City of Campbell River
Urban Forest Management Plan
2015 – 2035 FINAL DRAFT

December 4, 2015

City of Campbell River

DIAMOND HEAD CONSULTING LTD.

342 West 8th Avenue
Vancouver, BC
V5Y 3X2

SAFE CERTIFIED

Acknowledgements

The Plan benefited greatly from input by community stakeholders, the public and staff from the City of Campbell River. Specifically, the following individuals provided input, feedback and support for the plan and consultation process:

City of Campbell River Staff
Nina Baksh
Sara Brodie
Susan Bullock
Claire Cameron (co-op student)
Tom Clarke
Julie Douglas
Drew Hadfield
Jon Isfeld
Terri Martin
Ross Milnthorp
Ron Neufeld
Chris Osborne
Grant Parker
Jennifer Peters
Graham Stewart
Trina Soltys
Nathalie Viau
Kathleen Wilker
Amber Zirnhelt

City of Campbell River *Community Services Recreation & Culture Commission*

City of Campbell River *Advisory Planning & Environment Commission*

Greenways Lands Trust
Cynthia Bendickson
Chuck DeSorcy
Richard Hamilton
Erin Nowak

Urban Forest Management Plan Consulting Team
Diamond Head Consulting Ltd.
Amelia Needoba, PMP, ISA Cert. Arb
Trevor Cox, MCIP, ISA Cert. Arb
J. Brett Allen, RPBio, MCIP
Edward Porter, MCIP

This report draws heavily on extensive inventory work and analysis completed by the late Irv Penner, RPF, ISA Certified Arborist. Irv was a steadfast advocate for Campbell River's urban forest and he donated extensive volunteer time to Greenways Land Trust and a host of stewardship programs. His knowledge and passion are greatly missed.

Table of contents

1 Executive Summary

Urban Forest Vision

Campbell River's urban forest is healthy, diverse and connected to the native Coastal Western Hemlock rainforest that supports the city's prosperity and identity. Native wildlife is abundant and the extensive canopy and permeable landscapes help make Campbell River's air and water some of the cleanest in the world. The community manages the urban forest in partnership with the City to create beautiful and beneficial public and private landscapes and corridors.

Campbell River's Urban Forest Management Plan was developed in consultation with the community to co-create the vision and establish priorities for management. This community-supported vision for the urban forest will be achieved by implementing the plan over a 20 year timeframe.

Campbell River's urban forest is highly valued by residents for its environmental quality, its beauty and naturalness, and the social and recreational opportunities it provides. Habitat and stormwater mitigation services provided by the urban forest were particularly important to people. These values contribute significantly to the quality of life of Campbell River residents. Urban forests are increasingly being recognized for the important economic, social, and environmental benefits and ecosystem services they provide to people living in urban areas.

Campbell River's population is expected to increase by almost 6,000 people by 2041 as the City chooses to accommodate growth. The City's Sustainable Official Community Plan designates an 'Urban Containment Boundary' (UCB) with the role of focusing urban development and minimizing the expansion of infrastructure beyond that boundary. Campbell River's population, and future growth, is concentrated in the UCB and its boundary establishes the approximate edge of the 'urban' town and the beginning of rural areas. The UCB is an appropriate boundary within which to consider management of Campbell River's urban forest given that the approach and objectives for managing tree populations in urban areas differs markedly from forest management in the rural wild land.

Within the UCB, sixty-three percent (or 565 ha) of Campbell River's total urban forest canopy is located on land uses zoned as residential. Of that area, approximately 400 ha are held in undeveloped forested parcels. Most tree removals in Campbell River are associated with new residential development into these areas as the City grows within the UCB. This trend, coupled with projected environmental pressures, will mean that urban trees in streets and yards will have an increasingly valuable role to play in maintaining and improving quality of life for the people living in Campbell River. Native forested lands within and around the city will always

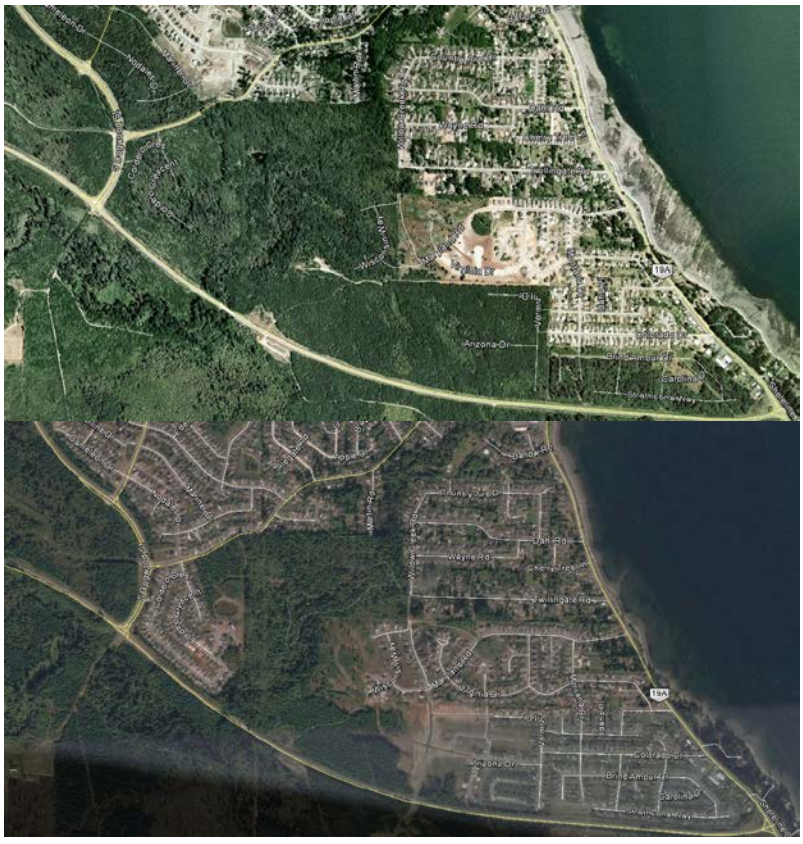
form an important part of the city's identity and character, but as private forested lands are developed, what remains within the urban area will primarily consist of forest protected in parks or environmentally sensitive area corridors. Trees planted in streets and yards will become a more visible feature of the city's treed character in urban areas.

The City of Campbell River and Greenways Lands Trust (GLT) formed a partnership to create Campbell River's Urban Forest Management Plan. Phase I involved completing an urban forest inventory. This full scope inventory captured the current level of canopy coverage and baseline data used to develop Phase II, the Urban Forest Management Plan. The partnership between the City and GLT is ongoing and will be an important link in implementing the plan and in building community ownership of the urban forest.

Key Challenges

The process followed to develop this plan highlighted several key challenges for Campbell River's urban forest:

Canopy decline: Campbell River's 33% urban forest canopy cover is declining. Without any change to current policy and practices, canopy could decline to approximately 20% by the time the Urban Containment Boundary is fully developed.



July 2005
Southern extent of Campbell River showing native forest boundary
(Source: Google Earth)

September 2014
Southern extent of Campbell River showing example of canopy decline as development has expanded into previously forest areas
(Source: Google Earth)

Urban trees in competition with other infrastructure and services: Tree assets are not currently integrated into planning for other infrastructure assets and services, which can cause conflicts resulting in damage either to trees or other infrastructure.

Changing climate and extreme weather events: Warmer and drier summers, wetter winters, and an increasing frequency of extreme weather events will present challenges for both the urban forest and the people of Campbell River.

Managing water: Under projected future scenarios, stormwater will be more abundant (over shorter time periods) and summer water supplies will be more limited.

Managing natural areas and biodiversity: Habitat fragmentation and windthrow at forest edges affect the integrity of natural areas and erode canopy cover.

Principles and Objectives

The guiding principles for developing objectives and actions to achieve Campbell River's urban forest vision are:

Maximize Urban Forest Benefits for Campbell River's Growing and Aging Population

Contribute to a Healthy and Creative Campbell River

Protect and Restore Campbell River's Ecological Health and Naturalness[1]

Protect and Enhance Campbell River's Urban Watersheds and Water Quality

Adapt Campbell River's Urban Forest to a Changing Climate

The nine key objectives are to:

A. Increase canopy cover within the Urban Containment Boundary to 40% by 2060
B. Protect existing canopy cover
C. Develop a tree care program
D. Improve urban forest diversity
E. Adapt the urban forest population to a changing climate
F. Manage the urban forest to reduce greenhouse gas emissions and improve air quality
G. Integrate the urban forest into watershed, stormwater and flood management
H. Strengthen the ecology and biodiversity of natural areas within the municipality
I. Engage and partner with the community to build ownership of the urban forest

[1] Ecological health and naturalness encompasses concepts of habitat, nature, biodiversity, plants and wildlife in ecosystems that are ecologically functional and perceived to be in a relatively 'natural' state.

Each objective is associated with a suite of actions for implementation. In total, 53 actions have been prioritized for implementation in the next five years. Summarized at a very high level, these priority actions relate to implementing:

- A planting program for public land and an incentive program for tree planting on private land.
- A new tree protection, removal and replacement approach for development.
- A tree care program.
- Updated policy and procedures relevant to the urban forest that strengthen City management of greenhouse gas emissions, stormwater and natural areas.
- An urban forest stewardship program that engages the Campbell River community in management of the urban forest resource and encourages private landowners to partner in achieving the community's urban forest vision.

If Campbell River's existing canopy cover is to be maintained for the continued benefit and enjoyment of citizens, then the actions in this plan will require implementation. Without action, canopy cover in the city will continue to decline.

