to Large	Lacebark pine	*Pinus bungeana*	No
Medium to Large	Shore Pine	*Pinus contorta*	No
Medium to Large	Lodgepole pine	*Pinus contorta var. latifolia*	No
Medium to Large	Western White Pine	*Pinus monticola*	No
Medium to Large	Austrian pine	*Pinus nigra*	No
Medium to Large	Ponderosa Pine	*Pinus ponderosa*	No
Medium to Large	Fastigiate white pine	*Pinus strobus 'Fastigiata'*	No
Medium to Large	Scotch Pine	*Pinus sylvestris*	No
Medium to Large	London Planetree	*Platanus x acerifolia 'Bloodgood'*	No
Medium to Large	Douglas Fir	*Pseudotsuga menziesii*	No
Medium to Large	Callery Pear	*Pyrus calleryana*	No
Medium to Large	Aristocrat Pear	*Pyrus calleryana 'Aristocrat'*	No
Medium to Large	Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	No
Medium to Large	Glen's Form Chanticleer Pear	*Pyrus calleryana 'Glen's form'*	No
Medium to Large	Jack pear	*Pyrus calleryana 'Jackzam'*	No
Medium to Large	Rancho Pear	*Pyrus calleryana 'Rancho'*	No
Medium to Large	Redspire Pear	*Pyrus calleryana 'Redspire'*	No
Medium to Large	Whitehouse Flowering Pear	*Pyrus calleryana 'Whitehouse'*	No
Medium to Large	Sawtooth oak	*Quercus acutissima*	Yes
Medium to Large	Crimson spire oak	*Quercus alba* x *Q. robur 'Crimschmidt'*	No
Medium to Large	Swamp white oak	*Quercus bicolor*	No
Medium to Large	Canyon Live Oak	*Quercus chrysolepsis*	No
Medium to Large	Scarlet Oak	*Quercus coccinea*	No
Medium to Large	Forest Green™ Oak	*Quercus frainetto 'Schmidt'*	Yes
Medium to Large	Oregon White Oak	*Quercus garryana*	No
Medium to Large	Shingle Oak	*Quercus imbricaria*	No

Medium to Large	Bur oak	*Quercus macrocarpa*	No
Medium to Large	Pin oak	*Quercus palustris*	No
Medium to Large	Willow Oak	*Quercus phellos*	No
Medium to Large	English Oak	*Quercus robur*	Yes
Medium to Large	Columnar English Oak	*Quercus robur 'Fastigiata'*	Yes
Medium to Large	Skymaster™ Oak	*Quercus robur 'Skymaster™'*	No
Medium to Large	Regal Prince Oak	*Quercus robur x bicolor 'Long'*	No
Medium to Large	Red Oak	*Quercus rubra*	Yes
Medium to Large	Red Oak	*Quercus rubra*	Yes
Medium to Large	Shumard Oak	*Quercus shumardii*	Yes
Medium to Large	Cascara	*Rhamnus purshiana*	No
Medium to Large	Pacific willow	*Salix lucida ssp. Lasiandra*	No
Medium to Large	Coast Redwood	*Sequoia sempervirens*	No
Medium to Large	Giant sequoia	*Sequoiadendro n giganteum*	No
Medium to Large	'Regent' Scholar Tree	*Sophora japonica 'Regent'*	No
Medium to Large	Fragrant Snowbell Tree	*Styrax obassia*	No
Medium to Large	Bald Cypress	*Taxodium distichum*	No
Medium to Large	Pacific yew	*Taxus brevifolia*	No
Medium to Large	Western Red Cedar	*Thuja plicata*	No
Medium to Large	American Linden	*Tilia americana*	Yes
Medium to Large	Continental Appeal Linden	*Tilia americana 'Continental Appeal'*	No
Medium to Large	Redmond Bigleaf Linden	*Tilia americana x euchlora 'Redmond'*	No
Medium to Large	Chancellor™ Linden	*Tilia cordata 'Chancole'*	No
Medium to Large	Corinthian linden	*Tilia cordata 'Corzam'*	Yes
Medium to Large	Glenleven Linden	*Tilia cordata 'Glenleven'*	No
Medium to Large	Greenspire™ Linden	*Tilia cordata 'Greenspire™ '*	Yes
Medium to Large	Little leaf linden 'Olympic'	*Tilia cordata 'Olympic'*	Yes
Medium to Large	Rancho Linden	*Tilia cordata 'Rancho'*	No
Medium to Large	Harvest Gold linden	*Tilia cordatax mongolica 'Harvest Gold'*	No
Medium to Large	Sterling Silver Linden	*Tilia tomentosa 'Sterling'*	No
Medium to Large	Crimean Linden	*Tilia x euchlora*	No
Medium to Large	Western Hemlock	*Tsuga heterophylla*	No
Medium to Large	Frontier Elm	*Ulmus Americana 'Frontier'*	Yes
Medium to Large	Triumph Elm	*Ulmus japonica x pumila x wilsoniana 'Triumph'*	No
Medium to Large	Accolade™ Elm	*Ulmus japonica x wilsonia*	Yes
Medium to Large	Triumph™ Elm	*Ulmus 'Morton Glossy'*	No
Medium to Large	Lacebark elm	*Ulmus parvifolia*	Yes
Medium to Large	Emerald Sunshine elm	*Ulmus propinqua*'JFS-Bieberich'	Yes
Medium to Large	Prospector elm	*Ulmus wilsoniana*	No
Medium to Large	Patriot elm	*Ulmus*'Patriot'	Yes
Medium to Large	Pioneer elm	*Ulmus*'Pioneer'	No
Medium to Large	Zelkova	*Zelkova serrata*	Yes
Medium to Large	Green Vase™ Zelkova	*Zelkova serrata 'Green Vase'™*	Yes

Medium to Large	Halka™ Zelkova	*Zelkova serrata 'Halka'™*	No
Medium to Large	Musashino Zelkova	*Zelkova serrata 'Musashino'*	Yes
Medium to Large	Village Green zelkova	*Zelkova serrata 'Village Green'*	Yes
Small Trees	Henry Maple	*Acer henryi*	No
Small Trees	Apollo™ Maple	*Acer saccharum 'Barrett Cole'*	No
Small Trees	Tatarian maple	*Acer tataricum*	No
Small Trees	Pacific Sunset Maple	*Acer truncatum x A. platanoides 'Warrenred'*	Yes
Small Trees	Pacific Sunset Maple	*Acer truncatum x platanoides 'Pacific Sunset'*	Yes
Small Trees	Red Horse Chestnut	*Aesculus x carnea*	Yes
Small Trees	Canadian serviceberry	*Amelanchier canadensis*	No
Small Trees	Cumulus Serviceberry	*Amelanchier laevis 'Cumulus'*	No
Small Trees	Snowcloud Serviceberry	*Amelanchier laevis 'Snowcloud'*	No
Small Trees	Autumn Brilliance Serviceberry	*Amelanchier x grandiflora 'Autumn Brilliance'*	No
Small Trees	Princess Diana Serviceberry	*Amelanchier x grandiflora 'Princess Diana'*	No
Small Trees	Strawberry Tree	*Arbutus 'Marina'*	Yes
Small Trees	American Hornbeam	*Carpinus caroliniana*	No
Small Trees	Japanese hornbeam	*Carpinus japonica*	No
Small Trees	Eastern Redbud	*Cercis canadensis*	Yes
Small Trees	Chinese fringetree	*Chionanthus retusus*	Yes
Small Trees	Gloryblower Tree	*Clerodendrum trichotomum*	No
Small Trees	Giant Dogwood	*Cornus contoroversa*	No
Small Trees	June Snow Dogwood	*Cornus controversa 'June Snow'*	No
Small Trees	Eddie's White Wonder Dogwood	*Cornus* 'Eddies White Wonder'	No
Small Trees	Chinese Dogwood	*Cornus kousa 'Chinensis'*	No
Small Trees	National Chinese dogwood	*Cornus kousa 'National'*	No
Small Trees	Stellar Pink Dogwood	*Cornus kousa x florida*	No
Small Trees	Venus Dogwood	*Cornus kousa x nutalli*	No
Small Trees	Thornless Cockspur Hawthorn	*Crataegus crus-galli*	No
Small Trees	Mayflower	*Crataegus laevigata*	Yes
Small Trees	Paul's Scarlet hawthorn	*Crataegus laevigata 'Paul's Scarlet'*	No
Small Trees	Washington hawthorn	*Crataegus phaenopyrum*	No
Small Trees	Lavalle Hawthorne	*Crataegus x lavallei*	No
Small Trees	Purple Fountain beech	*Fagus sylvatica 'Purple Fountain'*	No
Small Trees	Leprechaun™ Ash	*Fraxinus pennsylvanica 'Johnson'*	No
Small Trees	Western Juniper	*Juniperus Occidentalis*	No
Small Trees	September Goldenrain	*Koelreuteria paniculata 'September'*	No

Small Trees	Arnold tuliptree	*Liriodendron tulipifera* 'Arnold'	Yes
Small Trees	Amur maackia	*Maackia amurensis*	No
Small Trees	Elizabeth magnolia	*Magnolia acuminata 'Elizabeth'*	No
Small Trees	Butterflies Magnolia	*Magnolia acuminata x denudada*	No
Small Trees	Edith Bogue magnolia	*Magnolia grandiflora 'Edith Boque'*	No
Small Trees	Galaxy Magnolia	*Magnolia liliflora x sprengeri*	Yes
Small Trees	Marilee crabapple	*Malus* 'Jarmin'	Yes
Small Trees	Professor Sprenger Crabapple	*Malus 'Professor Sprenger+A86'*	No
Small Trees	Robinson Crabapple	*Malus 'Robinson'*	No
Small Trees	Sugar Tyme Crabapple	*Malus 'Sutyzam'*	No
Small Trees	Zumi Calocarpa Crabapple	*Malus x zumi*	No
Small Trees	Vanessa Persian ironwood	*Parrotia persica 'Vanessa'*	No
Small Trees	Japanese black pine	*Pinus thunbergiana*	No
Small Trees	Zebrina Himalayan pine	*Pinus wallinchiana 'Zebrina'*	No
Small Trees	Cascade Snow Cherry	*Prunus 'Cascade Snow'*	No
Small Trees	Cherry Plum	*Prunus cerasifera*	No
Small Trees	Crimson Pointe plum	*Prunus cerasifera 'Cripoizam'*	No
Small Trees	Newport Plum	*Prunus cerasifera 'Newport'*	No
Small Trees	Thundercloud plum	*Prunus cerasifera 'Thundercloud'*	No
Small Trees	Mt. St. Helens plum	*Prunus* 'Frankthrees'	No
Small Trees	Flowering Cherry 'Kwanzan'	*Prunus 'Kwanzan'*	Yes
Small Trees	Shiro plum semi-dwarf	*Prunus salicinia*	No
Small Trees	Columnar Sargent Cherry	*Prunus sargentii 'Columnaris'*	Yes
Small Trees	Pink Flair™ Cherry	*Prunus sargentii 'JFS-KW58'*	No
Small Trees	Royal Burgundy Cherry	*Prunus serrulata 'Royal Burgundy*	No
Small Trees	Snow Goose cherry	*Prunus* 'Snow Goose'	No
Small Trees	Snow Goose Cherry	*Prunus 'Snow Goose'*	No
Small Trees	Common Chokecherry	*Prunus virginiana*	No
Small Trees	Canada Red Chokecherry	*Prunus virginiana 'Canada Red'*	No
Small Trees	Akebono Flowering Cherry	*Prunus x yedoensis 'Akebono'*	No
Small Trees	Yoshino Cherry	*Prunus x yeodoensis*	No
Small Trees	Autumn Blaze Pear	*Pyrus calleryana 'Autumn Blaze'*	No
Small Trees	Trinity Pear	*Pyrus calleryana 'Trinity'*	No
Small Trees	Hosui Asian pear	*Pyrus pyrifolia 'Hosui'*	No
Small Trees	Chojuro Asian pear	*Pyrus pyrifolia*'Chojuro'	No
Small Trees	Summer Charm tree lilac	*Syringa pekinensis 'Summer Charm'*	No
Small Trees	Beijing Gold tree lilac	*Syringa pekinensis 'Zhang Zhiming'*	No
Small Trees	Oregon Myrtle	*Umbellularia californica*	No
Small Trees	City Sprite zelkova	*Zelkova serrata* 'City Sprite'	Yes

Small Trees	Wireless™ Zelkova	*Zelkova serrata 'Schmidtlow'*	No
Narrow Spaces	Flame maple	*Acer ginnala* 'Flame'	Yes
Narrow Spaces	Paperbark Maple	*Acer griseum*	No
Narrow Spaces	Butterfly Japanese Maple	*Acer palmatum 'Butterfly'*	No
Narrow Spaces	Sango Kaku Japanese Maple	*Acer palmatum 'Sango Kaku'*	No
Narrow Spaces	Roughbark maple	*Acer triflorum*	No
Narrow Spaces	Western Serviceberry	*Amelanchier alnifolia*	No
Narrow Spaces	Serviceberry	*Amelanchier* x *grandiflora*	No
Narrow Spaces	Flowering Dogwood	*Cornus florida*	No
Narrow Spaces	Kousa Dogwood	*Cornus kousa*	No
Narrow Spaces	Cornelian cherry dogwood	*Cornus mas*	No
Narrow Spaces	Grace smoketree	*Cotinus coggygria* x *obovatus 'Grace'*	No
Narrow Spaces	American smoketree	*Cotinus obovatus*	No
Narrow Spaces	Black Hawthorne	*Crataegus douglasii*	No
Narrow Spaces	Crimson Cloud Hawthorn	*Crataegus laevigata 'Crimson Cloud'*	Yes
Narrow Spaces	Golden Desert Ash	*Fraxinus excelsior 'Golden Desert'*	No
Narrow Spaces	Wedding Bells silverbell	*Halesia carolina 'Wedding Bells'*	No
Narrow Spaces	Columnar goldenchain	*Laburnum anagyroides* 'Columnaris'	No
Narrow Spaces	Southern Magnolia	*Magnolia grandiflora* 'Victoria' or 'Little Gem'	Yes
Narrow Spaces	Merrill Magnolia	*Magnolia* x *loebneri 'Merrill'*	No
Narrow Spaces	Saucer Magnolia	*Magnolia x soulangeana*	No
Narrow Spaces	Adirondack Crabapple	*Malus 'Adirondack'*	No
Narrow Spaces	Columnar Siberian Crabapple	*Malus baccata 'Columnaris'*	No
Narrow Spaces	Centurion Crabapple	*Malus 'Centurion'*	No
Narrow Spaces	Red Jewel™ Crabapple	*Malus 'Jewelcole'*	No
Narrow Spaces	Prariefire Crabapple	*Malus 'Prairie Fire'*	No
Narrow Spaces	Purple Prince crabapple	*Malus* 'Purple Prince'	No
Narrow Spaces	Red Barron Crabapple	*Malus 'Red Barron'*	Yes
Narrow Spaces	Golden Raindrops crabapple	*Malus 'Schmidtcutleaf'*	No
Narrow Spaces	Snowdrift crabapple	*Malus 'snowdrift'*	No
Narrow Spaces	Chonosuki Crabapple	*Malus tschonoskii*	No
Narrow Spaces	Fraser's Photinia	*Photina fraseri*	No
Narrow Spaces	Chinese Pistache	*Pistachia chinensis*	Yes
Narrow Spaces	Portugal laurel	*Prunus lusitanica*	No
Narrow Spaces	Beauty plum semi- dwarf	*Prunus salicinia*'Beauty'	No
Narrow Spaces	Amanogawa cherry	*Prunus serrulata 'Amanogawa'*	No
Narrow Spaces	Shirofugen flowering cherry	*Prunus serrulata 'Shirofugen'*	No
Narrow Spaces	Mt Fuji flowering cherry	*Prunus serrulata 'Shirotae' (Mt Fuji)*	No
Narrow Spaces	Winter Flowering Cherry	*Prunus subhirtella 'Autumnalis'*	No
Narrow Spaces	Flowering Plum	*Prunus x blireana*	No

Narrow Spaces	Big Cis plum	*Prunus* x *cistena 'Schmidtcis'*	No
Narrow Spaces	Spire cherry	*Prunus* x *hilleri*	No
Narrow Spaces	Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	No
Narrow Spaces	Cleveland Select Pear (Chanticleer)	*Pyrus calleryana 'Chanticleer'*	No
Narrow Spaces	Globe locust	*Robinia pseudoacacia 'Inermis'*	No
Narrow Spaces	Black hawk mountain ash	*Sorbus aucuparia 'Black hawk'*	No
Narrow Spaces	Tall Stewartia	*Stewardia montadelpha*	No
Narrow Spaces	Japanese Stewartia	*Stewartia pseudocamellia*	No
Narrow Spaces	Korean Stewartia	*Stewartia sinensis*	No
Narrow Spaces	Japanese Snowbell	*Styrax japonicus*	No
Narrow Spaces	Snowcone Japanese snowbell	*Styrax japonicus* 'JFS- D'	No
Narrow Spaces	Fragrant Snowbell Tree	*Styrax obassia*	No
Narrow Spaces	Japanese Tree Lilac	*Syringa reticulata*	Yes
Narrow Spaces	Ivory Silk Tree Lilac	*Syringa reticulata 'Ivory Silk'*	No
Narrow Spaces	Summer Sprite linden	*Tilia cordata* 'Halka'	No

*See original tree list for notes and details about the tree species listed above

**The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

A total of 58 of 290 (20%) tree species in Camas's tree list are in the "Adopted Street Tree List" for Sacramento, CA. The majority (39 tree species or 67%) are in the "Medium to Large" planting space category, 13 are in the "Small" planting space category (22%), and six are in the "Narrow Spaces" planting space category (10%). The table below summarizes these trees in Camas's list that are also in the Sister City's list (excludes Camas's "Prohibited Trees").