The financial costs of implementation predominantly relate to planting and maintenance for an increased street tree program, and for the equivalent of one new full time staff position. In addition, there are workload implications for existing staff.

In return for this investment, it is expected that street trees will provide approximately $1.70 for every $1 invested in planting and maintenance over an average 70 year tree lifespan. This estimate only includes dollar benefits from stormwater, air quality and carbon dioxide services. It does not include the significant economic benefits of trees demonstrated in research, including real estate value increases, increased commercial spending, and the many intangible benefits related to the health and well-being of Campbell River residents.

2 Background & context

2.1 A brief history of Campbell River

The City of Campbell River is located in an area long known for its rich natural resources. First Nations lived in the region for thousands of years prior to the arrival of European settlers. Campbell River and its surrounding forests and coastline provided Coast Salish, and later Laichwiltach peoples, with an abundance of fish and other resources necessary for survival[2]. The salmon runs and large temperate rainforests also attracted Europeans to the region, with serious settlement beginning in the 1880s. Logging fueled much of the subsequent growth in the community, but it also led to creation of British Columbia's first provincial park (Strathcona) in 1911. The forests played an important economic role in the community throughout the 1900s, giving rise to the Elk Falls Pulp and Paper Mill in 1952, which became one of the region's biggest employers. The closure of this mill in 2010 heralded a new era in Campbell River; however, the community's strong relationship with the forests, fish, and wildlife continues.

2.2 What is the urban forest?

An urban forest includes all of the publicly and privately-owned trees and supporting vegetation in an urban area[i]. This includes individual trees and groups of trees located on streets, backyards, parks, natural areas, and industrial zones. Other elements such as plants, water, soil, micro-organisms, and wildlife are also part of this forest community. Each of these elements, in addition to people and the built environment, have an influence on the health of the urban forest.

One way to measure the extent of the urban forest is through quantifying the urban tree canopy; by envisioning the layer of leaves,

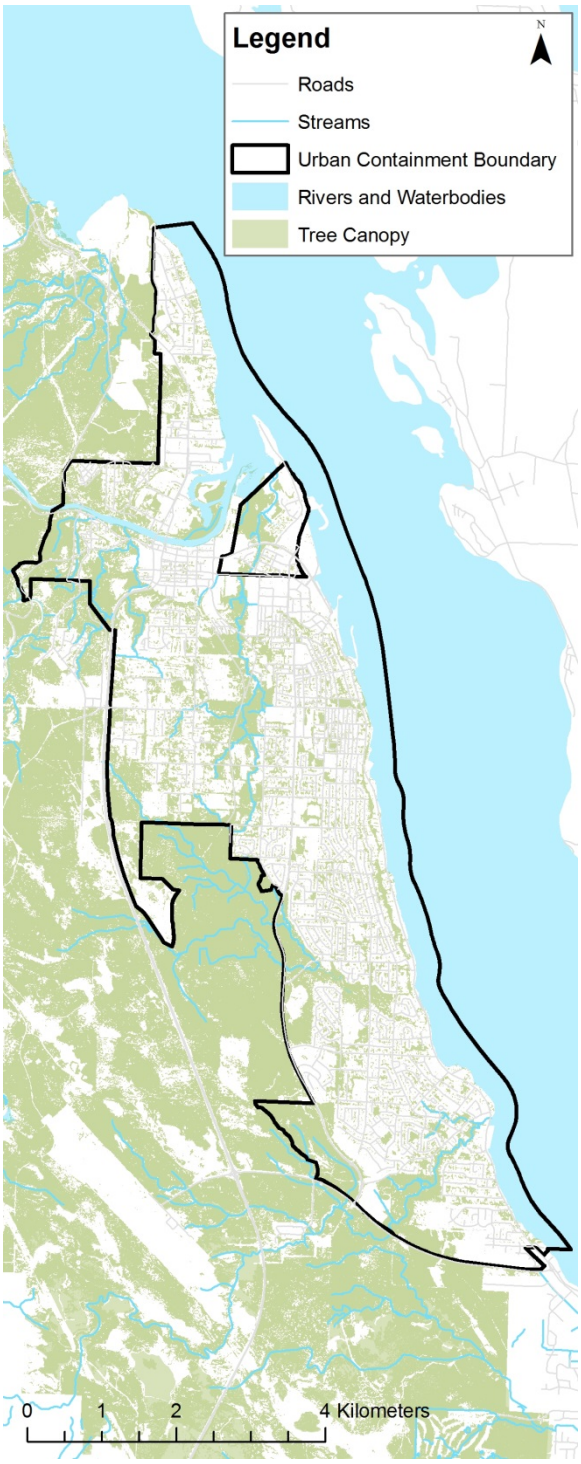


Figure 1. The City of Campbell River

[2] City of Campbell River. http://www.campbellriver.ca/discover-campbell-river/our-history-heritage/history-of-the-campbell-river-area

branches and tree stems when viewed from above. Canopy cover within the City of Campbell River was assessed using a program called i-Tree canopy that randomly locates sample points over aerial imagery. Within the Urban Containment Boundary (UCB) [3], the ratio of sample points that fell on tree canopy to those that did not was established to estimate canopy cover and yielded a result of 33% with an error of plus or minus 2%.

By definition, the urban forest occurs in areas with higher densities of people and more artificial surfaces (buildings, roads, etc.).[4] For the purposes of this plan, the area of focus is Campbell River's 2,968 ha UCB as shown in Figure 1 above. This is where the urban population is concentrated and where the majority of future development will occur over the 20 year timeframe of this plan.

Within Campbell River, several ecologically important natural areas anchor the city's urban forest resource. The Beaver Lodge Lands consist of more than 500 ha of Provincial Research Forest held in trust and protected under legislation. The Baikie Island Nature Reserve and Raven Park have restored a significant portion of the Campbell River Estuary and riparian forest. The Nunns Creek, Willow Creek and Simms Creek corridors protect substantial areas of tree canopy. Elk Falls Provincial Park is just outside the UCB but may eventually be at the urban interface if and when subdivision development extends to the UCB boundary. Greenways Lands Trust, BC Parks, the Nature Trust of BC and the Nature Conservancy of Canada are key land management partners of protected natural areas within the city boundary.

[3] An urban containment boundary sets aside land to be protected from most forms of development and is usually drawn where the edge of town meets the beginning of rural areas.
[4] http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf

2.3 What is an Urban Forest Management Plan?

Campbell River's Urban Forest Management Plan (UFMP) outlines the community-supported vision for the urban forest and provides objectives and actions to achieve that vision. The plan will be implemented over a 20 year timeframe (2015 - 2035) through prioritized actions that are based on consultation with municipal staff, inventory data and a review of policy and best management practices for urban forestry. In the first phase of work to develop this plan, Greenways Lands Trust partnered with the City to complete an urban forest inventory, which is reported in detail in the "Phase 1: Urban Forest Inventory" report[vi]. This full scope inventory captured the current level of canopy coverage and baseline data used to develop the UFMP.

The UFMP supports the vision and goals in the City's Official Community Plan (OCP) and its Integrated Community Sustainability Plan (ICSP), "Sustainable Campbell River".

Policy context

Several plans, policies and regulations are relevant to the management of Campbell River's trees and urban forest. The relationship between the Urban Forest Management Plan, provincial and other Campbell River policy documents and plans is illustrated in **Figure 2**.