Summary of Matching Tree Species

Table 7. Summary of matching tree species from Camas, WA and Sacramento, CA's recommended or approved tree lists

SUMMARY OF TREE SPECIES MATCHES (ordered by planting space size)*			
Space	**Common Name****	**Botanical Name**	**Sister Climate City of Sacramento, CA Street Tree?**
Medium to Large	Red Maple	*Acer rubrum*	Yes
Medium to Large	Armstrong Maple	*Acer rubrum 'Armstrong'*	Yes
Medium to Large	Autumn Flame red maple	*Acer rubrum* 'Autumn Flame'	Yes
Medium to Large	Bowhall Maple	*Acer rubrum 'Bowhall'*	Yes
Medium to Large	Norwegian Sunset Maple	*Acer truncatum x A. platanoides 'Keithsform'*	Yes
Medium to Large	Norwegian Sunset Maple	*Acer truncatum x platanoides 'Norwegian Sunset'*	Yes
Medium to Large	European Hornbeam	*Carpinus betulus*	Yes
Medium to Large	Pyramidal European Hornbeam	*Carpinus betulus 'Fastigiata'*	Yes
Medium to Large	Hackberry	*Celtis occidentalis*	Yes
Medium to Large	Maidenhair Tree	*Ginkgo biloba*	Yes
Medium to Large	Autumn Gold Ginkgo	*Ginkgo biloba 'Autumn Gold'*	Yes
Medium to Large	Saratoga Ginkgo	*Ginkgo biloba 'Saratoga'*	Yes
Medium to Large	Fairmont Maidenhair tree	*Ginko biloba 'Fairmount'*	Yes
Medium to Large	Halka ginkgo	*Ginko biloba 'Halka'*	Yes
Medium to Large	Princeton Sentry™ Ginko	*Ginko biloba 'Princeton Sentry'*	Yes
Medium to Large	Kentucky Coffeetree	*Gymnocladus dioicus*	Yes
Medium to Large	Goldenrain Tree	*Koelreuteria paniculata*	Yes
Medium to Large	Tulip Tree	*Liriodendron tulipifera*	Yes
Medium to Large	Tupelo	*Nyssa sylvatica*	Yes
Medium to Large	Sawtooth oak	*Quercus acutissima*	Yes
Medium to Large	Forest Green™ Oak	*Quercus frainetto 'Schmidt'*	Yes
Medium to Large	English Oak	*Quercus robur*	Yes
Medium to Large	Columnar English Oak	*Quercus robur 'Fastigiata'*	Yes
Medium to Large	Red Oak	*Quercus rubra*	Yes
Medium to Large	Red Oak	*Quercus rubra*	Yes
Medium to Large	Shumard Oak	*Quercus shumardii*	Yes
Medium to Large	American Linden	*Tilia americana*	Yes
Medium to Large	Corinthian linden	*Tilia cordata 'Corzam'*	Yes
Medium to Large	Greenspire™ Linden	*Tilia cordata 'Greenspire™ '*	Yes
Medium to Large	Little leaf linden 'Olympic'	*Tilia cordata 'Olympic'*	Yes
Medium to Large	Frontier Elm	*Ulmus Americana 'Frontier'*	Yes
Medium to Large	Accolade™ Elm	*Ulmus japonica x wilsonia*	Yes
Medium to Large	Lacebark elm	*Ulmus parvifolia*	Yes
Medium to Large	Emerald Sunshine elm	*Ulmus propinqua*'JFS-Bieberich'	Yes
Medium to Large	Patriot elm	*Ulmus*'Patriot'	Yes
Medium to Large	Zelkova	*Zelkova serrata*	Yes

Medium to Large	Green Vase™ Zelkova	*Zelkova serrata 'Green Vase'™*	Yes
Medium to Large	Musashino Zelkova	*Zelkova serrata 'Musashino'*	Yes
Medium to Large	Village Green zelkova	*Zelkova serrata 'Village Green'*	Yes
Small Trees	Pacific Sunset Maple	*Acer truncatum x A. platanoides 'Warrenred'*	Yes
Small Trees	Pacific Sunset Maple	*Acer truncatum x platanoides 'Pacific Sunset'*	Yes
Small Trees	Red Horse Chestnut	*Aesculus x carnea*	Yes
Small Trees	Strawberry Tree	*Arbutus 'Marina'*	Yes
Small Trees	Eastern Redbud	*Cercis canadensis*	Yes
Small Trees	Chinese fringetree	*Chionanthus retusus*	Yes
Small Trees	Mayflower	*Crataegus laevigata*	Yes
Small Trees	Arnold tuliptree	*Liriodendron tulipifera* 'Arnold'	Yes
Small Trees	Galaxy Magnolia	*Magnolia liliflora x sprengeri*	Yes
Small Trees	Marilee crabapple	*Malus* 'Jarmin'	Yes
Small Trees	Flowering Cherry 'Kwanzan'	*Prunus 'Kwanzan'*	Yes
Small Trees	Columnar Sargent Cherry	*Prunus sargentii 'Columnaris'*	Yes
Small Trees	City Sprite zelkova	*Zelkova serrata* 'City Sprite'	Yes
Narrow Spaces	Flame maple	*Acer ginnala* 'Flame'	Yes
Narrow Spaces	Crimson Cloud Hawthorn	*Crataegus laevigata 'Crimson Cloud'*	Yes
Narrow Spaces	Southern Magnolia	*Magnolia grandiflora* 'Victoria' or 'Little Gem'	Yes
Narrow Spaces	Red Barron Crabapple	*Malus 'Red Barron'*	Yes
Narrow Spaces	Chinese Pistache	*Pistachia chinensis*	Yes
Narrow Spaces	Japanese Tree Lilac	*Syringa reticulata*	Yes

*See original tree list for notes and details about the tree species listed above

**The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Vulnerability of Urban Trees in the Pacific Northwest to Climate Change

Current Conditions

To understand the current and projected vulnerability of urban trees, the existing growing conditions and suitability of tree species was first examined. For urban forestry, the USDA's Plant Hardiness Zone is often utilized to determine current growing conditions. The USDA Plant Hardiness Zone Map is the standard by which gardeners, growers, and urban foresters can determine which perennial plants and trees are most likely to thrive at a location. For Camas, the northern portion and the majority of the City is in USDA Plant Hardiness zone 8a, but to the east, the City is in zone 8b and along the Columbia River Camas is in zone 9a. This means that the average annual extreme minimum temperature ranges between 10-15 degrees Fahrenheit in 8a, 15 to 20 degrees in 8b, and 20-25 degrees in 9a.

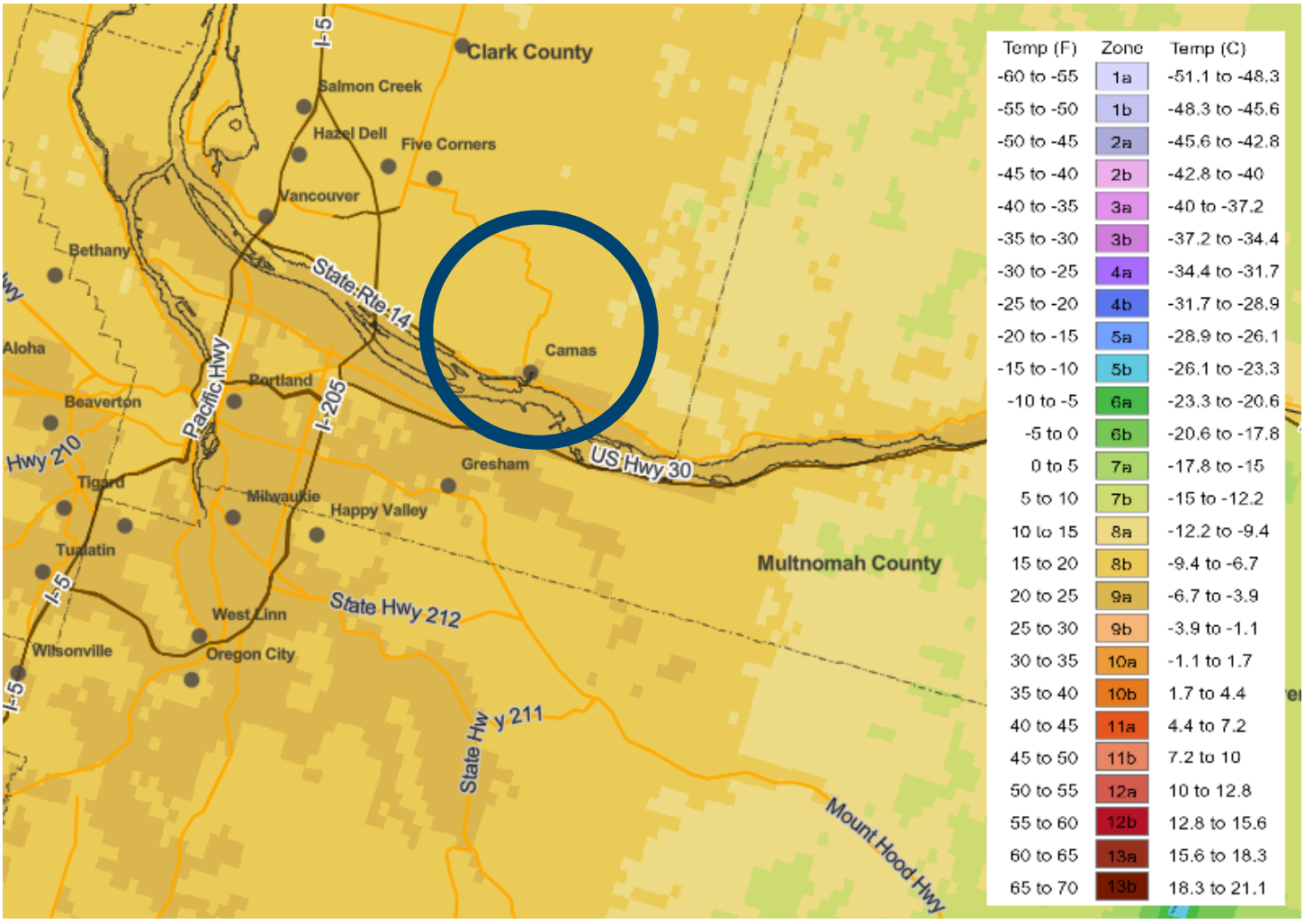


Figure 6. Map displaying the plant hardiness zones for Camas, WA (Source: USDA Plant Hardiness Zone Map, https://planthardiness.ars.usda.gov/)

Forecasting Future Conditions

Primary Resource and Tool: *Climate Change Vulnerability of Urban Trees (Climate Change Response Framework, www.forestadaptation.org)*

Trees in urban areas can be vulnerable to a variety of climate-related stressors such as intense heat, drought, flooding, and changing pest and disease patterns. Climate vulnerability is a function of the impacts of climate change on a tree species and its adaptive capacity. Species with projected negative impacts of climate change on their habitat suitability and low adaptive capacity will have high vulnerability. Those with projected positive or neutral climate change impacts on their habitat suitability and high adaptive capacity will have low vulnerability.

When assessing the vulnerability of an entire urban forest or ecosystem, additional factors beyond the vulnerability of individual tree species are also important to consider. Physical factors such as elevation or soil type may affect the susceptibility of the urban forest to drought or flooding. Biological factors such as a high proportion of vulnerable trees or the presence of particular pests or diseases may make impacts to a particular urban forest more pronounced. Human-influence factors such as the amount of impervious surface, the influence of the urban heat island, or past management in a particular site are also important considerations.

When evaluating the adaptive capacity of a particular urban forest, considerations could include: biological factors such as the amount of biological or genetic diversity of urban forest; economic factors such as the amount of funding available to support urban forestry efforts; organizational factors such as policies and the number of trained staff to do the work; and social factors such as support from the community to assist with tree care and planting. Ecological adaptive capacity factors, such as species diversity, connectivity, age class diversity, and genetic diversity, are also important to consider.

Note that the heat and hardiness zone suitability analysis, which helps inform the overall vulnerability, is meant to provide an estimate of potential changes in habitat suitability based on temperature extremes and does not consider additional factors such as changes in precipitation or other habitat requirements. The adaptability scores provide a qualitative assessment that accounts for disturbance and biological factors as a complement to information provided by projected heat and hardiness zones. The tree species vulnerability lists in previous and upcoming sections are not recommended planting guides and should be combined with knowledge in the region as well as additional factors of consideration such as allergenicity, wildlife and cultural values, and local planting lists.

To determine which tree species will be less vulnerable, several studies were reviewed, and the following factors were considered:

Urban adaptability: Based on a tree species' tolerance to climate-related disturbances such as drought, flooding, pests, and disease, as well as its growth requirements such as shade tolerance, soil needs, and ease of nursery propagation. A species that is tolerant to a wide range of disturbances and can be planted on a variety of sites is generally a higher preference. A species that is highly susceptible to disturbances and/or is limited to specific planting sites is ranked lower in preference.

Hardiness and heat zone suitability: Tree species heat and hardiness zone tolerance ranges were compared to current and projected heat and hardiness zones for Washington using downscaled climate models under low emissions (RCP 4.5) and high emissions (RCP 8.5) scenarios for changes in greenhouse gases (based on the USDA Office of Sustainability and Climate's online resource). For this particular assessment, we include heat zone suitability alone, as well as heat and hardiness zone suitability. Heat zone suitability was determined by the current and projected zones for Washington through the end of the 21st century. For some species, only the hardiness zone ranges were available, and heat zone suitability was not determined (marked N/A). The assessed tree species had the same suitability and vulnerability under both low and high emissions scenarios because all species were suitable under the projected heat zones through the end of the century, and the projected hardiness zone is the same under both low and high emissions scenarios.

Climate Change Vulnerability Ratings for Northwest Urban Trees

Table Key:					
Urban Adaptability:		**Zone Suitability:**		**Vulnerability:**	
+	High: Species may perform better than modeled	√	Suitable	▼	Low: Suitable zone, high adaptability
●	Medium	X	Not Suitable	●	Low-moderate: Suitable zone, medium adaptability
–	Low: Species may perform worse than modeled			⊖	Moderate: Suitable zone, low adaptability or zone suitable, high adaptability
				○	Moderate-high: Zone not suitable, medium adaptability
				△	High: Zone not suitable, low adaptability

*Invasive species

Table 8. Climate vulnerability and suitability of urban trees in the Pacific Northwest (Source: Climate Change Response Framework, NIACS)

		HEAT ONLY		HEAT & HARDINESS	
Common Name (Alphabetized)**	**Urban Adapt-ability**	**Zone Suitability**	**Vulnerability**	**Zone Suitability**	**Vulnerability**
Aleppo pine	●	√	●	√	●
Alleghany serviceberry	+	√	▼	√	▼
American basswood	●	√	●	X	○
American beech	●	√	●	√	●
American elm	●	√	●	√	●
American hornbeam	+	√	▼	√	▼
American smoke tree	●	√	●	X	○
American sycamore	●	√	●	√	●
American witch-hazel	●	√	●	X	○
Amur maackia*	+	√	▼	X	⊖
Apricot	●	√	●	X	○
Arizona cypress	●	√	●	√	●
Austrian pine	●	√	●	X	○
Bald cypress	+	√	▼	√	▼
Big leaf maple	●	√	●	√	●
Birch bark cherry	●	√	●	X	○
Black cherry	–	√	⊖	√	⊖
Black locust*	●	√	●	X	○
Black maple	●	√	●	X	○
Black poplar	●	N/A	N/A	√	●
Black walnut	–	√	⊖	√	⊖
Boxelder	●	√	●	√	●
Callery pear*	●	√	●	√	●
Cherry plum	●	√	●	√	●
Chinese chestnut	●	√	●	X	○
Chinese elm	+	√	▼	√	▼

Chinese fringetree	+	√	▼	√	▼
Chinese juniper	+	√	▼	√	▼
Chinese pistachio	+	√	▼	√	▼
Chinese tree lilac	+	√	▼	X	⊖
Coast live oak	●	√	●	√	●
Coast redwood	–	√	⊖	√	⊖
Cockspur hawthorn	●	√	●	X	○
Colorado spruce	●	√	●	X	○
Common chokecherry	●	√	●	X	○
Common fig	–	√	⊖	√	⊖
Common hackberry	+	√	▼	√	▼
Common hawthorn*	●	√	●	X	○
Common hazel/European filbert	●	√	●	X	○
Common hibiscus	+	√	▼	X	⊖
Common holly*	●	√	●	√	●
Common laburnum	●	√	⊖	X	△
Common lilac	●	√	●	X	○
Common pear	●	√	●	√	●
Common plum	●	√	●	√	●
Corkscrew willow	●	N/A	N/A	√	●
Cornelian cherry	●	√	●	X	○
Crabapple	●	√	●	X	○
Crepe myrtle	+	√	▼	√	▼
Dawn redwood	●	√	●	X	○
Douglas fir	●	√	⊖	X	△
Downy serviceberry	+	√	●	√	▼
Eastern hemlock	–	√	⊖	X	△
Eastern red cedar	+	√	▼	√	▼
Eastern redbud	●	√	●	X	○
Eastern white pine	–	√	⊖	X	△
Edible apple	●	√	●	X	○
Emerald sunshine elm	+	N/A	N/A	X	⊖
Empress tree*	+	√	▼	√	▼
English elm	●	√	●	X	○
English laurel*	●	√	●	√	●
English oak	●	√	●	X	○
English walnut	●	√	●	X	○
European ash	●	√	●	X	○
European hornbeam	●	√	●	√	●
European larch	●	√	●	X	○
European olive	●	√	●	√	●
Flowering dogwood	●	√	●	√	●