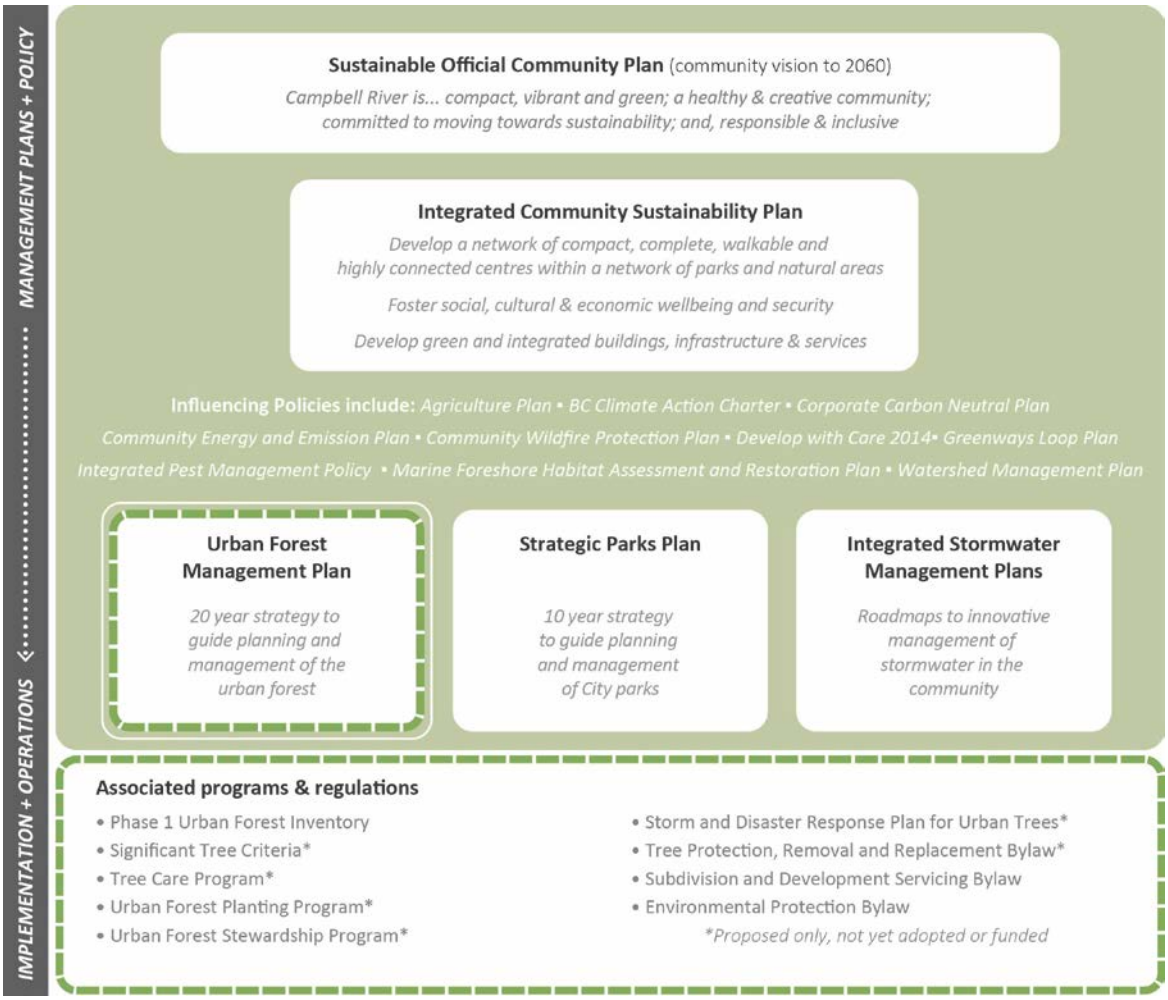


Figure 2. Diagram illustrating relationships between the Urban Forest Management Plan, provincial and Campbell River policy documents, plans and implementation deliverables.

2.4 Community context

This Urban Forest Management Plan was developed in consultation with the community to co-create the vision and establish priorities for management. Two open houses and an online survey were used as opportunities for engagement and involved approximately 200 members of the community. The figures below provide an overview of current community attitudes towards the urban forest and its management. A separate community consultation summary report (contained within the Technical Appendices) details other results of this process[ii].

Greenways Lands Trust was a central community partner in the initiation and development of Campbell River's Urban Forest Management Plan. This partnership is ongoing and will be an important link in implementing the plan and in building community ownership of the urban forest.

How do residents of Campbell River value the urban forest?

1. **Environmental quality** (the urban forest provides clean air, clean water, slope stability and other environmental benefits).
2. **Naturalness and biodiversity** (the urban forest provides habitat for plants and animals, and supports ecological processes).
3. **Social and recreation opportunities** (the urban forest provides places for recreation, for children and adults to be in nature and contributes to character and sense of place).
4. **Aesthetics** (the urban forest contributes to Campbell River's beauty and scenery).

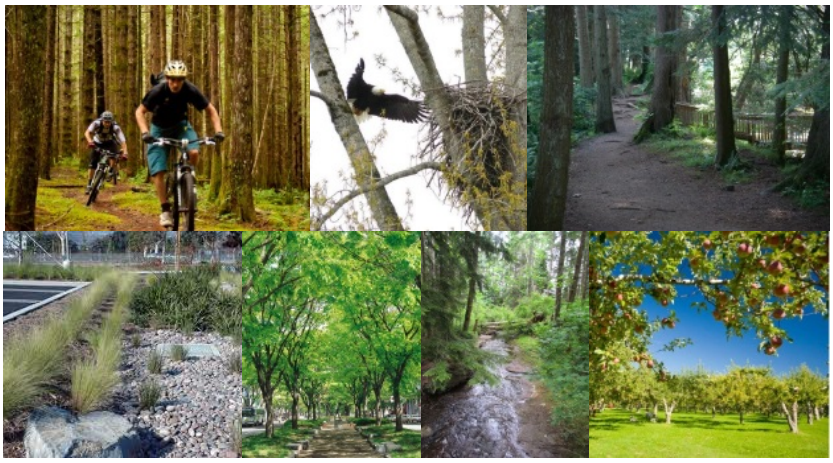


Figure 3. Images selected by attendees during an open house held on September 25 2014 as preferred representations of Campbell River's future urban forest

What priorities do Campbell River residents have for improving the urban forest?

1. **Tree protection** (retaining more tree canopy within new developments, connecting greenspaces and protecting significant trees).
2. **Maintenance** (better tree maintenance and related public space maintenance).
3. **Tree planting** (increasing the number and diversity of trees planted within the city).
4. **Education and engagement** (involving the public more in managing trees and educating people about the benefits of the urban forest and how to care for it).

Figure 4. Locations people identified as priorities for more tree planting.

A survey based on 131 responses yielded results with an accuracy of +/-9% at the 95% confidence level. Results indicated that residents generally agree or strongly agree that the City should:

- Require Development Permit applicants to cover the cost of tree planting to replace the canopy lost (86%).
- Require minimum canopy targets for new subdivision developments (86%).
- Set minimum soil volumes for trees on new developments sites (84%).
- Aim to increase canopy cover within the urban containment boundary (79%).
- Introduce regulations to protect trees on private land that are 'significant' based on defined criteria (76%).
- Aim to account for urban trees in carbon sequestration (72%).

There was uncertainty among residents regarding the introduction of a tree protection bylaw for private trees based on a minimum size. While residents tended towards agreement (62%), rather than disagreement, people will likely require more information before determining whether or not they would support a bylaw based on minimum size. However, there was majority support for regulating canopy loss in development areas and requiring minimum canopy cover targets for new developments. Survey results are provided in the Technical Appendix.

2.5 How do urban trees contribute to our quality of life?

Urban forests are increasingly being recognized for the important economic, social, and environmental benefits and ecosystem services[5] they provide. Urban forests support people's health and well-being[6].

Campbell River has a population of 31,186 people (2011 Census – BC Stats) and services a population of approximately 60,000 people across the region. The city's resident population is expected to increase by almost 6,000 people by 2041 as the City chooses to accommodate growth, with the majority of population increase occurring in the over 65 age group[iii]. These trends, and projected environmental changes and pressures, will mean trees will have an increasingly valuable role to play in maintaining and improving quality of life for the people living in Campbell River.

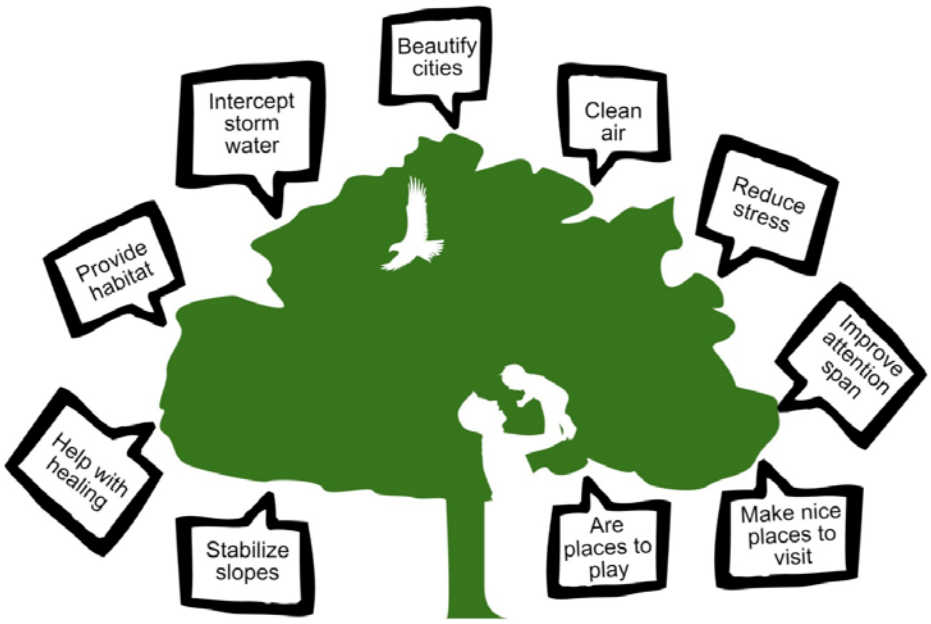


Figure 5. Trees provide a broad range of social, economic, environmental and cultural benefits to people living in cities (graphic made with Piktochart).

More than half of the world's population now lives in urban areas and population trends indicate that an additional 2 billion people will be added to the global population by 2050[iv]. The area of urban land worldwide is expected to triple between 2000 and 2030[v]. This rate of growth has major implications for global land use change, the ability of the Earth's ecosystems to support us, energy consumption and emissions, which highlights the importance of urban forests in providing good quality 'human habitat' and essential ecosystem services for people who live in cities. For small cities, the challenge will continue to be maintaining opportunities, services and quality of life that attract and retain local populations against the pull of economic opportunities and services in larger cities.

[5] Ecosystem Services: The benefits people obtain from ecosystems such as clean air and water, recreation and cultural benefits.

[6] The Green Cities: Good Health website collects and summarizes research about the benefits of nature in cities and towns - http://depts.washington.edu/hhwb/Top_Introduction.html

A recent analysis[vi] of the canopy cover within the Urban Containment Boundary found:

33% canopy cover

Up to 60% reduction in fine particulate matter by street trees

1.6 billion litres of stormwater runoff intercepted (4% of total rainfall)

10-15% residential heating savings from wind reduction
30% saved on air conditioning

2,940 tonnes of carbon sequestered annually and 100,000 tonnes stored

Street trees have a replacement value of $2,200,000 and return $4 for every $1 invested.

The importance of urban forests will only increase in the future. Climate change is predicted to result in a higher frequency of extreme weather events: heat waves, drought, flood, wildfire, and heavy rainfall events[vii]. These events are expected to place more pressure on public infrastructure and the healthcare system. Increasingly, research and case studies support that trees and green infrastructure[7] are cost effective ways to mitigate climate change impacts and build resilient cities[viii].

The July 2009 heat wave in the lower mainland is estimated to have contributed to an additional 122 deaths[ix] among vulnerable members of the population including children, seniors and people with chronic health conditions.

Trees provide shade and evapotranspirative cooling that gives people relief on hot summer days. Extreme heat events place stress on people living in cities and towns and, when occurring for extended periods, can result in heat related illness and even mortality.

An increase of 343 trees per square kilometre was associated with a 29% lower early childhood prevalence of asthma in New York City[x].

Trees clean the air by capturing particulates and through absorption[8] and adsorption[9] of other pollutants. Fine particulate matter (particles less than 2.5 micrometre diameter) is the primary air pollutant of concern in BC because of its highly toxic nature[xi]. Winter wood smoke and summer wildfire are the main source of fine particulate pollutants in Campbell River[xii]. In one year, a mature city tree can capture up to 1.4 kg of particulate matter[xiii].

[7] Green Infrastructure: A strategically planned and managed network of natural lands, working landscapes, and other open spaces that conserves ecosystem values and functions and provides associated benefits to human populations.
[8] Absorption: the transfer of a gaseous pollutant from the air into a contacting liquid, such as water.
[9] Adsorption: The gas molecules or particulates are absorbed—attracted to and held—on the surface of a solid.

Trees can reduce the urban heat island effect[10] (Figure 6). In summer the urban heat island effect can increase heat related illness and mortality, drive up energy demand, and increase air pollution and greenhouse gas emissions.

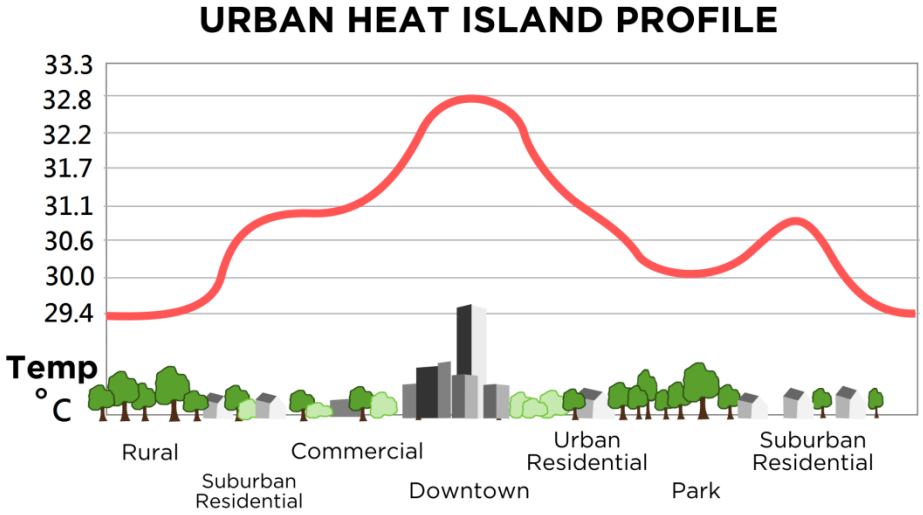


Figure 6. Representation of the urban heat island effect that results in built up areas being hotter than surrounding rural areas.

The World Health Organization reports that one in eight global deaths annually are caused by air pollution exposure confirming that air pollution is now the world's largest single environmental health risk[xiv].

On average, Campbell River receives close to 1400 mm of rain each year. Combined with sea level rise, high intensity rainfall events may increase the frequency of flooding in coastal communities[xv] and periodically overwhelm the capacity of drainage infrastructure. Because Campbell River's infrastructure does not treat stormwater, there is a risk that polluted water could be released into natural drainages. Trees intercept stormwater and reduce, slow and clean the volume of runoff that enters drainage infrastructure and natural waterways. Capturing rainfall in permeable surfaces rather than pipes also recharges ground water, maintains stream flows and increases soil moisture thus delaying the summer drought period and benefitting vegetation health.

[10] Urban Heat Island Effect: describes built up areas that are hotter than nearby rural areas. As urban areas develop, vegetation and permeable surfaces are replaced with buildings and hardscape. These surfaces heat up during the day and gradually release heat throughout the night.

2.6 How is Campbell River doing with urban forest management?

Nine key strategic needs emerged during plan development[xvi] and these form the objectives driving the future implementation of this plan. These same objectives have been used to assess the baseline state of Campbell River's urban forest performance. Each objective has supporting performance indicators with defined low to optimal states (for definitions, see Section 3.3).

Assessment Criteria	Low	Moderate	Good	Optimal
A. INCREASING CANOPY COVER				
Relative canopy cover performance	○	○	●	○
Tree establishment planning and implementation	●	○	○	○
Tree standards for development and streetscape outcomes	○	●	○	○
Planting the largest tree suitable for the site	○	●	○	○
B. PROTECTING CANOPY COVER				
Tree protection policy development and enforcement	●	○	○	○
Canopy cover inventory	○	○	○	●
Public agency (internal & external) cooperation	○	●	○	○
Recognition of green infrastructure asset value	○	●	○	○
C. DEVELOPING TREE CARE PROGRAM				
Tree inventory	○	●	○	○
GIS asset management system integration	○	●	○	○
Tree risk management	●	○	○	○
Maintenance of publicly-owned trees	●	○	○	○
D. IMPROVING URBAN FOREST DIVERSITY				
Species distribution	●	○	○	○
Useful life expectancy distribution	○	○	●	○
Native vegetation	●	○	○	○
E. ADAPTING URBAN FOREST TO CHANGING CLIMATE				
Species suitability	○	○	●	○
Storm response	●	○	○	○
Pest and Disease Management	○	●	○	○
F. MANAGING URBAN FOREST TO REDUCE GHG EMISSIONS AND IMPROVE AIR QUALITY				
Building energy efficiency and air quality improvement	●	○	○	○
Waste biomass utilization	●	○	○	○
Corporate emissions and carbon neutrality	●	○	○	○
G. MANAGING URBAN FOREST FOR WATERSHED, STORMWATER AND FLOOD MANAGEMENT				
Permeability of surfaces for water infiltration	○	●	○	○
Passive and active water capture for vegetation	●	○	○	○
Green infrastructure for stormwater management	●	○	○	○
H. MANAGING URBAN FOREST TO STRENGTHEN ECOLOGY AND BIODIVERSITY OF NATURAL AREAS				
Publicly-owned natural areas planning	○	●	○	○
Publicly owned natural areas inventory	●	○	○	○
Invasive species	○	○	●	○
I. BUILDING COMMUNITY OWNERSHIP IN THE URBAN FOREST				
Community action	○	○	●	○
Involvement of large private land and institutional land holders	●	○	○	○
Development community cooperation	●	○	○	○
Municipality-business interaction	●	○	○	○
General awareness of trees as a community resource	○	●	○	○

3 Issues & opportunities for urban forest management

3.1 Canopy decline

Canopy cover was measured at 33% using 2012 aerial imagery. Canopy cover in Campbell River's UCB has been declining over time due, in large part, to clearing of existing forest for development. Satellite imagery between 2000 and 2012 demonstrates that substantial canopy loss has occurred in Campbell River's urban area without any substantial canopy gain (Figure 7). Canopy decline is a common trend for cities in BC and farther afield as cities grow and densify replacing vegetation and permeable surface with buildings, pavement and other infrastructure. Determining how and where to protect and replace tree canopy as the city develops is a key issue for Campbell River. Establishing a canopy cover target, and putting in place programs and policy to support tree planting and protection, are central to this plan's approach to reversing canopy decline.

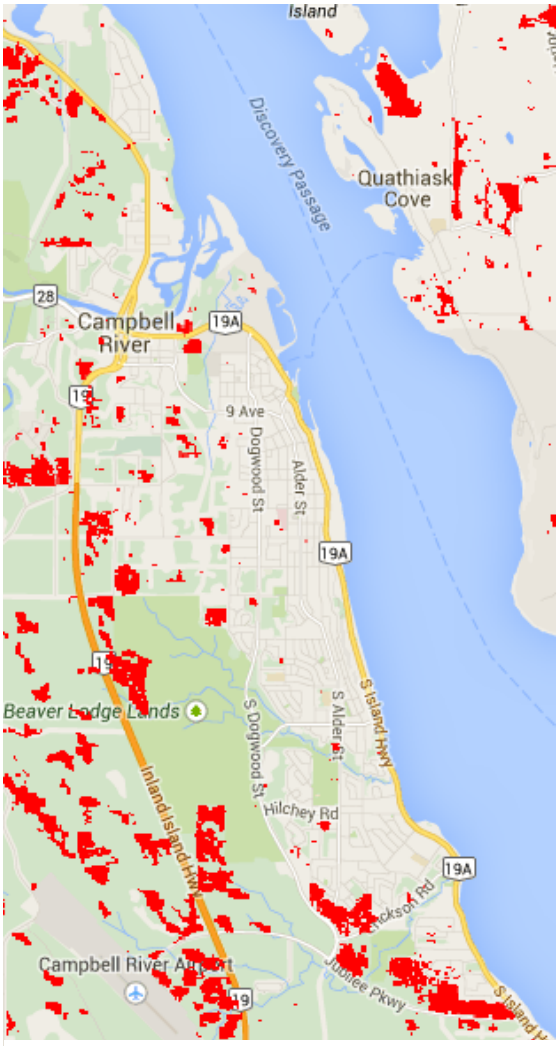


Figure 7. Campbell River canopy loss between 2000 and 2012 Source: Hansen/UMD/Google/USGS/NASA

Current practices permit developers to clear almost all existing canopy (Figure 8), except where protected such as when adjacent to watercourses and bald eagle nests, and require the replacement of only one tree per lot. Unless City policy and urban forest management practices are changed to regulate canopy protection and replacement, the city's canopy cover is projected to drop to approximately 20% (Figure 9) based on the area of forested land estimated to be available for development.