Foothill pine	–	N/A	N/A	√	⊖
Freeman maple	+	√	▼	X	⊖
Giant sequoia	●	√	⊖	X	△
Ginkgo	+	√	▼	X	⊖
Glossy privet	+	√	▼	√	▼
Golden raintree*	+	√	▼	√	▼
Grand fir	●	√	●	X	○
Gray birch	–	√	⊖	X	△
Green ash	●	√	●	√	●
Green beech	●	√	●	X	○
Hardy rubber tree	+	√	▼	X	⊖
Higan cherry	●	√	●	X	○
Hinoki cypress	–	√	⊖	X	△
Honey locust*	●	√	●	X	○
Horse chestnut*	●	√	●	X	○
Ironwood	+	√	▼	√	▼
Italian stone pine	●	√	●	√	●
Jack pine	–	√	⊖	X	△
Japanese cherry	●	√	●	X	○
Japanese maple	●	√	●	X	○
Japanese snowbell	●	√	●	X	○
Japanese stewartia	–	√	⊖	X	△
Japanese tree lilac	+	√	▼	X	⊖
Japanese white pine	●	√	●	√	●
Japanese zelkova	+	√	▼	X	⊖
Katsura tree	–	√	⊖	X	△
Kentucky coffeetree	+	√	▼	X	⊖
Kobus magnolia	●	N/A	N/A	X	○
Korean mountain ash	●	√	●	X	○
Kousa dogwood	+	√	▼	X	⊖
Large leaf linden	●	√	●	X	○
Lawson's cypress	●	√	●	X	○
Littleleaf linden	+	√	▼	X	⊖
Live oak	+	√	▼	√	▼
Mediterranean cypress	+	√	▼	√	▼
Midland hawthorn	●	√	●	X	○
Miyabe's maple	+	√	▼	X	⊖
Mountain hemlock	●	N/A	N/A	X	○
Narrow-leafed ash	●	√	●	X	○
Noble fir	●	√	●	X	○
Nootka cypress	–	√	⊖	X	△
Northern catalpa	●	√	●	X	○
Northern white cedar	+	√	▼	X	⊖
Norway maple*	+	√	▼	X	⊖

Norway spruce	●	√	●	X	○
Oregon ash	●	√	●	X	○
Oregon oak	●	√	●	√	●
Pacific dogwood	●	√	●	X	○
Pacific madrone	●	√	●	√	●
Paper birch	●	√	●	X	○
Paperbark maple	–	√	⊖	X	△
Peach	●	√	●	√	●
Persian parrotia	+	√	▼	X	⊖
Persian silk tree	–	√	⊖	√	⊖
Pin oak	●	√	●	X	○
Ponderosa pine	–	√	⊖	X	△
Quaking aspen	●	√	●	X	○
Red alder	–	√	⊖	X	△
Red maple	+	√	▼	√	▼
Red oak	●	√	●	X	○
River birch	●	√	●	√	●
Rowan	●	√	●	X	○
Russian olive*	+	√	▼	X	⊖
Sargent cherry	●	√	●	X	○
Sawara cypress	●	√	●	X	○
Sawtooth oak*	+	√	▼	√	▼
Scarlet oak	●	√	●	√	●
Scots pine	●	√	●	X	○
Serbian spruce	●	√	●	X	○
Shantung maple	+	√	▼	X	⊖
Shingle oak	+	√	▼	X	⊖
Shumard oak	●	√	●	√	●
Siberian elm*	●	√	●	√	●
Silver birch	–	√	⊖	X	△
Silver linden	●	√	●	X	○
Silver maple	●	√	●	√	●
Smoke tree	+	√	▼	X	⊖
Sour cherry	●	√	●	X	○
Sourwood	+	√	▼	√	▼
Southern catalpa	●	√	●	√	●
Southern magnolia	●	√	●	√	●
Strawberry tree	+	√	▼	√	▼
Sugar maple	●	√	●	X	○
Swamp birch	+	√	▼	X	⊖
Swamp white oak	+	√	▼	X	⊖
Sweet cherry	●	√	●	X	○
Sweet chestnut	–	√	⊖	X	△

Sweet mountain pine	●	√	●	X	○
Sweetgum	–	√	▼	√	⊖
Sycamore maple*	●	√	●	X	○
Tatarian maple	●	√	●	X	○
Tree of heaven*	+	√	▼	X	⊖
Trident maple	●	√	●	√	●
Tulip tree	–	√	⊖	X	△
Tupelo	+	√	▼	√	▼
Turkish filbert	●	√	●	X	○
Vine maple	+	√	●	√	●
Washington hawthorn	●	√	●	X	○
Wax-leaf privet	●	√	●	√	●
Weeping higan cherry	●	√	●	X	○
Western hemlock	–	√	●	X	○
Western red cedar	+	√	▼	X	⊖
White ash	–	√	⊖	√	⊖
White fir	●	√	●	X	○
White mulberry*	●	√	●	X	○
White oak	–	√	⊖	√	⊖
White poplar	●	√	●	√	●
White spruce	●	√	●	X	○
Willow oak	+	√	▼	√	▼
Windmill palm	+	√	▼	√	▼
Yellow buckeye	●	√	●	X	○
Yellowwood	●	√	●	X	○

**The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Camas's Tree List Compared to the Sister Climate City and the Vulnerability Study

Table Key:

Indicator of Resiliency

Table 9. The City of Camas's approved list for street tree plantings and indicators of resiliency (Sources: PlanIT Geo, Inc. and the Climate Change Response Framework)

Common Name (Alphabetized)*	Botanical Name**	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Accolade™ Elm	*Ulmus japonica x wilsonia*	Yes	N/A	N/A	N/A
Adirondack Crabapple	*Malus 'Adirondack'*	No	N/A	N/A	N/A
Akebono Flowering Cherry	*Prunus x yedoensis 'Akebono'*	No	N/A	N/A	N/A
Amanogawa cherry	*Prunus serrulata 'Amanogawa'*	No	N/A	N/A	N/A
American Beech	*Fagus grandifolia*	No	Medium	Suitable	Low-moderate
American Hophornbeam	*Ostrya virginiana*	No	N/A	N/A	N/A
American Hornbeam	*Carpinus caroliniana*	No	High	Suitable	Low
American Linden	*Tilia americana*	Yes	N/A	N/A	N/A
American smoketree	*Cotinus obovatus*	No	Medium	Not Suitable	Moderate-high
American Yellowwood	*Cladrastis kentuckia*	No	Medium	Not Suitable	Moderate-high
Amur Corktree	*Phellodendron amurense*	No	N/A	N/A	N/A
Amur maackia	*Maackia amurensis*	No	High	Not Suitable	Moderate
Apollo™ Maple	*Acer saccharum 'Barrett Cole'*	No	N/A	N/A	N/A
Aristocrat Pear	*Pyrus calleryana 'Aristocrat'*	No	N/A	N/A	N/A
Armstrong Maple	*Acer rubrum 'Armstrong'*	Yes	N/A	N/A	N/A
Arnold tuliptree	*Liriodendron tulipifera* 'Arnold'	Yes	N/A	N/A	N/A
Atlas cedar	*Cedrus atlantica*	No	N/A	N/A	N/A
Austrian pine	*Pinus nigra*	No	Medium	Not Suitable	Moderate-high
Autumn Blaze Maple	*Acer x freemanii 'Jeffersred'*	No	N/A	N/A	N/A
Autumn Blaze Pear	*Pyrus calleryana 'Autumn Blaze'*	No	N/A	N/A	N/A
Autumn Brilliance Serviceberry	*Amelanchier x grandiflora 'Autumn Brilliance'*	No	N/A	N/A	N/A
Autumn Flame red maple	*Acer rubrum* 'Autumn Flame'	Yes	N/A	N/A	N/A
Autumn Gold Ginkgo	*Ginkgo biloba 'Autumn Gold'*	Yes	N/A	N/A	N/A
Bald Cypress	*Taxodium distichum*	No	High	Suitable	Low
Beauty plum semi-dwarf	*Prunus salicinia*'Beauty'	No	N/A	N/A	N/A

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Beijing Gold tree lilac	*Syringa pekinensis 'Zhang Zhiming'*	No	N/A	N/A	N/A
Big Cis plum	*Prunus* x *cistena 'Schmidtcis'*	No	N/A	N/A	N/A
Bigleaf Maple	*Acer macrophyllum*	No	Medium	Suitable	Low-moderate
Black hawk mountain ash	*Sorbus aucuparia 'Black hawk'*	No	N/A	N/A	N/A
Black Hawthorne	*Crataegus douglasii*	No	N/A	N/A	N/A
Bonfire Maple	*Acer saccharum 'bonfire'*	No	N/A	N/A	N/A
Bowhall Maple	*Acer rubrum 'Bowhall'*	Yes	N/A	N/A	N/A
Brandywine Maple	*Acer rubrum 'Brandywine'*	No	N/A	N/A	N/A
Bur oak	*Quercus macrocarpa*	No	N/A	N/A	N/A
Butterflies Magnolia	*Magnolia acuminata x denudada*	No	N/A	N/A	N/A
Butterfly Japanese Maple	*Acer palmatum 'Butterfly'*	No	N/A	N/A	N/A
Callery Pear	*Pyrus calleryana*	No	Medium	Suitable	Low-moderate
Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	No	N/A	N/A	N/A
Callery Pear 'Capital'	*Pyrus calleryana 'Capital'*	No	N/A	N/A	N/A
Canada Red Chokecherry	*Prunus virginiana 'Canada Red'*	No	N/A	N/A	N/A
Canadian serviceberry	*Amelanchier canadensis*	No	N/A	N/A	N/A
Canoe or Paper Birch	*Betula papyrifera*	No	Medium	Not Suitable	Moderate-high
Canyon Live Oak	*Quercus chrysolepsis*	No	N/A	N/A	N/A
Cascade Snow Cherry	*Prunus 'Cascade Snow'*	No	N/A	N/A	N/A
Cascara	*Rhamnus purshiana*	No	N/A	N/A	N/A
Catalpa	*Catalpa speciosa*	No	Medium	Not Suitable	Moderate-high
Centurion Crabapple	*Malus 'Centurion'*	No	N/A	N/A	N/A
Chancellor™ Linden	*Tilia cordata 'Chancole'*	No	N/A	N/A	N/A
Cherry Plum	*Prunus cerasifera*	No	Medium	Suitable	Low-moderate
Chinese Dogwood	*Cornus kousa 'Chinensis'*	No	N/A	N/A	N/A
Chinese fringetree	*Chionanthus retusus*	Yes	High	Suitable	Low
Chinese Pistache	*Pistachia chinensis*	Yes	High	Suitable	Low
Chojuro Asian pear	*Pyrus pyrifolia*'Chojuro'	No	N/A	N/A	N/A
Chonosuki Crabapple	*Malus tschonoskii*	No	N/A	N/A	N/A
City Sprite zelkova	*Zelkova serrata* 'City Sprite'	Yes	N/A	N/A	N/A
Cleveland Select Pear (Chanticleer)	*Pyrus calleryana 'Chanticleer'*	No	N/A	N/A	N/A
Coast Redwood	*Sequoia sempervirens*	No	Low	Suitable	Moderate

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Colorado Spruce	*Picea pungens*	No	Medium	Not Suitable	Moderate-high
Columnar English Oak	*Quercus robur 'Fastigiata'*	Yes	N/A	N/A	N/A
Columnar goldenchain	*Laburnum anagyroides* 'Columnaris'	No	N/A	N/A	N/A
Columnar Sargent Cherry	*Prunus sargentii 'Columnaris'*	Yes	N/A	N/A	N/A
Columnar Siberian Crabapple	*Malus baccata 'Columnaris'*	No	N/A	N/A	N/A
Commemoration Maple	*Acer saccharum 'commemoration'*	No	N/A	N/A	N/A
Common Chokecherry	*Prunus virginiana*	No	Medium	Not Suitable	Moderate-high
Continental Appeal Linden	*Tilia americana 'Continental Appeal'*	No	N/A	N/A	N/A
Corinthian linden	*Tilia cordata 'Corzam'*	Yes	N/A	N/A	N/A
Cornelian cherry dogwood	*Cornus mas*	No	Medium	Not Suitable	Moderate
Crimean Linden	*Tilia x euchlora*	No	N/A	N/A	N/A
Crimson Cloud Hawthorn	*Crataegus laevigata 'Crimson Cloud'*	Yes	N/A	N/A	N/A
Crimson Pointe plum	*Prunus cerasifera 'Cripoizam'*	No	N/A	N/A	N/A
Crimson spire oak	*Quercus alba* x *Q. robur 'Crimschmidt'*	No	N/A	N/A	N/A
Cumulus Serviceberry	*Amelanchier laevis 'Cumulus'*	No	N/A	N/A	N/A
David Odom Afterburner tupelo	*Nyssa sylvatica 'David Odom'*	No	N/A	N/A	N/A
Dawn Redwood	*Metasequoia glyptostroboides*	No	Medium	Not Suitable	Moderate-high
Dawyck purple beech	*Fagus sylvatica 'Dawyck Purple'*	No	N/A	N/A	N/A
Deodar cedar	*Cedrus deodara*	No	N/A	N/A	N/A
Douglas Fir	*Pseudotsuga menziesii*	No	Medium	Not Suitable	High
Dove Tree	*Davidia involucrata*	No	N/A	N/A	N/A
Eastern Redbud	*Cercis canadensis*	Yes	Medium	Not Suitable	Moderate-high
Eddie's White Wonder Dogwood	*Cornus* 'Eddies White Wonder'	No	N/A	N/A	N/A
Edith Bogue magnolia	*Magnolia grandiflora 'Edith Boque'*	No	N/A	N/A	N/A
Elizabeth magnolia	*Magnolia acuminata 'Elizabeth'*	No	N/A	N/A	N/A
Embers Red Maple	*Acer rubrum 'Embers'*	No	N/A	N/A	N/A
Emerald Sunshine elm	*Ulmus propinqua*'JFS-Bieberich'	Yes	High	Not Suitable	Moderate

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Engelmann Spruce	*Picea engelmannii*	No	N/A	N/A	N/A
English Oak	*Quercus robur*	Yes	Medium	Not Suitable	Moderate-high
European Beech	*Fagus sylvatica*	No	N/A	N/A	N/A
European Hophornbeam	*Ostrya carpinifolia*	No	N/A	N/A	N/A
European Hornbeam	*Carpinus betulus*	Yes	Medium	Suitable	Low-moderate
Fairmont Maidenhair tree	*Ginko biloba 'Fairmount'*	Yes	N/A	N/A	N/A
Fastigiate white pine	*Pinus strobus 'Fastigiata'*	No	N/A	N/A	N/A
Flame maple	*Acer ginnala* 'Flame'	Yes	N/A	N/A	N/A
Flowering Cherry 'Kwanzan'	*Prunus 'Kwanzan'*	Yes	N/A	N/A	N/A
Flowering Dogwood	*Cornus florida*	No	Medium	Suitable	Low-moderate
Flowering Plum	*Prunus x blireana*	No	N/A	N/A	N/A
Forest Green™ Oak	*Quercus frainetto 'Schmidt'*	Yes	N/A	N/A	N/A
Fragrant Snowbell Tree	*Styrax obassia*	No	N/A	N/A	N/A
Fragrant Snowbell Tree	*Styrax obassia*	No	N/A	N/A	N/A
Frans Fontaine hornbeam	*Carpinus betulus* 'Frans Fontaine'	No	N/A	N/A	N/A
Fraser's Photinia	*Photina fraseri*	No	N/A	N/A	N/A
Frontier Elm	*Ulmus Americana 'Frontier'*	Yes	N/A	N/A	N/A
Fruitless Mulberry	*Morus alba*	No	N/A	N/A	N/A
Galaxy Magnolia	*Magnolia liliflora x sprengeri*	Yes	N/A	N/A	N/A
Giant Dogwood	*Cornus contoroversa*	No	N/A	N/A	N/A
Giant sequoia	*Sequoiadendro n giganteum*	No	Medium	Not Suitable	High
Glenleven Linden	*Tilia cordata 'Glenleven'*	No	N/A	N/A	N/A
Glen's Form Chanticleer Pear	*Pyrus calleryana 'Glen's form'*	No	N/A	N/A	N/A
Globe locust	*Robinia pseudoacacia 'Inermis'*	No	N/A	N/A	N/A
Gloryblower Tree	*Clerodendrum trichotomum*	No	N/A	N/A	N/A
Golden Desert Ash	*Fraxinus excelsior 'Golden Desert'*	No	N/A	N/A	N/A
Golden Raindrops crabapple	*Malus 'Schmidtcutleaf'*	No	N/A	N/A	N/A
Goldenrain Tree	*Koelreuteria paniculata*	Yes	High	Suitable	Low

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Grace smoketree	*Cotinus coggygria* x *obovatus 'Grace'*	No	N/A	N/A	N/A
Grand Fir	*Abies grandis*	No	Medium	Not Suitable	Moderate-high
Green Mountain™ Maple	*Acer saccharum 'Green Mountain'™*	No	N/A	N/A	N/A
Green Vase™ Zelkova	*Zelkova serrata 'Green Vase'™*	Yes	N/A	N/A	N/A
Greenspire™ Linden	*Tilia cordata 'Greenspire™ '*	Yes	N/A	N/A	N/A
Hackberry	*Celtis occidentalis*	Yes	High	Suitable	Low
Halka ginkgo	*Ginko biloba 'Halka'*	Yes	N/A	N/A	N/A
Halka™ Honeylocust	*Gleditsia tricanthos 'Christie'*	No	N/A	N/A	N/A
Halka™ Zelkova	*Zelkova serrata 'Halka'™*	No	N/A	N/A	N/A
Hardy rubber tree	*Eucommia ulmoides*	No	High	Not Suitable	Moderate
Harvest Gold linden	*Tilia cordatax mongolica 'Harvest Gold'*	No	N/A	N/A	N/A
Henry Maple	*Acer henryi*	No	N/A	N/A	N/A
Heritage river birch	*Betula nigra 'Heritage'*	No	N/A	N/A	N/A
Hinoki falsecypress	*Chamaecyparis obtusa*	No	Low	Not Suitable	High
Honeylocust	*Gleditsia triacanthos var. inermis*	No	N/A	N/A	N/A
Hosui Asian pear	*Pyrus pyrifolia 'Hosui'*	No	N/A	N/A	N/A
Incense-Cedar	*Calocedrus decurrens*	No	N/A	N/A	N/A
Ivory Silk Tree Lilac	*Syringa reticulata 'Ivory Silk'*	No	N/A	N/A	N/A
Jack pear	*Pyrus calleryana 'Jackzam'*	No	N/A	N/A	N/A
Jacquemontii Birch	*Betula utilis var. jacquemontii*	No	N/A	N/A	N/A
Japanese black pine	*Pinus thunbergiana*	No	N/A	N/A	N/A
Japanese hornbeam	*Carpinus japonica*	No	N/A	N/A	N/A
Japanese Snowbell	*Styrax japonicus*	No	Medium	Not Suitable	Moderate-high
Japanese Stewartia	*Stewartia pseudocamellia*	No	Low	Not Suitable	High
Japanese Tree Lilac	*Syringa reticulata*	Yes	High	Not Suitable	Moderate
June Snow Dogwood	*Cornus controversa 'June Snow'*	No	N/A	N/A	N/A
Katsura	*Cercidiphyllum japonicum*	No	Low	Not Suitable	High
Kentucky Coffeetree	*Gymnocladus dioicus*	Yes	High	Not Suitable	Moderate
Kobus Magnolia	*Magnolia kobus*	No	Medium	Not Suitable	Moderate-high
Korean Stewartia	*Stewartia sinensis*	No	N/A	N/A	N/A
Kousa Dogwood	*Cornus kousa*	No	High	Not Suitable	Moderate
Lacebark elm	*Ulmus parvifolia*	Yes	N/A	N/A	N/A
Lacebark pine	*Pinus bungeana*	No	N/A	N/A	N/A