Figure 8. Current development practices in Campbell River, as shown in these two subdivisions, tend to result in the majority of canopy cover being removed before construction.

Just under half of the 33% canopy cover remaining within the UCB is available for development or conversion to agricultural land[11]. Several parcels zoned as rural are located in the Quinsam Road area and in North Campbell River. In natural area parks outside the UCB, the canopy cover sits at 69%[vi] (Figure 9). If the canopy cover of these natural area parks is indicative of what Campbell River's forest canopy cover would have supported prior to the 1880s when European settlement began, then canopy has declined by more than half within the UCB.

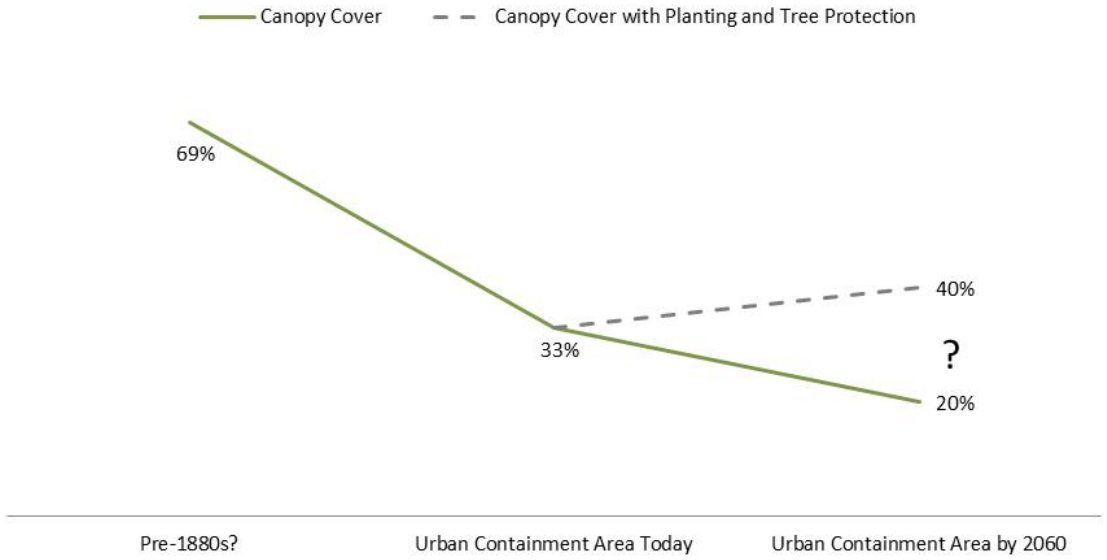


Figure 9. Percent canopy cover and trees per hectare shown for Natural Area Parks (NGO managed), the UCB today and potential future scenarios for canopy cover in the UCB.

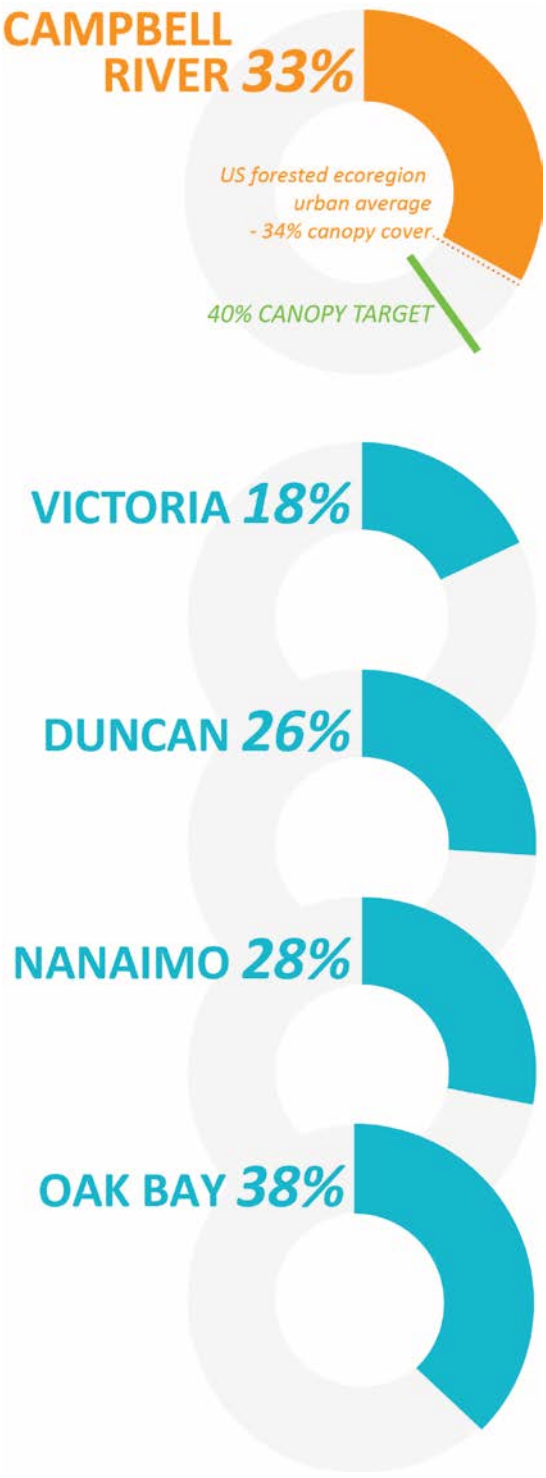
Setting a Canopy Cover Target

Based on a nation-wide study from the United States, canopy cover variation within urban areas[12] is primarily explained by ecoregion type (i.e., forested, grassland, desert), population density and land use[xvii]. Across all urban areas in the US, canopy cover averages 27%, and within forested ecoregions, canopy cover averages 34%[xvii]. In addition to ecoregion, population density influences canopy cover with percentage tree cover decreasing with increasing population density. Land use is the third driver in forested ecoregions, with canopy cover increasing as the amount of 'vacant' undeveloped land within a city area increases. Campbell River, having 33% canopy cover, sits just below the 34% canopy average for urban areas within forested ecoregions of the US. However, it is important to note that the US average incorporates major urban centres with much higher population density than Campbell River.

[11] 424 ha within residential, commercial & industrial, and rural zoned land are assumed to be available for development (once an indicative 10 m stream buffer and 5% parkland dedication are excluded). If completely cleared, that area would result in an approximate canopy loss of 14%.

[12] Urban areas were defined as populations of > 50,000 with at least 384 people per square km and/or places that contain some urbanized areas within their place boundaries, and/or urban places with at least 2,500 people and located outside urbanized areas.

Campbell River is located within the Very Dry Maritime Coastal Western Hemlock (CWH xm) where Douglas-fir is the dominant tree species and natural forest canopy cover is generally high. Pre-development canopy cover is not precisely known but is expected to be in the realm of the 69% canopy cover found in conservation areas[vi]. In terms of population density, approximately 946 people per km^2 reside within the UCB (based on 90% of the population residing inside that boundary). The City's 'vacant' undeveloped land area accounts for approximately half of the City's total canopy area presently. While a precise canopy benchmarking metric has not been established for this region, Campbell River's underlying ecology, population density and current land use distribution indicates that canopy cover greater than the current 33% should be supported. Oak Bay, located in the drier Coastal Douglas-fir Zone, with a population density of 1,170 people per km^2, and with very little undeveloped land area supports a canopy cover of 38%.



Campbell River can retain and plant more trees while still supporting development and building high quality neighbourhoods. An analysis of plantable locations within Campbell River found an estimated 14,000 potential planting locations in streets and 12.7 ha of potential plantable space in parks. An aspirational canopy cover goal was set at 40%, which was the preferred target from community engagement. This goal, while aspirational, may eventually be achievable in Campbell River through new tree planting, tree protection where feasible, and by creating space for large canopy trees as the city develops; however, the extent of future development anticipated within the UCB means that the measures implemented in this plan will, at a minimum, maintain tree canopy at 33% and, at best, increase the tree canopy towards the aspirational goal of 40% by 2060.

Residential areas and road corridors provide the best opportunity for increasing the urban forest canopy. Commercial areas can also support greater tree canopy in parking lots by integrating landscaping beds and expanding below ground soil volume to support large canopy trees (Figure 10).