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Lavalle Hawthorne	*Crataegus x lavallei*	No	N/A	N/A	N/A
Legacy Maple	*Acer saccharum 'legacy'*	No	N/A	N/A	N/A
Leprechaun™ Ash	*Fraxinus pennsylvanica 'Johnson'*	No	N/A	N/A	N/A
Little leaf linden 'Olympic'	*Tilia cordata 'Olympic'*	Yes	N/A	N/A	N/A
Lodgepole pine	*Pinus contorta var. latifolia*	No	N/A	N/A	N/A
London Planetree	*Platanus x acerifolia 'Bloodgood'*	No	N/A	N/A	N/A
Magnifica Hackberry	*Celtis occidentalis 'Magnifica'*	No	N/A	N/A	N/A
Maidenhair Tree	*Ginkgo biloba*	Yes	High	Not Suitable	Moderate
Marilee crabapple	*Malus* 'Jarmin'	Yes	N/A	N/A	N/A
Mayflower	*Crataegus laevigata*	Yes	N/A	N/A	N/A
Merrill Magnolia	*Magnolia x loebneri 'Merrill'*	No	N/A	N/A	N/A
Morgan Maple	*Acer rubrum 'Morgan'*	No	N/A	N/A	N/A
Mountain Silverbells	*Halesia monticola*	No	N/A	N/A	N/A
Mt Fuji flowering cherry	*Prunus serrulata 'Shirotae' (Mt Fuji)*	No	N/A	N/A	N/A
Mt. St. Helens plum	*Prunus* 'Frankthrees'	No	N/A	N/A	N/A
Musashino Zelkova	*Zelkova serrata 'Musashino'*	Yes	N/A	N/A	N/A
National Chinese dogwood	*Cornus kousa 'National'*	No	N/A	N/A	N/A
New World Maple	*Acer rubrum 'New World'*	No	N/A	N/A	N/A
Newport Plum	*Prunus cerasifera 'Newport'*	No	N/A	N/A	N/A
Northwood Maple	*Acer rubrum 'Northwood'*	No	N/A	N/A	N/A
Norway Spruce	*Picea abies*	No	Medium	Not Suitable	Moderate-high
Norwegian Sunset Maple	*Acer truncatum x A. platanoides 'Keithsform'*	Yes	N/A	N/A	N/A
Norwegian Sunset Maple	*Acer truncatum x platanoides 'Norwegian Sunset'*	Yes	N/A	N/A	N/A
October Glory red maple	*Acer rubrum 'October Glory'*	No	N/A	N/A	N/A
October Glory™ Maple	*Acer rubrum 'October Glory'™*	No	N/A	N/A	N/A
Oregon Myrtle	*Umbellularia californica*	No	N/A	N/A	N/A
Oregon White Oak	*Quercus garryana*	No	Medium	Suitable	Low-moderate
Pacific Dogwood	*Cornus nuttallii*	No	Medium	Not Suitable	Moderate-high

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Pacific Sunset Maple	*Acer truncatum x A. platanoides 'Warrenred'*	Yes	N/A	N/A	N/A
Pacific Sunset Maple	*Acer truncatum x platanoides 'Pacific Sunset'*	Yes	N/A	N/A	N/A
Pacific willow	*Salix lucida ssp. Lasiandra*	No	N/A	N/A	N/A
Pacific yew	*Taxus brevifolia*	No	N/A	N/A	N/A
Palo Alto sweetgum	*Liquidambar styrciflua 'Palo Alto'*	No	N/A	N/A	N/A
Paperbark Maple	*Acer griseum*	No	Low	Not Suitable	High
Patriot elm	*Ulmus*'Patriot'	Yes	N/A	N/A	N/A
Paul's Scarlet hawthorn	*Crataegus laevigata 'Paul's Scarlet'*	No	N/A	N/A	N/A
Persian Parrotia	*Parrotia persica*	No	High	Not Suitable	Moderate
Pin oak	*Quercus palustris*	No	Medium	Not Suitable	Moderate-high
Pink Flair™ Cherry	*Prunus sargentii 'JFS-KW58'*	No	N/A	N/A	N/A
Pioneer elm	*Ulmus*'Pioneer'	No	N/A	N/A	N/A
Ponderosa Pine	*Pinus ponderosa*	No	Low	Not Suitable	High
Port-Orford- cedar	*Chamaecyparis lawsoniana*	No	N/A	N/A	N/A
Portugal laurel	*Prunus lusitanica*	No	N/A	N/A	N/A
Prariefire Crabapple	*Malus 'Prairie Fire'*	No	N/A	N/A	N/A
Princess Diana Serviceberry	*Amelanchier x grandiflora 'Princess Diana'*	No	N/A	N/A	N/A
Princeton Sentry™ Ginko	*Ginko biloba 'Princeton Sentry'*	Yes	N/A	N/A	N/A
Professor Sprenger Crabapple	*Malus 'Professor Sprenger+A86'*	No	N/A	N/A	N/A
Prospector elm	*Ulmus wilsoniana*	No	N/A	N/A	N/A
Purple Fountain beech	*Fagus sylvatica 'Purple Fountain'*	No	N/A	N/A	N/A
Purple Prince crabapple	*Malus* 'Purple Prince'	No	N/A	N/A	N/A
Purple Rivers Beech	*Fagus sylvatica 'Riversii'*	No	N/A	N/A	N/A
Pyramidal European Hornbeam	*Carpinus betulus 'Fastigiata'*	Yes	N/A	N/A	N/A
Queen Elizabeth™ Maple	*Acer campestre 'Evelyn'*	No	N/A	N/A	N/A
Rancho Linden	*Tilia cordata 'Rancho'*	No	N/A	N/A	N/A
Rancho Pear	*Pyrus calleryana 'Rancho'*	No	N/A	N/A	N/A
Red Barron Crabapple	*Malus 'Red Barron'*	Yes	N/A	N/A	N/A
Red Horse Chestnut	*Aesculus x carnea*	Yes	N/A	N/A	N/A
Red Jewel™ Crabapple	*Malus 'Jewelcole'*	No	N/A	N/A	N/A

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Red Maple	*Acer rubrum*	Yes	High	Suitable	Low
Red Oak	*Quercus rubra*	Yes	Medium	Not Suitable	Moderate-high
Red Oak	*Quercus rubra*	Yes	Medium	Not Suitable	Moderate-high
Red Sunset Maple	*Acer rubrum 'Franksred'*	No	N/A	N/A	N/A
Red Sunset red maple	*Acer rubrum 'Red Sunset'*	No	N/A	N/A	N/A
Redmond Bigleaf Linden	*Tilia americana x euchlora 'Redmond'*	No	N/A	N/A	N/A
Redpointe Maple	*Acer rubrum 'redpointe'*	No	N/A	N/A	N/A
Redspire Pear	*Pyrus calleryana 'Redspire'*	No	N/A	N/A	N/A
Regal Prince Oak	*Quercus robur x bicolor 'Long'*	No	N/A	N/A	N/A
'Regent' Scholar Tree	*Sophora japonica 'Regent'*	No	N/A	N/A	N/A
Rivers purple beech	*Faguas sylvatica 'Riversii'*	No	N/A	N/A	N/A
Robinson Crabapple	*Malus 'Robinson'*	No	N/A	N/A	N/A
Roughbark maple	*Acer triflorum*	No	N/A	N/A	N/A
Royal Burgundy Cherry	*Prunus serrulata 'Royal Burgundy*	No	N/A	N/A	N/A
Sango Kaku Japanese Maple	*Acer palmatum 'Sango Kaku'*	No	N/A	N/A	N/A
Saratoga Ginkgo	*Ginkgo biloba 'Saratoga'*	Yes	N/A	N/A	N/A
Saucer Magnolia	*Magnolia x soulangeana*	No	N/A	N/A	N/A
Sawtooth oak	*Quercus acutissima*	Yes	High	Suitable	Low
Scanlon Red Maple	*Acer rubrum 'Scanlon'*	No	N/A	N/A	N/A
Scarlet Oak	*Quercus coccinea*	No	Medium	Suitable	Low-moderate
Scarlet Sentinel™ Maple	*Acer rubrum 'Scarsen'*	No	N/A	N/A	N/A
Schlesinger Maple	*Acer rubrum 'Schlesingeri'*	No	N/A	N/A	N/A
Scotch Pine	*Pinus sylvestris*	No	Medium	Not Suitable	Moderate-high
September Goldenrain	*Koelreuteria paniculata 'September'*	No	N/A	N/A	N/A
Serviceberry	*Amelanchier x grandiflora*	No	High	Suitable	Low
Shademaster' Thornless honeylocust	*Gleditsia triacanthos 'Shademaster'*	No	N/A	N/A	N/A
Shingle Oak	*Quercus imbricaria*	No	High	Not Suitable	Moderate
Shiro plum semi-dwarf	*Prunus salicinia*	No	N/A	N/A	N/A
Shirofugen flowering cherry	*Prunus serrulata 'Shirofugen'*	No	N/A	N/A	N/A
Shore Pine	*Pinus contorta*	No	N/A	N/A	N/A
Shumard Oak	*Quercus shumardii*	Yes	Medium	Suitable	Low-moderate

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Silver Fir	*Abies amabilis*	No	N/A	N/A	N/A
Sitka Spruce	*Picea sitchensis*	No	N/A	N/A	N/A
Skyline™ Honeylocust	*Gleditsia triacanthos 'Skyline'*	No	N/A	N/A	N/A
Skymaster™ Oak	*Quercus robur 'Skymaster™'*	No	N/A	N/A	N/A
Snow Goose cherry	*Prunus* 'Snow Goose'	No	N/A	N/A	N/A
Snow Goose Cherry	*Prunus 'Snow Goose'*	No	N/A	N/A	N/A
Snowcloud Serviceberry	*Amelanchier laevis 'Snowcloud'*	No	N/A	N/A	N/A
Snowcone Japanese snowbell	*Styrax japonicus* 'JFS- D'	No	N/A	N/A	N/A
Snowdrift crabapple	*Malus 'snowdrift'*	No	N/A	N/A	N/A
Sourwood	*Oxydendrum arboreum*	No	High	Suitable	Low
Southern Magnolia	*Magnolia grandiflora* 'Victoria' or 'Little Gem'	Yes	Medium	Suitable	Low-moderate
Spire cherry	*Prunus* x *hilleri*	No	N/A	N/A	N/A
Spring Flurry Serviceberry	*Amelanchier laevis 'Spring Flurry'*	No	N/A	N/A	N/A
State Street™ Maple	*Acer miyabei 'Morton'*	No	N/A	N/A	N/A
Stellar Pink Dogwood	*Cornus kousa x florida*	No	N/A	N/A	N/A
Sterling Silver Linden	*Tilia tomentosa 'Sterling'*	No	N/A	N/A	N/A
Strawberry Tree	*Arbutus 'Marina'*	Yes	High	Suitable	Low
Sugar Maple	*Acer saccharum*	No	Medium	Not Suitable	Moderate-high
Sugar Tyme Crabapple	*Malus 'Sutyzam'*	No	N/A	N/A	N/A
Summer Charm tree lilac	*Syringa pekinensis 'Summer Charm'*	No	N/A	N/A	N/A
Summer Sprite linden	*Tilia cordata* 'Halka'	No	N/A	N/A	N/A
Sun Valley Maple	*Acer rubrum 'Sun Valley'*	No	N/A	N/A	N/A
Sunset Maple	*Acer truncatum x Acer platanoides*	No	N/A	N/A	N/A
Swamp white oak	*Quercus bicolor*	No	High	Not Suitable	Moderate
Sycamore Maple	*Acer pseudoplatanus*	No	Medium	Not Suitable	Moderate-high
Tall Stewartia	*Stewardia montadelpha*	No	N/A	N/A	N/A
Tatarian maple	*Acer tataricum*	No	Medium	Not Suitable	Moderate-high
Thornless Cockspur Hawthorn	*Crataegus crus-galli*	No	N/A	N/A	N/A
Thundercloud plum	*Prunus cerasifera 'Thundercloud'*	No	N/A	N/A	N/A
Tricolor Beech	*Fagus sylvatica 'Roseo-marginata'*	No	N/A	N/A	N/A
Trinity Pear	*Pyrus calleryana 'Trinity'*	No	N/A	N/A	N/A

Common Name (Alphabetized)*	Botanical Name	Sister Climate City of Sacramento, CA Street Tree?	Urban Adaptability	Zone Suitability for Heat & Hardiness	Vulnerability to Heat & Hardiness
Triumph Elm	*Ulmus japonica x pumila x wilsoniana 'Triumph'*	No	N/A	N/A	N/A
Triumph™ Elm	*Ulmus 'Morton Glossy'*	No	N/A	N/A	N/A
Tulip Tree	*Liriodendron tulipifera*	Yes	Low	Not Suitable	High
Tupelo	*Nyssa sylvatica*	Yes	High	Suitable	Low
Vanessa Persian ironwood	*Parrotia persica 'Vanessa'*	No	N/A	N/A	N/A
Venus Dogwood	*Cornus kousa x nutalli*	No	N/A	N/A	N/A
Village Green zelkova	*Zelkova serrata 'Village Green'*	Yes	N/A	N/A	N/A
Washington hawthorn	*Crataegus phaenopyrum*	No	Medium	Not Suitable	Moderate-high
Wedding Bells silverbell	*Halesia carolina 'Wedding Bells'*	No	N/A	N/A	N/A
Weeping nootka cypress	*Chamaecyparis nootkatensis 'Pendula'*	No	N/A	N/A	N/A
Western Hemlock	*Tsuga heterophylla*	No	Low	Not Suitable	Moderate-high
Western Juniper	*Juniperus Occidentalis*	No	N/A	N/A	N/A
Western Red Cedar	*Thuja plicata*	No	High	Not Suitable	Moderate
Western Serviceberry	*Amelanchier alnifolia*	No	N/A	N/A	N/A
Western White Pine	*Pinus monticola*	No	N/A	N/A	N/A
Whitehouse Flowering Pear	*Pyrus calleryana 'Whitehouse'*	No	N/A	N/A	N/A
Willow Oak	*Quercus phellos*	No	High	Suitable	Low
Wineleaf Sycamore Maple	*Acer pseudoplatanus 'Spaethii'*	No	N/A	N/A	N/A
Winter Flowering Cherry	*Prunus subhirtella 'Autumnalis'*	No	N/A	N/A	N/A
Wireless™ Zelkova	*Zelkova serrata 'Schmidtlow'*	No	N/A	N/A	N/A
Yoshino Cherry	*Prunus x yeodoensis*	No	N/A	N/A	N/A
Yulan Magnolia	*Magnolia denudata*	No	N/A	N/A	N/A
Zebrina Himalayan pine	*Pinus wallinchiana 'Zebrina'*	No	N/A	N/A	N/A
Zelkova	*Zelkova serrata*	Yes	High	Not Suitable	Moderate
Zumi Calocarpa Crabapple	*Malus x zumi*	No	N/A	N/A	N/A

*See original tree list for notes and details about the tree species listed above

**The scientific and common names listed in the table above are copied directly from the source with little to no modification to reflect correct or updated spelling and nomenclature

Summary of Resilient Tree Species in Camas's List

Table 10. Summary of Camas's trees that are resilient to climate change

Metric	Count	% of 290 Tree Species
Urban Adaptability	25 tree species are highly adaptable	9%
Zone Suitability for Heat	24 tree species are suitable for hardiness zone shifts	8%
Low Vulnerability to Heat	12 tree species have a low vulnerability to heat	4%

SUMMARY

The City of Camas, WA should urgently prioritize the evaluation of this urban tree vulnerability study to make informed decisions regarding tree species planting on both public and private properties. In light of changing climates, understanding the resilience and vulnerability of different tree species is crucial for sustainable urban forestry. This study provides essential insights into which trees can thrive in the evolving environmental conditions, enabling the City to plant the optimal species for public sites, require resilient trees for private development, and make recommendations for private landowners to plant on their property. Equally important is identifying tree species that may no longer be suitable due to climate impacts, guiding the City in discontinuing their planting to promote ecological sustainability and resilient urban landscapes. This assessment ensures a strategic and adaptive approach to urban tree management in response to the challenges posed by climate change.

Camas's tree list provided in the City of Camas Plant Materials resource is in line with industry standards and best practices since the City's list includes information about each tree species' size at maturity and the recommended planting space width. In addition, the Plant Materials resource includes a list of tree species that are prohibited from being planted as street trees. Although, the Plant Materials list does not emphasize the planting of native tree species and the list includes ash (*Fraxinus*) tree species and cultivars that are susceptibly to the emerging and devasting pest known as the emerald ash borer, "*Agrilus planipennis*" (USDA APHIS, www.aphis.usda.gov).

The effects of climate change are already taking hold in the City and Camas recognizes the challenges that lie ahead. Some of the experienced and anticipated effects include prolonged periods of high temperatures and drought, extreme weather events, changes in the duration of seasons, favorable conditions for harmful tree pests and diseases, among other impacts. To grow a sustainable and resilient urban forest, the City should continue to examine the performance of trees planted and the species of trees that are recommended for planting.

To develop plans and strategies relating to tree planting for climate change, a Sister Climate City Analysis (SCCA) was conducted for this report. This SCCA examined the predicted climate of Camas 60 years from now and identified a city with a current climate that matches the projected climate of Camas. The City of Lincoln, CA was identified but no city-approved or recommended tree list was found. Therefore, a neighboring city, the City of Sacramento, CA was utilized given the location, resources available, and the urban forestry consultant's experience working in that region. From the SCCA, it was found that 58 of 290 (20%) tree species in Camas's tree list are in the "Adopted Street Tree List" for Sacramento. This means that those trees in Camas's list may favor well with changing climate since the Sister Climate City of Sacramento currently approves and is planting those tree species.

In addition to the Sister Climate City Analysis, the "Climate Change Vulnerability of Urban Trees" study completed by the Climate Change Response Framework (NIACS, forestadaptation.org) was utilized by cross-examining the tree species in Camas's list and the climate vulnerability ratings of tree species in the study. The results of this examination provide the City of Camas with information to select tree species that are resilient to the effects of climate change in the region.

Together, with the SCCA and the Climate Change Vulnerability study, the City of Camas is equipped with the information to increase the planting of tree species that are resilient, reduce plantings of highly susceptible trees, and perhaps introduce new species to the City (while being mindful of non-native invasive tree species). It is recommended that the City consider developing a Master Street Tree Planting Plan and/or an Urban Forest Management Plan that is informed by this study as well as data from a comprehensive citywide public street (and park) tree inventory. Knowing the composition of the public tree population alongside this vulnerability study would inform the City of the types of trees to plant going forward.

This analysis shows the City of Camas is on track for planting a resilient urban forest, but the City should be mindful of the diversity of species, the availability of tree species at nurseries, the associated benefits of the trees planted, the maintenance needs, and other considerations beyond what is covered in this summary report. The results of this analysis are not meant to serve as a definitive guide for tree species selection. Instead, it provides an analysis of what is currently being planted compared to the effects of climate change and offers general guidance on the species of trees that should continue to be planted while considering other goals and standards such as species diversity.

APPENDIX A. CLIMATE ADAPTATION REPORT

Climate Change Impacts for Northwest

Source: Adaptation Workbook, Developed in partnership with the U.S. Department of Agriculture (USDA), the USDA Forest Service, the Northern Institute of Applied Climate Science, and American Forests.

This region was defined in the National Climate Assessment (2014) and includes the states of Idaho, Oregon, Washington. National Climate Assessment (2018) - Northwest

Temperatures in the Northwest are projected to increase by 4.9 to 8.5 degrees Fahrenheit by late-century (2071-2100).
All climate models agree that temperatures are projected to increase over the 21st century across the Northwest, with almost uniform temperature increases across the entire region. The greatest warming is expected in southern Idaho and along the coast. The greatest warming is expected during summer months, particularly in Idaho and Oregon. The warming trend is projected to be accentuated in certain mountain areas in late winter and spring.
R.S. Vose, D.R. Easterling, and others. 2017. Climate Science Special Report: Temperature Changes in the United States. U.S. Global Change Research Program.

By the middle of the century, the Northwest region is expected to experience 3 to 18 more days per year with a maximum temperature exceeding 95 degrees F, and the hottest day of the year is projected to warm by 6.25°F.
The largest simulated increases occur in southern Idaho, with as many as 18 more days above 95 degrees F each year. The smallest increases in hot days occur in high-elevation areas of the Cascades and Rocky Mountains, because projected temperature increases are still not enough to increase the chance of such warm days.
R.S. Vose, D.R. Easterling, and others. 2017. Climate Science Special Report: Temperature Changes in the United States. U.S. Global Change Research Program.
K. Kunkel, L. Stevens, and others. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment - Northwest. NOAA.

The Northwest region is expected to experience between 5 and 30 fewer days per year with a minimum temperature below 10 degrees Fahrenheit by the middle of the century, and the coldest day of the year will warm is projected to warm by 7.33°F.
The largest decreases are expected in the inland of the region, particularly in high-elevation areas in central Idaho. The smallest decrease in cold days is expected coastal and southern parts of the region, where these kinds of cold days rarely occur. Similarly, high-elevation areas are expected to have up to 40 fewer days with a minimum temperature below 32 degrees by the middle of the century, particularly in the mountains of Oregon and Washington, and northern Idaho.
R.S. Vose, D.R. Easterling, and others. 2017. Climate Science Special Report: Temperature Changes in the United States. U.S. Global Change Research Program.
K. Kunkel, L. Stevens, and others. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment - Northwest. NOAA.

Climate conditions will continue to increase wildfire risks in in the Northwest by the end of the century.
Although wildfires are a natural part of most Northwest forest ecosystems, warmer and drier conditions have helped increase the number and extent of wildfires in western U.S. forests since the 1970s. Warmer winters have led to reductions in the mountain snowpack that historically blanketed the region's mountains, increasing wildfire risk. The warming trend is projected to be accentuated in certain mountain areas in late winter and spring, further exacerbating snowpack loss and increasing the risk for wildfires. In central Idaho and eastern Oregon and Washington, vast mountain areas have already been transformed by wildfires, but the western Cascades and coastal mountain ranges have less experience with this growing threats. Under the A1B emissions scenario, the median annual area burned in the Northwest would quadruple relative to the 1916 to 2007 period to 2 million acres (range of 0.2 to 9.8 million acres) by the 2080s. Averaged over the region, this would increase the probability

that 2.2 million acres would burn in a year from 5% to nearly 50%. The limitation for these sorts of projections is that they do not account for changes in land use, fire suppression rates, or vegetation changes.
C. May, C. Luce, and others. 2018. Fourth National Climate Assessment: Northwest. U.S. Global Change Research Program.
P. Mote, A. Snover, and others. 2014. National Climate Assessment – Northwest. U.S. Global Change Research Program.

By the end of the century, average annual precipitation is projected to increase slightly in the Northwest, along with increased year-to-year variability in precipitation.
There is general agreement between different climate scenarios for future precipitation projections in the Northwest. Generally, the largest increase is projected for northern Washinton (9-12% increase), with increases becoming smaller toward southern Oregon and Idaho (0-3% increases). Precipitation decreases appear more likely for summer months across the entire region (average decline = 11%), particularly in high-elevation areas. Winter months may experience slightly increased precipitation, and projections for fall and spring are mixed across the region. Years of abnormally low precipitation and extended drought conditions are expected to occur throughout the century, and extreme events, like heavy rainfall associated with atmospheric rivers, are also anticipated to occur more often.
C. May, C. Luce, and others. 2018. Fourth National Climate Assessment: Northwest. U.S. Global Change Research Program.
K. Kunkel, L. Stevens, and others. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment - Northwest. NOAA.

The number of days per year with more than 1 inch of precipitation will increase across the Northwest by the middle of the century.
The largest increases in days per year with more than 1 inch of precipitation is projected for areas east of the Cascades in Oregon and Washington (40% increase). For the rest of the region, projected changes in extreme rainfall are smaller than normal year-to-year variation.
K. Kunkel, L. Stevens, and others. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment - Northwest. NOAA.

The freeze-free season is expected to increase by 20 to 40 days in the Northwest by the middle of the century.
The freeze-free season is defined as the period of time between the last spring frost (daily minimum temperature below 32 degrees F) and the first fall frost. The length of the annual freeze-free season has been increasing since the 1980s, and all climate models agree that it will continue to increase in the future. The largest increases are projected for the areas west of the Cascades, with some areas increasing by more than 40 days. The rest of the region is expected to have roughly 25-day increases in the growing season.
K. Kunkel, L. Stevens, and others. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment - Northwest. NOAA.

Warmer temperatures, reduced snowpack, and greater water demand for agriculture may reduce available water for natural ecosystems.
Winter snowpack, which slowly melts and releases water in spring and summer, is key to the Northwest's hydrology and water supplies. Since around 1950, area-averaged snowpack on April 1 in the Cascade Mountains decreased about 20%, spring snowmelt occurred 0 to 30 days earlier, late winter/early spring streamflow increases ranged from 0% to greater than 20% as a fraction of annual flow, and summer flow decreased 0% to 15% as a fraction of annual flow. Under climate change, the largest changes are expected in basins that typically recieve lots of snow. Warming will increase winter stream flows and advance the timing of snowmelt as much as 3-4 weeks earlier by the middle of this century. Summer flows in these basins are projected to be substantially lower.
C. May, C. Luce, and others. 2018. Fourth National Climate Assessment: Northwest. U.S. Global Change Research Program.
P. Mote, A. Snover, and others. 2014. National Climate Assessment – Northwest. U.S. Global Change Research Program.

Climate change will amplify many existing stressors to forest ecosystems in the Northwest, such as insect pests, tree diseases, and wildfire.

Forest pests, diseases, and droughts are expected to become more damaging under climate change, and these factors may interact in unpredictable ways. Many impacts will be driven by water deficits, which increase tree stress and mortality, tree vulnerability to insects, and fuel flammability. Higher temperatures and drought stress are contributing to outbreaks of mountain pine beetles that are increasing pine mortality in drier Northwest forests. Between now and the end of this century, the elevation of suitable beetle habitat is projected to increase as temperature increases, exposing higher-elevation forests to the pine beetle, but ultimately limiting available area as temperatures exceed the beetles' optimal temperatures. As a result, the proportion of Northwest pine forests where mountain pine beetles are most likely to survive is projected to first increase (27% higher in 2001 to 2030 compared to 1961 to 1990) and then decrease (about 49% to 58% lower by 2071 to 2100).

P. Mote, A. Snover, and others. 2014. National Climate Assessment – Northwest. U.S. Global Change Research Program.

J. Vose, D. Peterson, and others. 2012. Effects of Climate Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector.. USDA Forest Service Pacific Northwest Research Station.

Many tree species and ecosystems in the Northwest may decline under climate change.

For many tree species, the most climatically suited areas will shift from their current locations, increasing vulnerability to insects, disease, and fire in areas that become unsuitable. Projections indicate that 21 to 38 currently existing plant species may no longer find climatically appropriate habitat in the Northwest by late this century. Subalpine forests and alpine ecosystems are especially at risk and may undergo almost complete conversion to other vegetation types by the 2080s. For example, Climate is projected to become unfavorable for Douglas-fir over 32 percent of its current range in Washington by the end of the century.

P. Mote, A. Snover, and others. 2014. National Climate Assessment – Northwest. U.S. Global Change Research Program.

J. Vose, D. Peterson, and others. 2012. Effects of Climate Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector.. USDA Forest Service Pacific Northwest Research Station.

The urban heat island effect can exacerbate the effects of increasing temperatures.

Evidence Medium; Agreement High

Urban areas with one million or more people can be 2 to 13° F warmer than their surrounding rural areas due to the "urban heat island effect" from heat-absorbing infrastructure such as pavement and buildings as well as waste heat generated from manufacturing and automobiles. The urban heat island is often more pronounced in historically redlined areas with lower tree cover.

H. Akbari. 2005. Energy saving potentials and air quality benefits of urban heat island mitigation. Lawrence Berkeley National Laboratory.

Maxwell, K. , Julius, S. , and others. 2018.

The surface urban heat island response to urban expansion: A panel analysis for the conterminous United States

Recent progress on urban overheating and heat island research. Integrated assessment of the energy, environmental, vulnerability and health impact. Synergies with the global climate change

The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas

Impervious cover can exacerbate the effects of increased heavy precipitation events in urban areas.

Evidence Medium; Agreement High

Increases in impervious cover can dramatically increase the size and frequency of localized flooding. Typically, urban floods are short-lived, but extended flooding can stress trees, leading to leaf yellowing, defoliation, and crown dieback. If damage is severe, mortality can occur. In addition, flooding can lead to secondary attacks by insect pests and diseases. Some species are more tolerant of flooding than others. Flood-intolerant species include upland species such as bitternut and shagbark hickory, Kentucky coffeetree, and white oak. Species that are

generally tolerant of flooding include species that are generally native to wetlands and riparian areas such as baldcypress, sycamore, and red maple. Trees in coastal areas may also be vulnerable to saltwater intrusion during flood events.

S. Bratkovich, L. Burban, and others. 1993. Flooding and Its Effect on Trees. USDA Forest Service Northeastern Area.

G. Hollis. 1975. The effect of urbanization on floods of different recurrence interval. Water Resources Research.

Maxwell, K. , Julius, S. , and others. 2018.
Causal Effect of Impervious Cover on Annual Flood Magnitude for the United States
Assessing the tree health impacts of salt water flooding in coastal cities: A case study in New York City

Low-diversity systems are at greater risk from climate change.

Evidence Medium; Agreement High

Studies have consistently shown that diverse systems have exhibited greater resilience to extreme environmental conditions and greater potential to recover from disturbance than less diverse communities. This relationship makes less diverse communities inherently more susceptible to future changes and stressors. The diversity of potential responses of a system to environmental change (response diversity), is a critical component of ecosystem resilience. Response diversity is generally reduced in less diverse ecological systems. Genetic diversity within species is also critical for the ability of populations to adapt to climate change, because species with high genetic variation have better odds of producing individuals that can withstand extreme events and adapt to changes over time.

E.V. Moran, F. Hartig, and others. 2015. Intraspecific trait variation across scales: Implications for understanding global change responses. Global Change Biology.

A.S. Jump, R. Merchant, and others. 2009. Environmental change and the option value of genetic diversity.

T. Elmqvist , C. Folke, and others. 2003. Response diversity, ecosystem change, and resilience. Frontiers in Ecology and the Environment.

A. Hoffman and C. Sgrò. 2011. Climate change and evolutionary adaptation. Nature.

Systems that are more tolerant of disturbance have less risk of declining on the landscape

Evidence Medium; Agreement High

Disturbances such as wildfire, flooding, and pest outbreaks are expected to increase in the future. Forests that are adapted to gap-phase disturbances, with stand-replacing events occurring over hundreds or thousands of years, may be less tolerant of more frequent widespread disturbances. Mesic hardwood forests can create conditions that could buffer against fire and drought to some extent, but these systems are not expected to do well if soil moisture declines significantly. Forest systems that are more tolerant of drought, flooding, or fire are expected to be better able to withstand climate-driven disturbances. This principle holds true only to a given point, because it is also possible for disturbance-adapted systems to experience too much disruption. For example, dry pine forests and woodlands might benefit from drier conditions with more frequent fire, but these systems might also convert to savannas or open grasslands if fire becomes too frequent or drought becomes too severe.

G. Nowacki and M. Abrams. 2008. The Demise of Fire and “Mesophication” of Forests in the Eastern United States. BioScience.

E. Gustafson and B. Sturtevant. 2013. Modeling Forest Mortality Caused by Drought Stress: Implications for Climate Change. Ecosystems.

Species in fragmented landscapes will have less opportunity to migrate in response to climate change.

Evidence Limited; Agreement High

Habitat fragmentation can hinder the ability of tree species to migrate to more suitable habitat on the landscape, especially if the surrounding area is nonforested. Modeling results indicate that mean centers of suitable habitat for tree species will migrate between 60 and 350 miles by the year 2100 under a high emissions scenario and between 30 and 250 miles under milder climate change scenarios. Based on data gathered for seedling distributions, it has been estimated that many northern tree species could possibly migrate northward at a rate of 60 miles per century. Fragmentation makes this disparity even more challenging, because the landscape is essentially less permeable to migration.

L. Iverson, M. Schwartz, and others. 2004. How fast and far might tree species migrate in the eastern United States due to climate change?. Global Ecology and Biogeography.
C. Woodall, C. Oswalt, and others. 2009. An indicator of tree migration in forests of the eastern United States. Forest Ecology and Management.

Systems that are limited to particular environments will have less opportunity to migrate in response to climate change.

Evidence Limited; Agreement High

Some species and forest types are confined to particular habitats on the landscape, whether through requirements for hydrologic regimes, soil types, or other reasons. Similar to species occurring in fragmented landscapes, isolated species and systems face additional barriers to migration. Widespread species may also have particular habitat requirements. For example, sugar maple is often limited to soils that are rich in nutrients like calcium, so this species may actually have less available suitable habitat than might be projected solely from temperature and precipitation patterns. Riparian forests are not expected to be able to migrate to upland areas because many species depend on seasonal flood dynamics for regeneration and a competitive advantage. Similarly, lowland conifer swamps contain a unique mix of species that are adapted to low pH values, peat soils, and particular water table regimes. These species face additional challenges in migration compared to more-widespread species with broad ecological tolerances.

A. Jump and J. Peñuelas. 2005. Running to stand still: adaptation and the response of plants to rapid climate change. Ecology Letters.

Date:	July 26, 2024
To:	Greenworks, City of Camas
From:	Bonnie Gee Yosick and Mary Chase, ECOnorthwest
Subject:	Camas Parks and Open Space Management Plan: Current Practices and Allocated Resources Assessment

Overview

The Camas Parks and Open Space Management Plan (POSMP) will serve as a management tool for Camas to maintain and enhance natural resources in its parks and open spaces efficiently and cost effectively. ECOnorthwest is supporting Greenworks and the City of Camas to create a plan that will establish service levels and priorities consistent with Camas Parks and Recreation's value of stewardship: consciously investing in parks and natural spaces while continuously preserving and protecting them to benefit future generations.

The POSMP assesses and analyzes the urban tree canopy, and synthesizes relevant information documenting current conditions, including management practices of the City's parks and open spaces and their natural resources.

This memorandum provides an overview of current management practices and allocated resources, including the roles and responsibilities of various departments in policy development, operations, and management, and permitting. This assessment includes:

- **Current Service Delivery Summary**: An overview of organizational structure, department budget, and program and asset inventory
- **SWOT Analysis:** Assessment of strengths, weaknesses, opportunities, and threats within current service delivery
- **Recommendations:** Strategies for cost-effective improvements supported by best practices

Current Service Delivery Summary

Parks and open spaces provide value to communities in a variety of ways. Access to nature has a range of benefits for community members like promoting public health, encouraging environmental stewardship, and building social cohesion. Trails, fields, and other facilities can provide necessary space for physical activity and relieving stress that can enhance health outcomes, while also creating community gathering spaces. Natural systems also work to reduce temperatures in cities, counter urban heat-island effects (even in smaller cities like Camas) and perform other functions like stormwater management and carbon sequestration. With this wide range of functions, parks provide valuable social and physical infrastructure to strengthen community resilience.