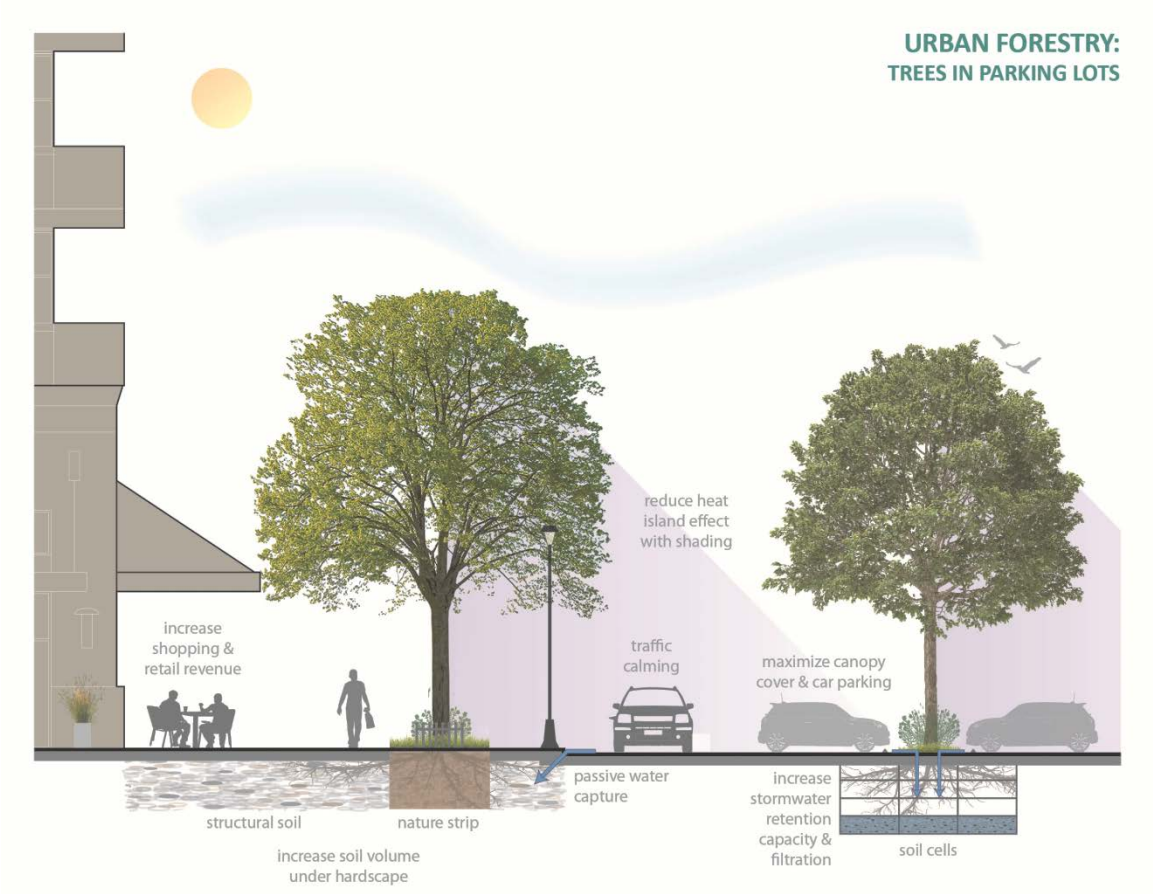


Figure 10. Providing opportunities to maximize canopy in commercial areas.

3.2 Urban trees in competition with other infrastructure and services

Trees in urban environments compete for space and funding with a variety of infrastructure and services. When poorly planned, tree planting and/or maintenance can result in mature trees in conflict with other infrastructure assets and services. Similarly, other infrastructure and services can conflict with trees if they are not considered in planning and appropriate tree protection is not in place. Collaboration in planning and design are essential to having an urban forest that maximizes benefits to the community and functions in harmony with other infrastructure and services (Figure 11). Several tree management issues relevant to Campbell River are described below.

Below ground infrastructure: Trees need adequate soil volume to ensure they grow, stay healthy, and have a long lifespan. Some areas of the city (e.g. downtown), have limited soil available for trees. Conflict with below ground infrastructure (e.g. pipes) can occur when trees are planted in shared space. For example, the roots of London planes on Shoppers Row have grown into leaking pipes causing blockages.

By designing with adequate soil volume and passive water infiltration to support the growth of a large canopy tree, future conflicts can be minimized while still providing an attractive retail environment. Some strategies for minimizing tree root and below ground infrastructure conflicts are presented in the "Technical Appendices to the Urban Forest Management Plan", hereafter referred to as the Technical Appendix.

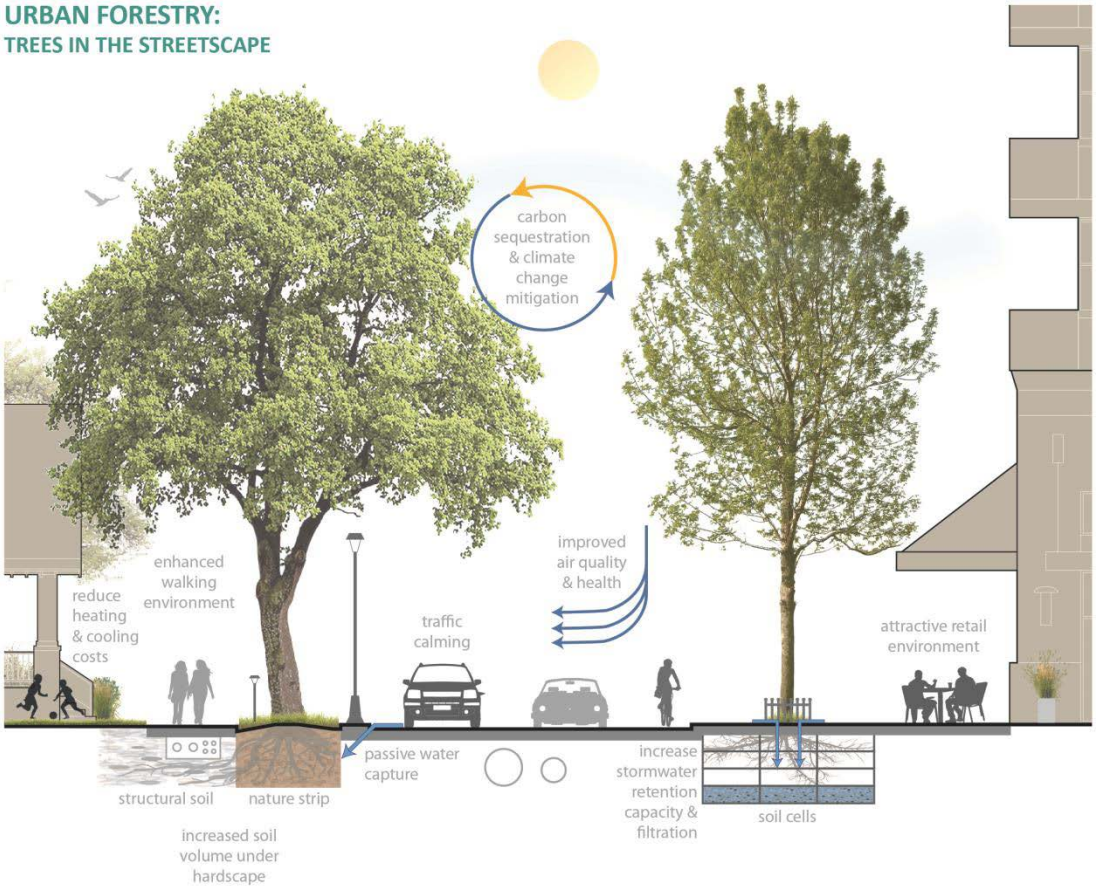


Figure 11. Providing opportunities to increase soil volume and minimize conflicts with infrastructure.

Figure 12. The public street component of the Seymour Pacific development on St. Ann's Street included the installation of structural soils beneath the sidewalk to increase the volume of soil available for the Scarlet Oaks planted in the roadside.

Utility clearance and brushing: Brushing and mowing, and utility clearance are common maintenance activities along roadsides in Campbell River. Public trees are sometimes damaged during these activities, which can result in injuries that reduce the amenity value of trees and often reduce their longevity.

Improving communication and applying best practices in pruning can prevent damage while ensuring that utilities and roads are safely maintained. Planting planning can incorporate guidance on tree selection and placement to minimize tree growth into the limits of approach for power lines or other utility clearance limits.

Public tree (street trees and park trees) care and maintenance: Public trees in Campbell River are currently maintained reactively with the exception of the London plane trees on Shoppers Row, which are pollarded periodically. While the number of public trees that require more intensive management (e.g. regular pruning) is relatively low, the current budget is not sufficient to ensure a healthy, beneficial and aesthetically pleasing tree population in the long term.

Increasing the budget allocated to public tree care and maintenance will support maintaining Campbell River's urban forest to industry standards.

The presence of larger trees in yards and as street trees can add from 3% to 15% to home values throughout neighbourhoods[x].

View management: Many buildings within Campbell River have water views; trees can be obstructions in these viewscapes. The pursuit of unobstructed views sometimes results in poor pruning outcomes, tree removal, vandalism or neighbour disputes.

Municipalities are trustees of the environment for the benefit of the citizens of the community at large and therefore have a responsibility to make policy and decisions for the benefit of the whole community, not just in the interests of individual property owners.

Urban forest management in Campbell River will require a balanced approach that protects and enhances the benefits of trees while reasonably managing property owner expectations about access to views. Some strategies for managing trees in viewscapes are presented in the Technical Appendix.

While development costs can be greater for lots where trees were conserved (5.5% in one study), builders can recover extra costs of preserving homes through higher sales prices and faster sales for houses on wooded lots[x].

Construction and development: When undertaking construction for development or renewal projects trees can easily be damaged or killed unless proper tree protection management is in place.

Protection is required both for the above ground portions of the tree and the roots below ground. Protecting existing trees is worth the investment. A single large tree in the right place delivers up to sixteen times the benefits of a small tree across a range of benefits including air quality improvement, stormwater interception, carbon sequestration and energy savings. Medium to large street trees need to remain in the landscape for at least 40 - 50 years to begin to make returns on investment. Retaining existing large trees in the landscape is often better than trying to re-establish canopy because the existing tree is already providing benefits and the costs associated with establishing that large stature tree have already been expended.