In the last decade, the City has made progress towards delivering high-quality parks and open spaces to benefit residents of Camas, adding over 316 new acres of open space and 146 acres for future parks. Successful acquisitions have increased the park system's total size in 2010 by over 75 percent.

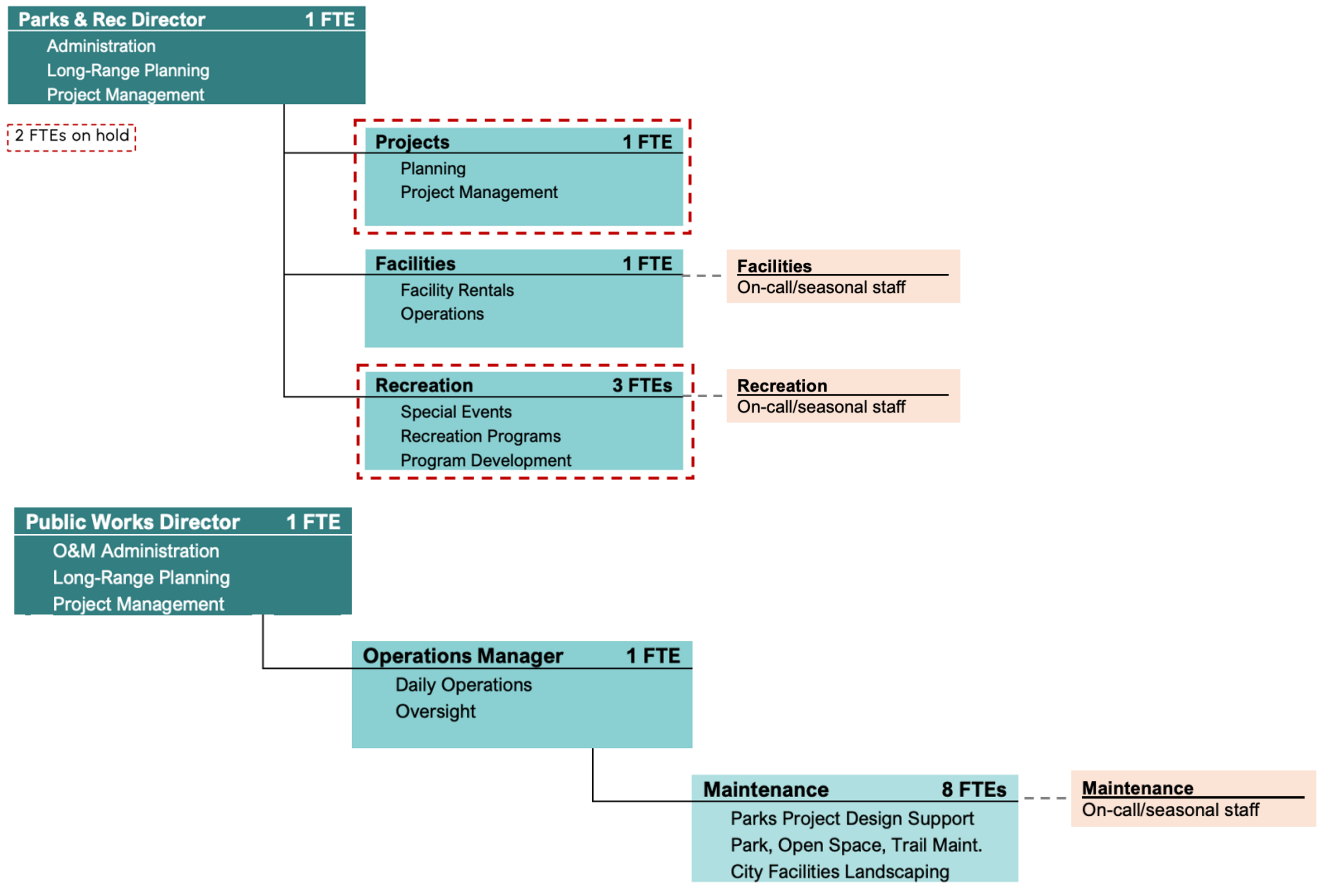
Organization Mission and Structure

The Camas Parks and Recreation Department has a stated mission to: ***"promote a healthy and sustainable community by listening and responding to the community's needs and desires, protecting, and preserving its natural spaces to improve ecological health, and developing and maintaining parks, trails and recreation programs that are welcoming for all."***[1]

The department's major divisions that advance different aspects of this purpose include Projects, Facilities, and Recreation, which include a range of services in planning, facility rentals, events, and programming. Maintenance work for facilities is accomplished through the Public Works department.

Due to a hiring freeze since the adoption of the 2023-2024 budget, the Parks department currently does not have any allocated FTE for the Projects unit and the Recreation unit has 2 FTEs. The Public Works FTEs shown perform maintenance for all City facilities landscaping, including medians and other public buildings. Some additional seasonal staff are hired to augment maintenance work and provide community events and summer recreational programing support.

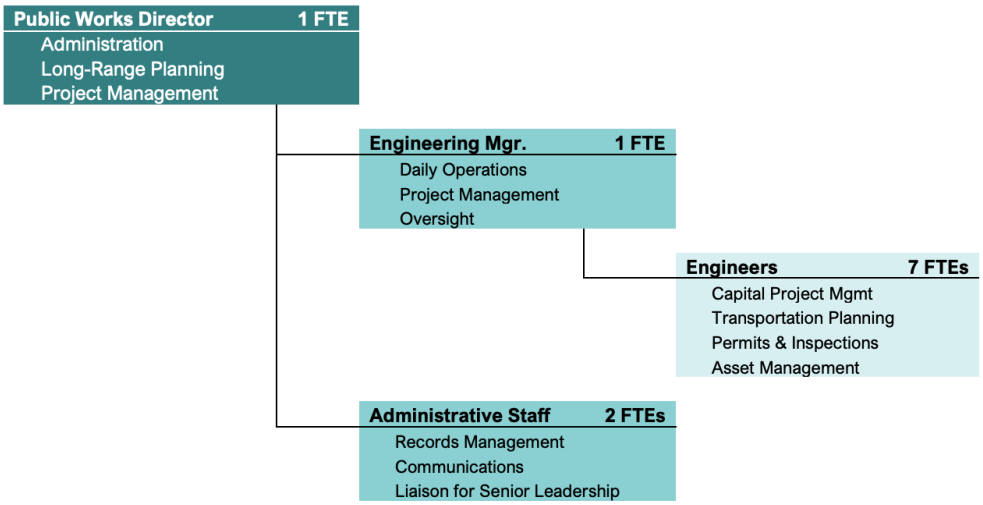
Exhibit 1. Parks and Recreation Organization Chart
Source: City of Camas 2023-2024 Adopted Budget



[1] City of Camas, 'Parks and Recreation,' https://www.cityofcamas.us/parksrec/page/about-parks-and-recreation-department.

Public Works also provides support for new capital projects. Although the units shown in Exhibit 2 are not involved in maintenance of parks, open spaces, etc., they are involved in buildout of new facilities.

Exhibit 2. Public Works Organization Chart
Source: City of Camas 2023-2024 Adopted Budget



Within these broad categories, the Parks and Recreation Department splits out some of its services further into several positions. Recreation coordination responsibilities are divided between program coordination for youth, adults, and seniors in the community and special City-sponsored events, as well as development of programs and new facilities.

Exhibit 3. Parks and Recreation Organization Chart Detail
Source: City of Camas Parks and Recreation Department

KEY TAKEAWAYS

In management of natural resources, the Parks and Recreation Department has the greatest overlap with the **Public Works Department** for parks maintenance functions, including design and construction support for new capital projects, landscaping, and ongoing maintenance of facilities landscaping, parks, open space, and trails.

Internally, management of recreational programs, facility operations, and administration is shared between multiple positions who also coordinate with external partners.

Budget Structure

As a part of the City's overall organizational structure, the City Administrator is authorized to transfer budget amounts between Parks and other departments, but any revisions that alter the total expenditures of a fund or that affect the number of authorized employee positions, salary ranges, or other conditions of employment must be approved by the City Council. The Department's budget comes from several sources, including some that feed into the general Parks budget (such as the City General Fund and charges for services) or specific capital projects (such as grants and impact fees). Of the City's overall budget, Parks accounted for only a small share (approximately 3.1 percent as of 2022).

Exhibit 4. Camas General Budget, 2022
Source: City of Camas

This analysis primarily considers the City of Camas's 2022 budget for Parks and Recreation as a benchmark for the proportionate allocation of different funding sources towards Parks facilities and operations. While the current Operating and Capital Budget is for the fiscal biennium 2023-2024, data from 2022 provides a complete picture of actual annual expenditures. The adopted 2023-2024 Biennium Budget also notes that the Parks and Recreation Department has experienced "cost increases for seasonal personnel, supplies, and professional services for operations and recreational programs,"[2] associated with new staff, capital projects, and fleet expansion in recent years, which is detailed further in the Program and Asset Inventory section of this memorandum.

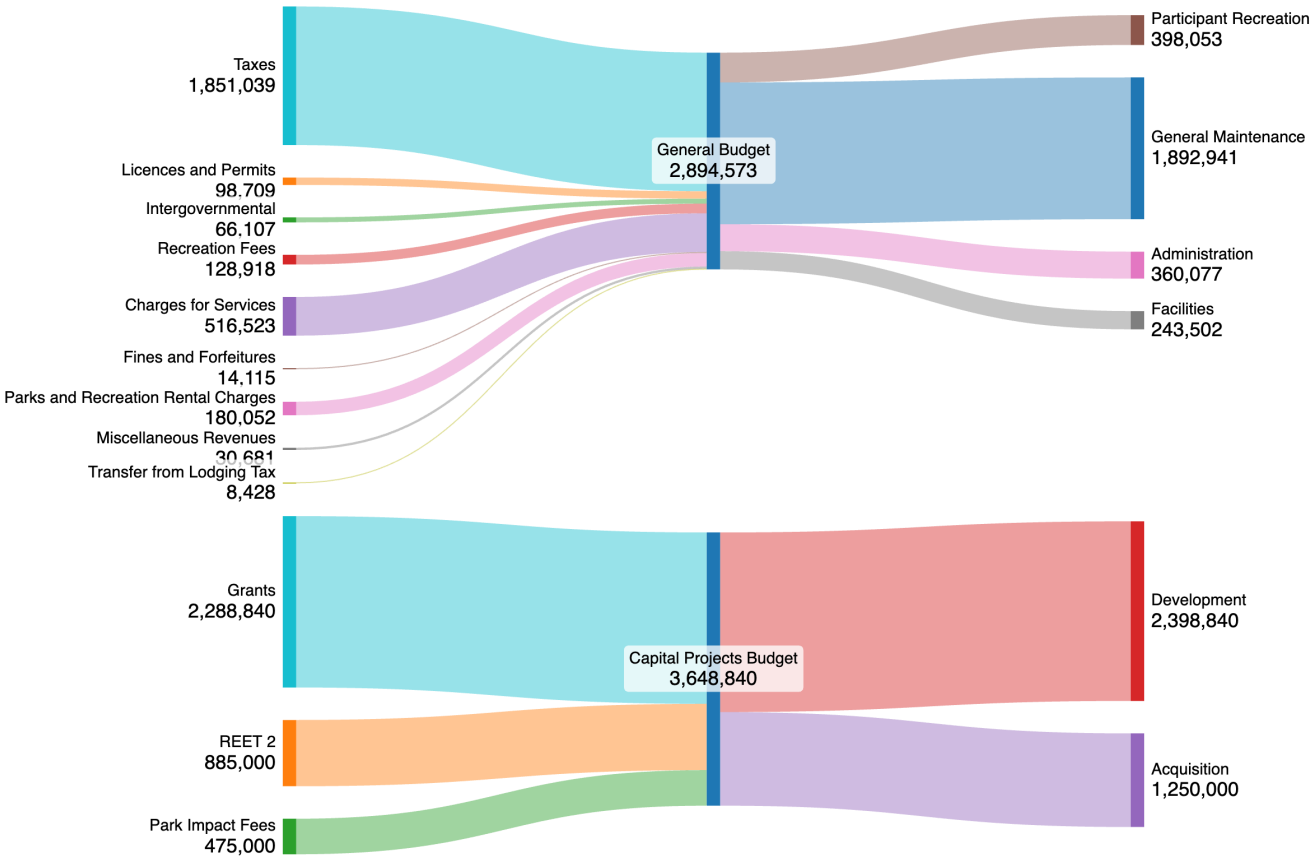
The Parks and Recreation budget structure can be broadly considered in two categories: General Budget and Capital Projects:

[2] City of Camas, '2023-2024 Biennium Budget,' 98.

- **General Budget** encompasses the costs of participant recreation programs, administration and staffing, facilities operations, and general maintenance which is funded primarily through ongoing sources like the City's local taxes, charges for services, and facility rental or recreation program fees. Other smaller sources come from licenses and permits, local lodging tax, and other revenues. The largest amount of these funds goes towards general maintenance (approximately two-thirds of the general budget in 2022).
- **Capital Budget** goes towards physical Parks projects, including both acquisition of new properties and development activities (e.g. construction or infrastructure improvements). The sources for new capital projects are different than the City's general budget sources, with grants providing the largest share of the capital budget in 2022, as well as park impact fees (PIF) and the City's local Real Estate Excise Taxes (REET 2). In 2022, a larger share went towards improvements and development in existing parks (about two-thirds of the capital budget), while $1.25 million (the remaining one-third) went towards acquisition of land for Green Mountain Parks.

Park Impact Fees (PIFs) are one-time fees collected on new development. In Washington, PIFs can only be used to "pay for public facilities needed to serve new growth and development, and that is reasonably related to the new development that creates additional demand and need for public facilities, that is a proportionate share of the cost of the public facilities, and that is used for facilities that reasonably benefit the new development." - RCW 82.02.090(3)

Exhibit 5. FY 2022 Camas Parks Budget, Includes Full-Time and Seasonal Staff
Source: City of Camas



KEY TAKEAWAYS

General maintenance is the largest share of the Parks Department's general operating budget, primarily funded through local taxes as part of the City's general fund. Sources like charges for services, fees, fines, licenses/permits, and facility rentals for events or programs provide smaller amounts of funds allocated towards administration, facilities, and recreation programs but do not cover the cost of operating these public services.

As the City expands its portfolio of recreational facilities through grants, REET 2, and park impact fees feeding into its capital budget, the proportionate cost of maintaining assets will also increase over time. However, these capital budget sources are restricted to capital expenditures and not available to cover ongoing costs, meaning that the City will need to plan for increased maintenance needs either through identifying/allocating additional funds and/or improving efficiency of service delivery.

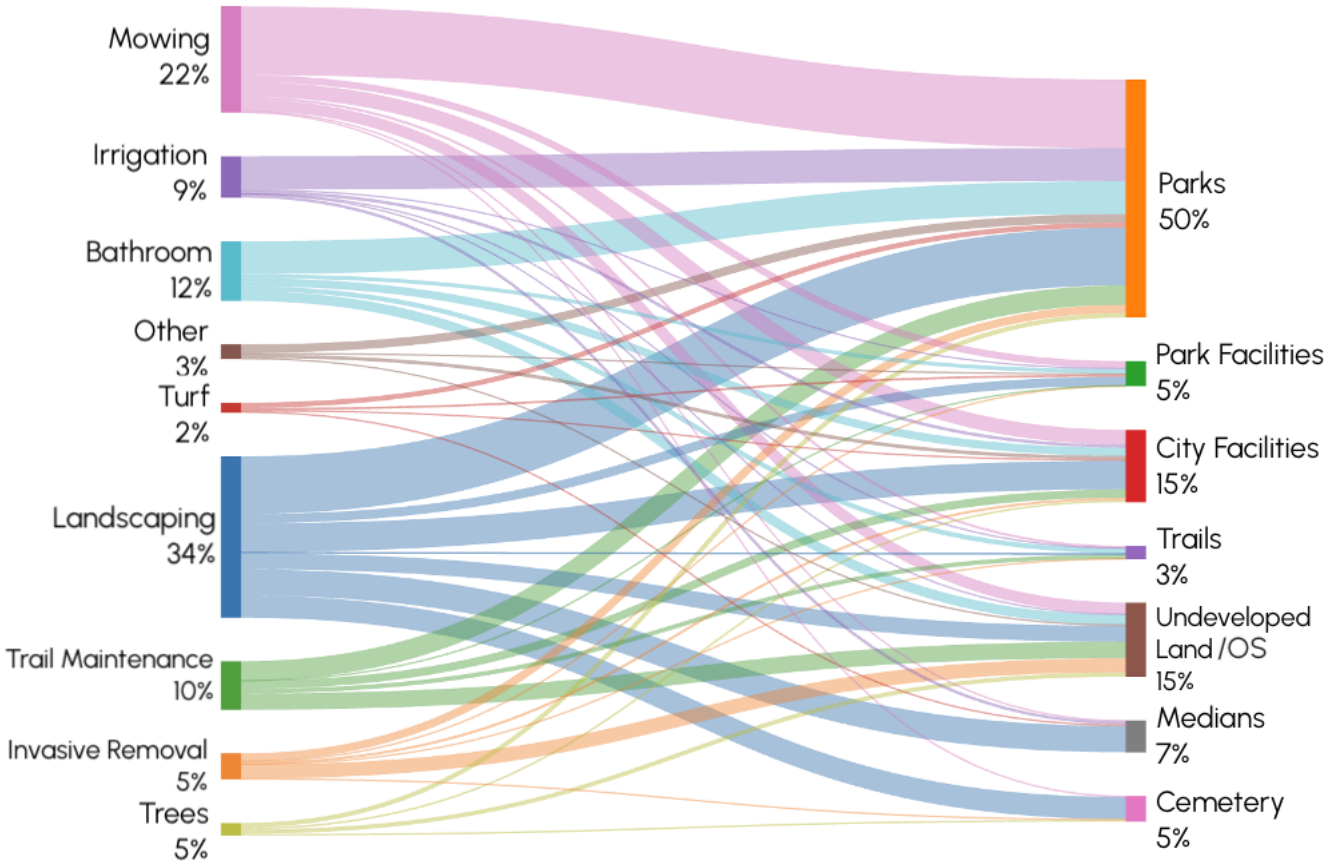
Program and Asset Inventory

ASSETS

The Parks and Recreation Department oversees **sixteen different parks** in the City of Camas, **1,064 acres** of City-owned parks and open spaces, **twelve miles of trails** (including the Heritage Trail, Washougal River Greenway, and others), **four facilities** for recreational use (including the Camas Community Center, Lacamas Lake Lodge and Conference Center, Fallen Leaf Lake picnic facility, and Scout Hall), as well as **the Camas Cemetery**. As Camas grows, the current park system represents an increasing inventory of parks and open spaces, increasing by over 75 percent since 2010.

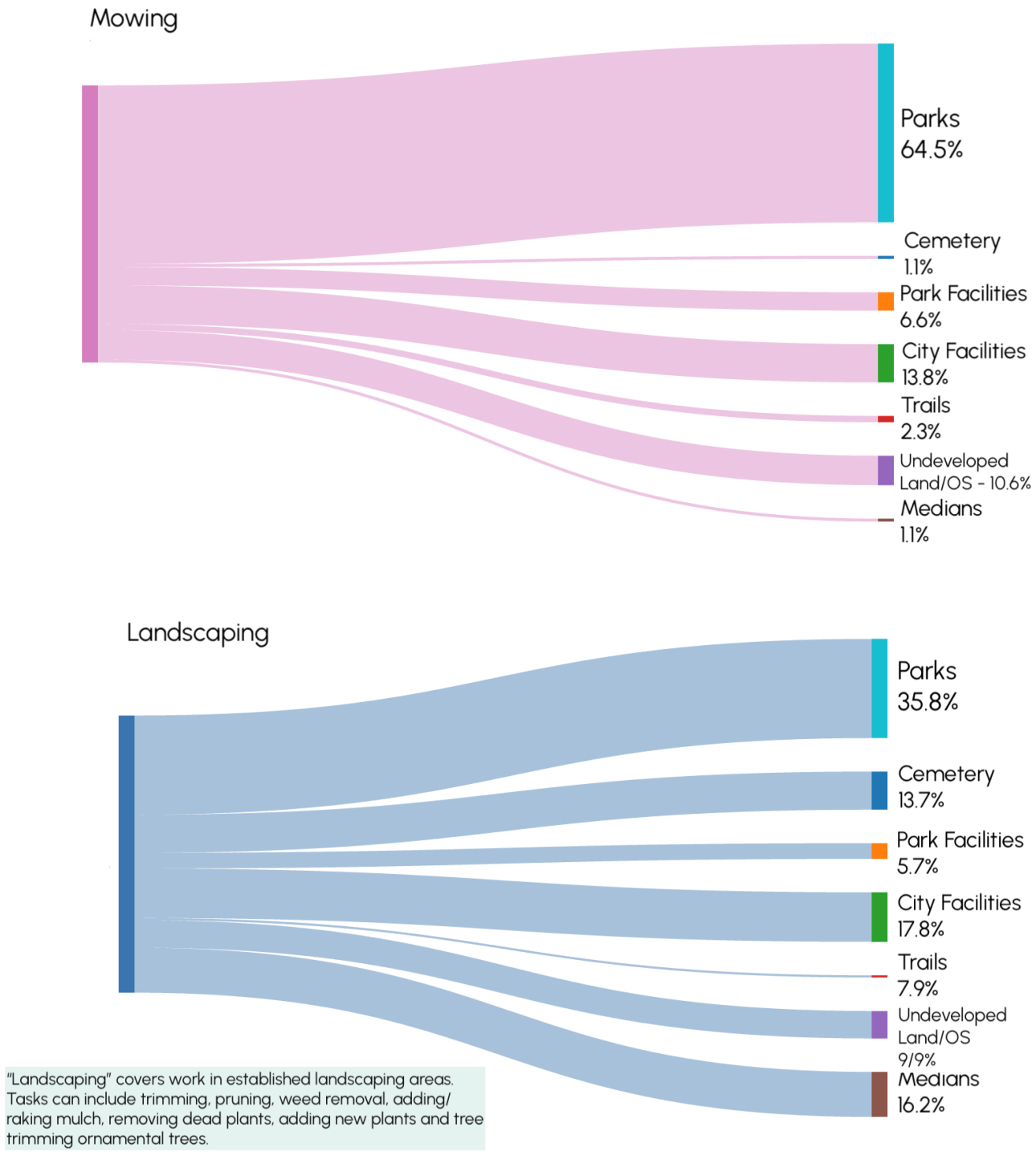
The Parks and Recreation Department works with the Public Works Department to provide maintenance services. In addition to Parks assets outlined above, Public Works also provides services on other City-owned properties, including Camas City Hall, the Library, city annex building, the Camas-Washougal Municipal Court House, Camas-Washougal Fire Department Stations #42 and #43, the City of Camas Operations Center, and the Camas Police Station. The Department also provides landscaping services in the City's roadway medians. In addition to maintenance performed by full-time staff, the City also hires workers for additional maintenance activities (not represented in Exhibit 6 and Exhibit 7).

Exhibit 6. Parks and Recreation Maintenance Labor Detail, 2023 (Full-Time Employees Only)
Source: City of Camas
Note: This graphic shows labor hours for full time maintenance staff. It does **not** include maintenance hours by part-time, seasonal, or on-call workers.



The largest shares of maintenance labor based on the City's tracking in 2023 were **landscaping** and **mowing**. Individually, the labor hours spent on mowing and landscaping for City facilities (aside from Parks assets), open space, the cemetery, and medians were greater than several maintenance categories in total (such as tree and turf maintenance).

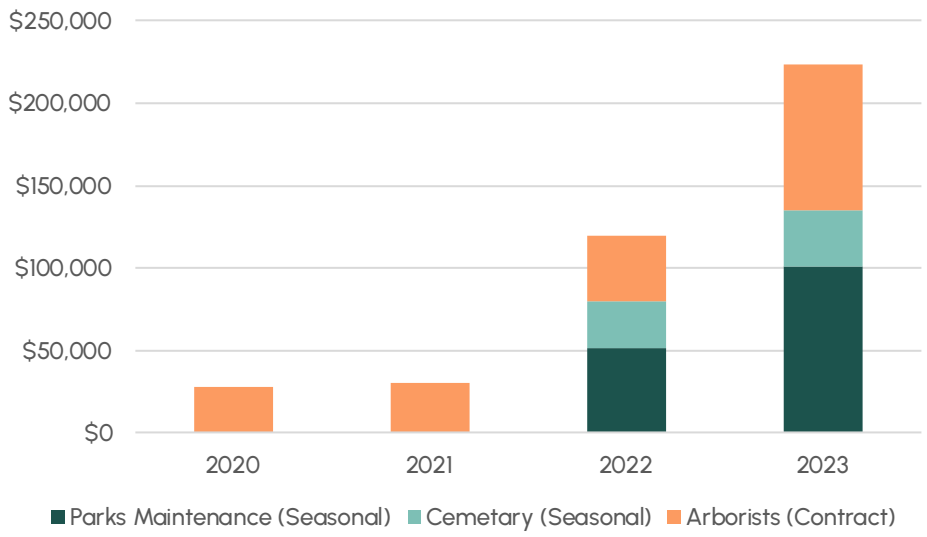
Exhibit 7. Parks and Recreation Maintenance Labor Detail, Mowing and Landscaping, 2023
Source: City of Camas



External factors can increase the need for certain types of maintenance activities. In particular, severe weather and storms can increase the need for more specialized maintenance labor like hazard tree removal. These services are currently performed in a reactionary manner, and due to resources and staff capacity, the city sometimes needs to hire outside contractors to respond to needs. As the changing climate is likely to increase the severity and frequency of extreme weather events, the vulnerability of many trees will continue to rise and increase the need for these services. Strategies for preventative care, education, and an adaptive plant palette are covered in the POSMP report in order to improve these conditions in the long-term, and hopefully reduce the need to hire contractors to perform management tasks.

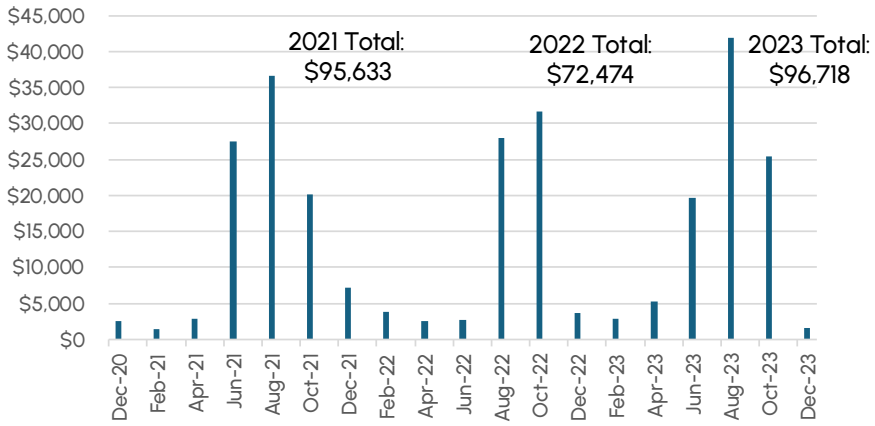
Spending for seasonal staff and contractors has increased since 2020, with the largest share of spending towards arborists and general parks maintenance in 2023. During the onset of the COVID-19 pandemic in 2020 and 2021 there was no spending on parks maintenance or cemetery maintenance contractors.

Exhibit 8. Annual Seasonal Staff and Contractor Costs, 2020-2023
Source: City of Camas, Greenworks
Note: Parks and Cemetery Maintenance had $0 of seasonal staff/contractor spending in 2020 and 2021.



Water use in parks and publicly-owned open spaces can also vary based on external factors as well as more predictable seasonal variation. Warmer summer and early autumn months between June and October tend to require much higher spending on water for maintaining parks, while winter and spring months between December and April tend to require less water usage. However, fluctuations in heat and weather patterns may require flexibility to adapt to changing needs (particularly as the impacts of climate change create more unpredictable conditions). The type of vegetation, soil health, use of mulch, and other management factors are recommended in the POSMP to help address water needs over time.

Exhibit 9. Water Use Costs by Bi-Monthly Period, December 2020-December 2024
Source: City of Camas



PROGRAMS

The Department also operates recreational programs and community events year-round for a range of community members, including youth, adults, and seniors. As of the 2023-2024 Biennium Budget, Parks personnel had 6 staff members (two on-hold positions). Seasonal program activities include arts, athletics, camps, and special events held at Parks facilities. Public Works maintenance team of 8 staff members perform city-wide maintenance of city-owned properties, including parks assets.

KEY TAKEAWAYS

Only about half of labor hours spent on maintenance was performed on parks, with an additional twenty-three percent spent on other Parks & Rec assets including facilities, trails and open spaces. And additional five percent was spent on the cemetery.

Maintaining other City-owned facilities and undeveloped open space accounted for fifteen percent of labor hours each, with the large shares spent on landscaping, mowing, trail maintenance, and invasives removal. As the City expands its parks and open space inventory, there will be a need for additional maintenance labor both before development of recreational facilities and after new facilities are developed.

Recommendations and SWOT Analysis: Strengths, Weaknesses, Opportunities and Threats

SWOT Analysis

Analysis of strengths, weaknesses, opportunities, and threats allows organizations to understand both internal and external factors that can have a positive or negative influence on intended outcomes. This section summarizes these factors for Camas's Parks and Recreation Department, particularly in terms of

efficient service delivery related to operations and allocating resources. For more detail on these factors and recommendations for technical aspects of natural resources management, see the POSMP.

Exhibit 10. SWOT Summary

	POSITIVE	NEGATIVE
INTERNAL	**Strengths:** • Large and growing inventory of parks and open spaces • High level-of-service acreage with 38.8 acres per resident (the highest among comparison districts analyzed) • Skilled Parks and Recreation staff • Diverse schedule of recreation activities for residents accessible for different ages • Currently leveraging County resources to expand portfolio (Legacy Lands program) and other grant resources for capital projects • Community member interest in parks and open space stewardship and greater involvement; existing Camas Parks Foundation and Ivy League for fundraising and invasive plant removal volunteers •	**Weaknesses:** • City subsidizes community use through low facility-rental fees and charges • High amount of effort towards mowing/landscaping • Significant time and resources spent on non-Parks and non-Open Space facilities • Need for invasives removal in open spaces (citywide) • Resources spent on reactive management to extreme weather events • Lack of specialized stewardship experience for different land types or natural systems • Lack of established standards, agreements or ongoing conversations with private entities (HOAs) about parks and natural system expectations
EXTERNAL	**Opportunities:** • Increase staff capacity to grow partnerships with community-based groups and leverage potential volunteer efforts • Identify opportunities for joint training for both staff and community members to improve knowledge and best practices • Work with Homeowners Associations (HOAs) to collectively address natural area needs on private property (e.g. invasives removal, trail	**Threats:** • Lack of additional external resources (grants) for maintenance and ongoing operations with new assets • Low capacity at current staff levels to engage with volunteer/community partners • Increasing need for more specialized contract services (e.g. arborists) to handle reactive issues • Unpredictable weather patterns associated with climate change that create unexpected costs and

	maintenance, replanting of native plants/trees) • Identify best design practices that reduce need for on-going maintenance to free up staff time to address long-term or proactive issues	maintenance needs and increase system-wide vulnerabilities.

Best Practice Considerations for Improving Public Service Delivery

Best practices for improving service delivery related to parks and open space can demonstrate how other public agencies have achieved successful reforms for more efficient processes. As the City of Camas seeks to enhance its natural resource service delivery as part of the POSMP, recent literature on public policy and administration provides direction and options for consideration.

Maintaining high-quality natural resources is a major component of parks and open space management, which includes specific considerations for sustaining complex ecosystems. These resources are delineated according to both natural phenomena (e.g. watersheds or topography) as well as human-made boundaries (e.g. developed parks or reserved natural areas). Natural resources often cross jurisdictional boundaries and can often require interagency, intergovernmental, or public-private partnerships.[3] Subsequently, management of natural resources typically requires both objective scientific measures (e.g. water quality testing) and accountability between institutions (e.g. intergovernmental agreements) to sustainably manage ecological systems, services, and their benefits to communities.

Emerging external challenges like climate change as well as changing state legislative rules will also require agencies to continue to adapt to different approaches to managing natural resources. Implementing measures to increase climate resilience and respond to state (or federal) level policies will require adaptable strategies from jurisdictions like Camas. In Washington, the Growth Management Act requires coordinated approaches to land use within a region with sets of rules and considerations for adding new land into a city from its Urban Growth Area (UGA). As new land is added to the City of Camas, or as current land develops into more populated areas (i.e. North Shore Subarea and Green Mountain), parks and recreational services may need to adapt to different densities and land uses to provide adequate services. Responding to changing conditions both in the natural environment due to climate change and state-level policies requires flexibility in adapting service delivery practices as outlined further in the recommendations of this memorandum.

Measuring improvements to natural resource delivery can be done in several ways, which may sometimes require tradeoffs between different outcomes. Thinking through the types of services Camas Parks and Recreation provides, this analysis considers how to ensure high-impact activities are

[3] Dianna M. Hogan et al., "Urban Ecosystem Services and Decision Making for a Green Philadelphia," USGS Numbered Series, Urban Ecosystem Services and Decision Making for a Green Philadelphia, vol. 2014–1155, Open-File Report (Reston, VA: U.S. Geological Survey, 2014), https://doi.org/10.3133/ofr20141155, 8.

prioritized at a system level. These high-impact activities would be defined as those which optimize benefits to the community or be those that are early investments to allow long-term impacts. For more information on this systems approach, please refer to the POSMP.

Broad types of best practices for measuring improved service delivery include:

More efficient service delivery and resource allocation. Changes to service delivery methods that reduce costs, level of staff effort, and timelines can more efficiently use public funding and resources, and typically lead to a greater quantity of services provided.[4] Efficiency in information systems and communication can also facilitate more clear and consistent internal coordination between partnering agencies and the public.[5] Information, additional education, and leadership from Camas on expectations can help provide consistency across land use types, both public and privately-owned. However, a greater volume of services provided does not necessarily guarantee other criteria like ecosystem services goals, quality, and equitable access.

More equitable distribution of and access to services in the community. A more equitable distribution of public resources can address deficiencies within communities that have been historically underserved by public programs, investments, and processes.[6] The tradeoffs between equitable outcomes (which may be more costly) and efficiency (which may be insufficient for addressing equity issues) can require a nuanced balance in service delivery from public agencies related to physical distribution, funding allocation, and specific criteria within programs and decision-making.[7]

Higher quality ecosystem services and social benefits. Public-sector agencies are recognizing parks, trails, and open space as critical infrastructure. And improving services in the context of natural resources can mean improving outcomes directly for the ecosystem (e.g. air and water quality) and social benefits (e.g. recreation and improved health outcomes).[8] Over time, leadership to prioritize these resources and guide policy relating to climate change needs to change organizations' benchmarks for measuring these qualities.[9] Agencies may define quality services differently, but have shared goals such as prioritizing native plants, protecting critical assets and resources like the urban tree canopy, or other metrics.

As Camas works to improve its service delivery for natural resources, balancing greater efficiency, equitable distribution, and high-quality services will require a careful look how to align community

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[4] Teresa Curristine, Zsuszanna Lonti, and Isabelle Joumard, "Improving Public Sector Efficiency: Challenges and Opportunities" (OECD Journal on Budgeting, 2007), https://www.oecd.org/gov/budgeting/43412680.pdf.

[5] Public Sector Research Centre, "The Road Ahead for Public Service Delivery" (PricewaterhouseCoopers, 2007).

[6] Office of Equity and Human Rights, "Racial Equity Toolkit" (City of Portland, 2016), https://www.portlandoregon.gov/oehr/71685.