The Large Tree Argument

When it comes to trees, size does matter. Large-stature trees are worth the price to plant and care for. Research from the USDA published in 2003[xviii] assessed the average benefits for small, medium and large trees (see the table below). *On average, a large tree provides 16 times more value to the community over its lifetime than a small tree.*

	Small Tree (< 8 m tall)	Medium Tree (9-11 m tall)	Large Tree (>12 m tall)
Total benefits/year	$23	$33	$55
Total costs/year	$14	$17	$18
Net benefits/year	$9	$16	$37
Life expectancy	30 years	60 years	120 years
Lifetime benefits	$690	$1,980	$6,600
Lifetime costs	$420	$1,020	$2,160
Value to community	$270	$960	$4,440

This research factored in the costs of planting, maintenance, street sweeping, sidewalk repair and legal liability. Planting the right tree in the right place, and creating good planting sites prevents infrastructure conflict. Strategies to minimize potential conflicts between tree roots and infrastructure are discussed in the Technical Appendix.

Based on research into the minimum soil volume needed to grow healthy trees, the following guidelines are provided:

- 0.3-1 m^3 of soil per 1 square metre of canopy projection
- 28-60 m^3 of soil for a large tree

For Campbell River, it is recommended that a minimum soil volume requirement of 30 m^3 for medium to large trees be adopted with a target of providing 0.3-1 m^3 of soil per square metre of expected canopy projection.

3.3 Changing climate and extreme weather events

Climate change is expected to result in warmer, drier summers and wetter winters for the Strathcona Region (Table 1).

Climate Variable	Season	Projected Change from 1961-1990 Baseline	
		Ensemble Median	Range (10th to 90th percentile)
Mean Temperature (°C)	Annual	+2.5 °C	+1.3 °C to +3.7 °C
Precipitation (%)	Annual	+8%	+1% to +16%
	Summer	-12%	-32% to -0%
	Winter	+12%	+1% to +22%
Snowfall* (%)	Winter	-33%	-59% to -13%
	Spring	-72%	-86% to -14%

Table 1. Summary of Climate Change for Strathcona in the 2080s (source: http://www.pacificclimate.org/analysis-tools/plan2adapt)

The Pacific Institute for Climate Solutions Climate Insights 101[13] case study on the Campbell River Basin outlines how future precipitation will fall predominantly as rainfall, resulting in higher winter stream flows and leaving little snowmelt for summer, resulting in lower summer stream flow. These changes have implications for community water supplies, stormwater infrastructure, salmon spawning and hydroelectric power generation periods.

In addition, extreme weather events are expected to increase in frequency as the climate continues to change[xix]. Sea level rise coupled with more frequent high intensity rainfall events will increase the risk of flooding. Below are several recent examples of the type of weather events in Campbell River that are considered 'extreme':

- Campbell River implemented Stage 3 water restrictions in 2009 and then again in 2014 due to drought.
- Campbell River experienced heat waves in 2009 and 2014, and hotter drier summers are possibly contributing towards Sitka Spruce die-off along portions of the waterfront.
- In 2010 successive winter storms resulted in extreme inflows into the John Hart dam, which risked causing flooding in Campbell River.
- In 2012, a Pacific storm and low pressure system impacted Campbell River bringing damaging 134 km per hour winds.

Modeling for Metro Vancouver indicates that rainfall events that previously occurred every 25 years would instead occur every four years by 2050, and one in 25 year hot day events would instead occur every eight years.

[13] http://pics.uvic.ca/education/climate-insights-101

Careful planning, good management and species selection, will produce healthy tree assets that are more robust to the impacts of climate change. The urban forest (and green infrastructure) offers opportunities to benefit people by mitigating high rainfall and flood impacts, and by providing shade and cooling.

3.4 Managing water

Under projected future scenarios, stormwater will be more abundant (over shorter time periods) and water supplies will be more limited in summer.

Interception and Infiltration of Stormwater

Stormwater in Campbell River is currently managed through 165 km of pipes and 80 km of ditches that divert water directly into creeks, Campbell River or Discovery Passage. Trees and associated vegetation and soil play an important role in intercepting, retaining and slowing precipitation. Trees reduce the rate of flows, volume of stormwater runoff, flooding damage, stormwater treatment costs and problems associated with water quality[xx]. Numerous studies support the finding that urban vegetation can reduce the cost of building and maintaining drainage infrastructure by reducing the size and density of drains needed in cities[xxi].

In a natural forest, rainwater is intercepted by the canopy, then runs down the branches and stem onto the forest floor where it infiltrates into the ground. Surface runoff usually represents 10% or less of the rainfall volume[xxii]. When land is developed, the extent of impermeable surfaces is increased (i.e., roofs, streets, sidewalks, parking lots and other hard surfaces). Runoff volume increases in direct proportion to impervious area. A healthy watershed in Campbell River would be characterized by a high percentage of forest area (usually >65%) and a low percentage of impervious area (usually <15%). When these thresholds are exceeded, stream health deteriorates[xxii].

Stormwater Utility Fees

Cities in Canada and abroad are beginning to use stormwater utility fees and credit programs as a means of incenting property owners to manage their rainwater on site. The Minnesota Pollution Control Agency's (USA) Minimum Impact Design Standards (MIDS) provide credit calculations[14] for tree trenches and tree boxes. Volume credits are given for rainwater infiltration into the soil, interception from the tree canopy and water taken up and evapotranspired by trees. A tool with similar potential in BC is the BC Water Balance Model (www.waterbalance.ca).

Reducing, slowing and cleaning stormwater discharges generally improves both ecological and economic outcomes when compared to using only catch basins and pipes for controlling and managing the discharges. The urban forest canopy can be part of an integrated stormwater solution that utilizes both traditional and green drainage infrastructure. Best practices site based stormwater management[xxiii] reduces the volume of runoff by minimizing impervious area, increasing infiltration to ground and encouraging evapotranspiration via vegetation and/or long-term storage.

[14] http://stormwater.pca.state.mn.us/index.php/Calculating_credits_for_tree_trenches_and_tree_boxes

Water for maintaining urban landscapes

Water is an essential requirement for vegetation growth and maintaining vegetation health. For long lived vegetation, such as trees, long-term water shortages can reduce health and life expectancy.

Supplemental watering may be required to maintain vegetation health and the life of tree assets during extended drought. In order to maintain adequate water supplies for drinking and other essential uses, alternative water sources can be used for watering vegetation. Stormwater runoff is a resource that can be collected, cleaned and stored for later use.

Stormwater can be captured 'passively' by diverting stormwater to landscapes and increasing the permeability of surfaces, allowing the water to infiltrate into the ground (Figure 13). The soil acts as a reservoir and increasing permeability recharges soil moisture and groundwater, which is then available for vegetation. Passive stormwater interventions include curb cuts that divert water into curb bulges or tree pits, permeable pavement, raingardens and numerous other design options.

Figure 13. Raingarden capturing stormwater and allowing infiltration into the soil.

The soil reservoir is depleted in times of extended drought, at which point supplemental irrigation may be needed to maintain healthy vegetation. Stormwater can be 'actively' captured and stored for later use. Water storage can be small or large scale, with the most common example being residential rain water tanks. Large scale systems can be networked from roofs, or collecting and cleaning water from hard surfaces at a catchment level and storing in large tanks, ponds or wetland systems. This water is then available for landscape irrigation during periods of low rainfall, and water levels can be managed to provide storage capacity during high rainfall events to mitigate flood risk.

3.5 Managing natural areas and biodiversity

Campbell River's naturalness and biodiversity are valued by residents and visitors alike. Recognizing the importance of its forests, streams, and other natural areas, the City established a process to help protect them for future generations. Significant natural areas and features are protected through Development Permit Area designation of Environmentally Sensitive Areas (ESAs) (Figure 14). Growth of the existing parks network occurs through parkland dedication process associated with new development.

Urban development, including buildings, roads, and other infrastructure, results in disturbance to and fragmentation of natural areas. This can have significant implications for biodiversity; many species of wildlife require large, contiguous areas to meet their life needs. While some of Campbell River's remaining natural areas are designated as ESAs, parks and micro-habitats and features (i.e., trees and gardens); they are generally disconnected from one another. Improving landscape connectivity can slow biodiversity loss by allowing wildlife to access more habitats.

Figure 14. Stream and riparian vegetation in an Environmentally Sensitive Area (ESA).

Forest clearing also creates edges that can influence biodiversity. Wildlife that requires larger areas of undisturbed habitat is often excluded from these environments. In addition, edge habitats often expose trees to wind forces that they are not adapted to. Blowdown resulting from exposure to high winds can affect the integrity of protected natural areas, particularly riparian corridors that have minimal setbacks.

The integrity of ESAs can be enhanced by requiring assessment of these edges for wind firmness and designing to minimize the risk of blowdown, rather than clearing trees to maintain a minimum buffer width.

Physical features in urban green spaces influence social contact among neighbours, and nature plays an important role in creating vital neighborhood spaces[x].

4 Vision, principles & objectives

4.1 Vision & principles

Campbell River's urban forest is healthy, diverse and connected to the native Coastal Western Hemlock rainforest that supports the town's prosperity and identity. Native wildlife is abundant and the extensive canopy and permeable landscapes help make Campbell River's air and water some of the cleanest in the world. The community manages the urban forest in partnership with the City to create beautiful and beneficial public and private landscapes and corridors.

Guiding principles of this Plan are:

- *Maximize Urban Forest Benefits for Campbell River's Growing and Aging Population*
- *Contribute to a Healthy and Creative Campbell River*
- *Protect and Restore Campbell River's Ecological Health and Naturalness*
- *Protect and Enhance Campbell River's Urban Watersheds and Water Quality*
- *Adapt Campbell River's Urban Forest to a Changing Climate*

4.2 Priorities

Priorities for urban forest management in Campbell River were established based on public consultation outcomes (see the Technical Appendix) and the background review[ii]. These priorities focus on tree protection, maintenance, tree planting, and education and engagement to maintain and enhance urban forest values related to environmental quality, naturalness and biodiversity, social and recreation opportunities and aesthetics.