[7] Simon Dietz and Giles Atkinson, "The Equity-Efficiency Trade-off in Environmental Policy: Evidence from Stated Preferences," *Land Economics* 86, no. 3 (August 2010): 423–43.

[8] Dianna M. Hogan et al., "Urban Ecosystem Services and Decision Making for a Green Philadelphia."

[9] Linda Joyce and Maria Janowiak, "Climate Change in Natural Resource Assessments."

priorities of natural character features with activities in cooperation with partners to work towards the City's commitments.

Current Trends in Camas

The City of Camas is growing quickly. Since 2000, the population of Camas has grown at a faster rate than Clark County or Washington State overall, increasing by **120 percent** (or 5.2 percent annually) from 12,462 residents in 2000 to 27,420 residents in 2023. Since 2015, the City has permitted 2,763 new housing units, with single detached homes accounting for the largest share (70 percent) of new permits in the City of Camas, and another 8 percent were made up of attached townhomes (the remaining 22 percent being new multifamily building or middle-housing types like duplexes and triplexes).

As the City considers its future capacity for employment and housing growth, the Parks and Recreation Department will likely face implications for its level of service and capital improvements planning to meet increasing and changing demand patterns.

Both the City and Clark County are currently in the process of updating their Comprehensive Plans which guide growth management for jurisdictions in Washington. Clark County has developed interim allocations for housing and employment growth in each Urban Growth Area (UGA), which estimate that Camas will need to accommodate an estimated **4,222 new housing units and 11,528 new jobs** by 2045 in its UGA. The way that Camas accommodates new growth will require **intentional decisions about land use and density as well as the relationship between development and open space**. In its 2022 Housing Action Plan, the City of Camas identified some initial direction from its engagement process that noted the need for more diverse housing options like starter homes for young adults looking to purchase a house, accessory dwelling units (ADUs), accessible housing for older adults, and apartments/condominiums.[10] Changing patterns of development may also indicate changing needs for parks to ensure accessible recreation opportunities for all residents.

[10] City of Camas, 'Housing Action Plan,' https://www.cityofcamas.us/com-dev/page/camas-housing-action-plan, 2022.

Spotlight: Homeowners Associations (HOAs)

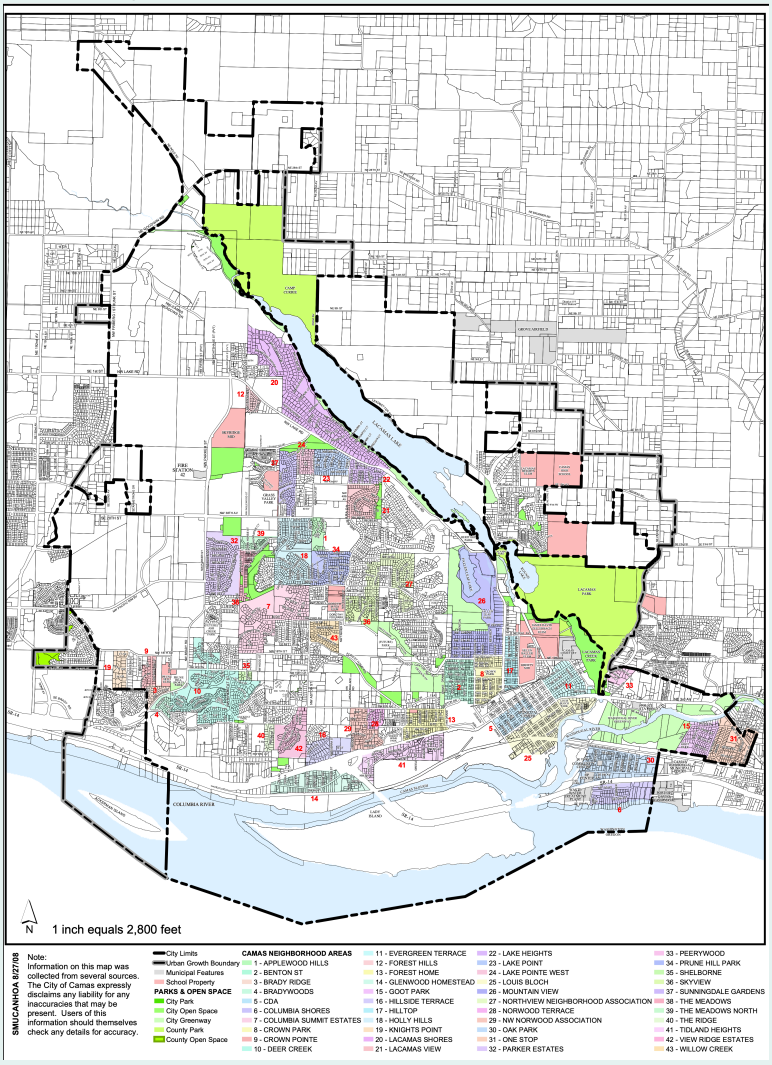
Homeowners Associations (HOAs) are residential organizations that manage and enforce specific rules within a subdivision or neighborhood. In Camas, HOAs cover a large area of the City's residential areas, including those adjacent to some of Camas's largest parks (Exhibit 11). HOAs own **50 percent of open space** in the City of Camas, including **8.4 miles of trail** open to the public.

Often, subdivisions include natural areas like parks, open space, and trails which are a part of ecological systems in Camas and connect to the wider network of trails and open space.

Working with HOAs to achieve the City's vision and goals to provide and preserve natural spaces and ecological health is an important consideration for the Parks and Recreation Department but can be complex because of public-private sector dynamics.

Exhibit 11. Map of Camas HOAs

Source: City of Camas



Washington State Comparisons

In its 2022 Parks, Recreation, and Open Space (PROS) Plan Update, Camas identified comparisons with other cities in Washington with similarities to Camas to understand the variation in operations. The PROS Plan found that in 2018 data reviewed, Camas had considerably lower spending and operating budget on parks and recreation services compared with peer cities, allocating the equivalent of $78.65 per person.[11] The PROS Plan Update used 2018 data to avoid pandemic distortions in local budget data. In a more recent comparison of park providers in Washington, Camas fell in the middle of per-capita spending looking at a broad section of cities but was still less than half of the cities with the greatest spending (the Cities of Tumwater and SeaTac). ***In terms of spending per acre and level of service, Camas provides***

[11] City of Camas, 'Parks, Recreation, and Open Space Plan,' https://www.cityofcamas.us/parksrec/page/parks-recreation-and-open-space-comprehensive-plan-pros-plan-update, 2022.

more acres per 1,000 residents than any comparable district while spending the second lowest amount per acre.

Exhibit 12. Comparative Metrics for Per-Capita Spending and Level of Service, Camas and Selected Washington Jurisdictions

Source: Local jurisdiction budget documents

*In order of per-capita spending

PARK PROVIDERS	POPULATION ESTIMATE	PARKS BUDGET	PARKLAND ACRES	PER-CAPITA SPENDING	PER-ACRE SPENDING	ACRES/1000 RESIDENTS
City of Tumwater	27,100	$7,608,421	514.5	$280.8	$14,788	19.0
City of SeaTac	31,740	$8,317,584	352	$262.1	$23,630	11.1
City of Port Angeles	20,240	$3,914,100	270	$193.4	$14,497	13.3
Park District of Si View	42,060	$6,250,632	890	$148.6	$7,023	21.2
PenMet Park District	40,000	$5,866,627	570.9	$146.7	$10,276	14.3
City of Camas	**27,420**	**$3,437,438**	**1,064**	**$125.4**	**$3,231**	**38.8**
City of Mercer Island	25,800	$2,127,581	479	$82.5	$4,442	18.6
City of Kenmore	24,230	$1,873,638	146	$77.3	$12,833	6.0
City of Longview	38,130	$2,170,690	488	$56.9	$4,448	12.8
City of Mountlake Terrace	23,810	$1,306,090	269	$54.9	$4,855	11.3
City of Maple Valley	29,250	$1,069,653	370.8	$36.6	$2,885	12.7

Sources: Washington State Office of Financial Management (2023 population estimates); cities of Tumwater, SeaTac, Camas, Mercer Island, Kenmore, Longview, Mountlake Terrace, and Maple Valley, biennial 2023-24 budgets; City of Port Angeles, Park District of Si View, and PenMet Park District, 2024 preliminary budgets.

Recommendations for Cost-Effective Service Delivery Improvements

This memorandum focuses on improvements for service delivery related to management practices and allocation of resources towards parks and open space. The recommendations below are organized around two key strategies, including strengthening collaboration with partner organizations and aligning internal organization and metrics with the POSMP framework. See the POSMP report for details about recommendations for improving technical aspects of ecosystem services and human access and amenities.

STRENGTHEN COLLABORATION WITH PARTNERS

Establish management standards that can give clear guidance to City staff and private landowners to help meet the goals of climate resiliency, best management practices, and effective resource allocation. The Camas Parks and Open Space Management Plan outlines a systems-based approach with minimal expectations for different types of land, including HOAs, private landowners, stormwater facilities, steep slopes, open spaces, trails, rights-of-way, wetlands, shorelines, and parks. The POSMP also provides best management practices that can work towards overall improvements and resilience across these different types of land in Camas. This approach can improve consistency across public and privately owned land and help prioritize the most impactful practices to human and ecosystem health. Communicating these standards and the mutual benefits of a holistic approach to parks and open space should be a priority for the City between departments and to HOAs and private landowners. Although the City may have more agency to change practices on publicly owned land, it can provide guidance and build relationships to increase participation from these private partners.

Establish agreements with HOAs and other partners for collaborative management of ecosystem services and recreational resources. Proactively engaging with HOAs and establishing formal agreements can help to advance collective expectations and efforts to improve quality of life for residents and maintain ecosystems. While the City and HOAs may have different sets of considerations for their operations related to natural resource management, this work should begin by identifying shared goals (like preventing spread of invasive species, collect tree inventory and providing recreational amenities). Creating foundational agreements can help the public sector and these private actors to work together (and can also be used as models for structuring agreements with nonprofits and other partners). Potential mechanisms include:

- **General written agreements.** Written agreements between public agencies and private or nonprofit partners often come in the form of memorandums of understanding (MOUs) which can lay out details for a variety of programming, maintenance, or other operations activities. While not necessarily binding, MOUs can help to provide a clear roadmap for cooperating with partners. In Camas, written agreements could help to facilitate symbiotic relationships with other entities to provide park services.
    - *See More: Project for Public Spaces*
- **Payment-in-lieu agreements.** This type of voluntary agreement between cities and other organizations provides payments in exchange for park benefits even when they are not required. In some cases, payment-in-lieu agreements are used between cities and larger nonprofit organizations (like universities) who are exempt from local fees or taxes but elect to contribute because of mutual benefits of adjacent park space. These agreements can also be

used with developers who are providing park facilities on private land but wish to pay an agreed upon amount to public entities for cooperative maintenance or other costs.

  - *See More: Los Angeles, CA; Paying for Parks*

- **Operations and maintenance agreements.** Similar to payment-in-lieu agreements, operations and maintenance agreements set out specific roles and responsibilities for cities and private or nonprofit partners. These are often established with mission-driven organizations to fill gaps in operating needs for specific facilities (like the example linked below for the Ann and Roy Butler Trail in Austin, TX).
  - *Example: Austin, TX*

Expand staff capacity within the Parks and Recreation Department to engage with HOAs, community-based groups, and volunteers. Encouraging residents to participate in volunteer stewardship of the natural environment can be mutually beneficial both for participants and the City. Dedicating either a part- or full-time staff member to engage with these efforts can maximize capacity for stewardship at a lower cost while providing meaningful educational opportunities for community members and access to nature. It can also focus efforts on city-wide goals to maximize the impact for systems or areas of need. Activities could include:

- **Maintaining parks and natural areas.** Many volunteer groups like the Ivy League support cities with programs that help residents get involved in activities (e.g. removing invasive species or tree plantings) often through organized one-time events (like volunteer days) or ongoing relationships where a group may 'adopt' an area to maintain over time.
  - *Local Example: Friends of the Columbia Gorge*
- **Beautification and clean-up.** Beautification and clean-up activities like litter/graffiti removal or installing new signage can be organized in a similar way to ecosystem maintenance activities, with targeted events or ongoing programs that help to keep public open spaces in good shape and welcoming to users.
  - *Local Example: SOLVE Oregon*
- **Enhancing educational programs.** Volunteer programs frequently include educational opportunities for individuals to learn more about their ecosystem while participating in parks maintenance or beautification efforts. Working with mission-based organizations to augment existing recreation offerings can also help to expand opportunities to a wider range of community members for these services (e.g. by providing culturally-specific and responsive services). They also provide an opportunity for training community members to help with proactive efforts to identify or mitigate potential hazards or long-term stressors.
  - *Local Example: Portland Parks Community Partnership Program*
- **Advocacy and fundraising.** Nonprofit groups like Camas's local Parks Foundation provide volunteer capacity for a range of activities (like those listed above) as well as support for fundraising for park improvements and different types of advocacy to benefit parks.
  - *See More: Camas Parks Foundation*

Create ongoing channels with state and county level partners. Cooperating with relevant partners from Washington State and Clark County can ensure both alignment with changing policies (e.g. state growth management rules) and knowledge of new opportunities to expand capital facilities or programs (e.g. grants). State-level policies can have both direct and indirect impacts on planning for park facilities. Patterns of new development and growth can necessitate different considerations for the location, size, and features of new park spaces to serve residents. County cooperation on programs like Legacy Lands is also critical for Camas in considering long-term capital plans and opportunities. Maintaining dialogue with these partners can help to proactively plan for future facilities as well as associated operating costs and staffing needs.

ALIGN INTERNAL ORGANIZATION AND METRICS WITH POSMP FRAMEWORK

Providing clear policy and practices to guide operations and maintenance funding can help to ensure alignment with the City's asset-management goals.

Reorganize maintenance staff by land type and train or hire champions to provide overall stewardship practices and goals. Organizing maintenance staff by land type or system can better align internal structures with ecosystem performance and uses outlined in the POSMP Framework. These include specific considerations for natural features like tree canopy, soil, vegetation/habitat, and water that often cross other types of boundaries but have their own set of best practice considerations for more efficient services systemwide. For example, invasive species removal to ensure healthy vegetation and overall habitat may apply to areas designated as parks, but also require maintenance on other publicly owned lands (like building lawns), along trails, or in medians. Either training existing staff or hiring new team members to align with these systems and champion stewardship across Camas's parks and open spaces can also help to take a more holistic approach to implementing best practices. These approaches may require short-term reorganization or training but result in more nuanced understanding of ecosystem needs and response to variable conditions.

Implement per-capita spending targets and tracking metrics to ensure adequate funding levels for maintaining high-quality parks and recreation amenities that meet the needs of the community in Camas. Camas's Parks, Recreation, and Open Space (PROS) Plan includes an assessment of a number of metrics related to performance measures like per-capita spending, per-acre spending, and acres per 1,000 residents that demonstrate both efficiency in parks spending and level of service. Tracking existing and new metrics alongside implementation of recommendations outlined in this section can provide a guide for the effectiveness of new measures, including the implications of indicators such as:

- **Per-Capita Spending.** In general, higher per-capita spending on parks often equates with more services offered proportionate to residents as Camas grows. Setting targets to increase per-capita spending can show progress towards providing more services. However, measures to improve efficiency can also reduce spending per capita while still offering high-quality parks and open space. Tracking of per-capita spending should consider where changes are occurring within the Parks budget. For example, if coordinated volunteer efforts are reducing the cost of maintenance activities, this reduction may lower per-capita spending but free up resources for other initiatives.
- **Acres per 1,000 Residents.** Compared with national averages for similarly-sized cities and comparisons with other Washington jurisdictions, Camas has a high level of service in parkland acres per 1,000 residents which contributes to its high quality of life. As Camas grows, it will be important to expand its parks and open space facilities in proportion with population (which is

anticipated by Clark County's estimates to continue increasing over the next twenty-year period).

- **Related Metrics.** In addition to direct parks metrics, working with other departments or agencies to track correlations with related indicators like public health can help to understand the impact of parks and open space. For example, a better understanding of the proportion of the population susceptible to obesity, developing diabetes, heat-related illnesses, or other chronic conditions, and the extent to which a robust park system can help reduce the population's risk to these conditions will improve the population's general well-being and lower health care and related costs.

See More: Trust for Public Land, National Recreation and Parks Association

Next Steps

These recommendations are intended to advance the community values around parks and open space in Camas identified as part of the POSMP. Specifically, these recommendations for improving operating practices both within the Camas Parks and Recreation Department and between partners focus primarily on the identified community value of **financial and resource allocation**. However, they also have overlapping benefits for other values of equitable access, asset protection, and public safety, preserving and enhancing natural features, and outreach and education. In particular, building stronger relationships with private landowners and individuals participating in stewardship programs can benefit quality of life and the environment consistently across Camas.

Many of these recommended actions will take time to implement. In the **short-term** over the next one to two years, the City will likely have the greatest ability to begin addressing actions that are internal to the Parks and Recreation Department as well as other City agencies. The recent PROS plan already provides a basis for tracking targets and tracking metrics which the City can continue to build on in-line with the recommendations in the POSMP. Sharing the management standards and best practices with the systems-based framework of the POSMP plan can also begin relatively quickly, though full adoption of this approach may take a longer time to become fully integrated. The City can also initiate conversations with other public agencies at the County and State level and HOAs, which will establish clear channels for ongoing relationships over the longer term.

Recommendations for increased staffing and reorganization of current staff to align with stewardship practices and goals of the POSMP will likely occur over the **medium to long term**. Resolving the City's current hiring freeze is a high priority towards realizing these goals and may present a challenge for progress on some actions in the short term. However, once staffing changes are made, the City will have more capacity to engage with stewardship programs and partnerships to maximize resources with volunteer activities over a longer timeline.

Cumulatively over the long term, investing in parks and open space brings a wide range of benefits and embodies community values in Camas. These actions will allow the City to implement more holistic and integrated management practices as part of the POSMP plan to sustain Camas's strong parks and recreation ecosystem.