The following objectives have been defined to address these priorities:

A. Increase canopy cover to within the Urban Containment Boundary to 40% by 2060
B. Protect existing canopy cover
C. Develop a tree care program
D. Improve urban forest diversity
E. Adapt the urban forest population to a changing climate
F. Manage the urban forest to reduce greenhouse gas emissions and improve air quality
G. Integrate the urban forest into watershed, stormwater and flood management.
H. Strengthen the ecology and biodiversity of natural areas within the municipality.

I. Engage and partner with the community to build ownership of the urban forest.

4.3 Objectives and targets

Objective: **A.** Increase canopy cover within the Urban Containment Boundary to 40% by 2060

Target: **Increase canopy cover within the Urban Containment Area to 40% by 2060.**

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Relative canopy cover performance	Existing canopy cover equals 0%-50% of the target.	Existing canopy cover equals 51%-70% of the target.	**Existing canopy cover equals 71%-90% of the target.**	Existing canopy cover equals 91%-100% of the target (if no net canopy loss is target chosen)
Tree establishment planning and implementation	**Tree establishment is ad hoc.**	Tree establishment occurs on an annual basis.	Tree establishment is directed by needs derived from a tree inventory and opportunities assessment.	Tree establishment is directed by needs derived from a tree inventory and opportunities assessment and is sufficient to meet canopy cover objectives.
Tree standards for development and streetscape outcomes	No tree related guidelines, specifications and standards.	**Guidelines, specifications and standards not adequate to meet canopy cover goals or exist but are not adhered to.**	Guidelines, specifications and standards adequate to meet canopy cover goals and often adhered to in plans and projects.	Guidelines, specifications and standards adequate to meet canopy cover goals and always adhered to for plans and projects.
Planting the largest tree suitable for the site	Trees planted without consideration of the site conditions.	**Tree species are considered in planting site selection.**	Community-wide guidelines are in place for the improvement of planting sites and the selection of suitable species.	The largest trees suitable for the sites are planted. All trees planted in sites with adequate soil quality and quantity, and growing space to achieve their genetic potential.

Actions in years 1-5:

Action 1. By land use category, work towards implementing the benchmark canopy targets defined below through a planting program (see the preliminary program outline in the Technical Appendix). The program will deliver 550 trees per year for 20 years on public land and 200 trees per year on private land to achieve 40% canopy cover by 2060. Tree planting selection and design will address functional needs, neighbourhood character and FireSmart.

Land Use Categories	Area Ha (water excluded)	Current Canopy	Canopy Target by Land Use	Approximate Change in Total City Canopy:	Approximate Number of New or Replacement Trees Needed (medium tree with avg. canopy of 126 m2):
Residential	1712	33%	**40%**	~ 4 %	9,500
Road	495	12%	**40%**	~ 5 %	11,000
Commercial & Industrial	269	17%	**20%**	< 1 %	700
Park & Open Space	243	57%	**60%**	< 1 %	600
Institutional	154	34%	**40%**	< 1 %	700
Rural	95	40%	*	-	-
Total City Canopy (when added to existing 33%)				**~ 40 %[+]**	**22,500**

*Canopy target not proposed within the Agricultural Land Reserve.

[+] Does not account for canopy loss due to mortality or removals, or gain due to growth of existing trees.

Action 2. For new subdivisions, the City should require developers to plant street trees (see Technical Appendix for suggested standards) and hold security against their survival for two-years following planting. Planting should be required prior to the issuance of any building permits, and prior to the return of any security deposits for works and services.

Action 3. The existing security amount of $265 per tree should be increased to $350 per tree in order to cover a second year of young tree maintenance and better reflect the average cost of tree planting.

Action 4. Consider requiring conceptual landscape plans to include soil preservation plans that detail where native soil will be retained, where topsoil and subsoil will be amended in place (and protected from heavy machine traffic), where topsoil will be stripped and stockpiled prior to grading for reapplications, where imported topsoil will be applied. Plans should be reviewed to ensure that resulting soil conditions will support tree growth where planting is indicated.

Action 5. Follow best management practices for tree planting based on International Society of Arboriculture's (ISA's) Best Management Practices Series – Tree Planting.

Action 6. Develop and implement a 'Neighbourwoods' program to subsidize appropriate trees for residents to plant in private property funded through an urban forest parcel tax.

Action 7. Consider amending the Subdivision and Development Servicing Bylaw No. 3419, 2010 as per the recommendation in the Technical Appendix and allocate enforcement resources to ensure that requirements are met.

Action 8. Work with departments across the City to create opportunities to establish more trees in the urban environment and improve plantable space. Specifically:

- Identify an internal champion at the management level to lead implementation of the urban forest management plan across the City.
- As infrastructure renewal occurs on public property, work with departments throughout the City to create opportunities for new or improved plantable space to improve canopy cover outcomes and tree health.

- As the 'Recreational Greenways' system and sidewalk/cycle routes are developed, incorporate tree planting and tree protection into design to maximize pedestrian and cyclist comfort through the provision of shade, protection and aesthetic quality.
- Review the Subdivision and Servicing Bylaw and Development Guidelines to identify and address potential conflicts between canopy cover and: weather protection in commercial areas; view management; signage; lighting; pedestrian zones, and; solar access.
- Incorporate guidance for treed buffers between agriculturally zoned land and adjoining land uses into Agriculture Guidelines as they are developed.
- Incorporate trees, and their contribution to neighbourhood character, health and well-being, and environmental quality (i.e., clean air and water, stormwater), into high performance design standards as they are updated.
- Integrate trees and green infrastructure when designing programs, facilities and infrastructure for their contributions to social well-being.

Actions in years 6 – 20 or earlier if opportunities arise:

Action 9. Establish appropriate canopy targets for each park type to inform tree planning and planting in existing parks and parks not yet acquired.

Action 10. Identify and prioritize public realm opportunities to build new or retrofit green infrastructure to increase permeability and plantable space, manage and harvest stormwater (e.g., building planting medians into existing roads, alternative tree planting systems, daylighting culverts etc.) funded through grants or a 'green fund'.

Action 11. On public lands, consider permitting planting of food (fruit and nut) trees in appropriate locations on a request basis, and require residents/stewardship groups take on maintenance responsibilities. The risk of human-wildlife conflicts, and how risk will be managed, should be considered when developing approval criteria.

Action 12. Advocate use of phytoremediation[15] or revegetation to restore brownfields, enhance biodiversity and improve aesthetic outcomes.

[15] Phytoremediation: the direct use of green plants and their associated microorganisms to stabilize or reduce contamination in soils, sludges, sediments, surface water, or ground water.

Objective **B.** Protect existing canopy cover

Target: **A tree protection and replacement bylaw is in place to protect trees on public and private land, including heritage/significant trees.**

Performance Indicators (2015 status highlighted in bold):

	LOW	MODERATE	GOOD	OPTIMAL
Tree protection policy development and enforcement	**No or very limited tree protection policy.**	Policies in place to protect public and private trees without enforcement.	Policies in place to protect public and private trees with enforcement.	Integrated municipal-wide policies that ensure the protection of trees on public and private land are consistently enforced and supported by significant deterrents.
Canopy cover inventory	No inventory.	Visual assessment.	Sampling of tree cover using aerial photographs or satellite imagery.	**Capture of tree cover by polygons in GIS using aerial photographs or satellite imagery.**
Public agency (internal & external) cooperation	Conflicting goals among departments and/or agencies.	**Common goals but limited cooperation among departments and/or agencies.**	Informal teams among departments and/or agencies are functioning and implementing common goals on a project-specific basis.	Municipal tree protection policy implemented by formal interdepartmental/ interagency working agreements on all municipal projects.
Recognition of green infrastructure asset value	No recognition of value of natural forms and functions within local government.	**Local government recognizes the value of natural forms and functions but does not have adequate information to protect or enhance green infrastructure.**	Local government recognizes the value of natural forms and functions and has inventoried green infrastructure within an asset management system. (e.g. City of Powell River)	Local government recognizes and accounts for the value of natural forms and functions within an asset management system, and invests in green infrastructure protection and enhancement.

Actions years 1-5:

Action 13. Consider implementing a tree management and protection policy to regulate cutting public and private trees, and to provide for tree protection and replacement during development. A comparison of different Bylaw types is included in the Technical Appendix.

Action 14. To support Bylaw implementation, create a 'green fund' to receive developer payments for public tree removals and payments in lieu of tree planting for canopy replacement (see Section 5.3 and Technical Appendix) to be used by the City for capital tree planting and green infrastructure projects in the public realm.

Action 15. Reinforce the canopy cover targets within the OCP and general development permit guidelines for landscape requirements when next updated.

Action 16. Work with departments throughout the City and with public agencies to establish common goals to implement tree protection policy. Specifically:

- Identify an internal champion at the management level to lead implementation of the urban forest management plan.
- Review the proposed Tree Protection, Replacement and Removal bylaw and finalize it for adoption.
- Communicate the importance of retention, protection and establishment of trees and green infrastructure in public space to build its profile as a shared priority among City departments.
- Review opportunities to create efficiencies between the proposed tree care program and the roadside brushing program to improve the outcomes for tree health and budgets.
- Establish a committee to review significant tree submissions composed of community and City representatives with relevant expertise.

Actions in years 6 – 20 or earlier if opportunities arise:

Action 17. Update canopy cover inventory every five years.

Action 18. Add canopy cover and green infrastructure spatial data into the corporate asset management system (Cartegraph) and, when possible, quantify the value of services they deliver, the cost of maintenance and their appreciating value over time using available tools (e.g., iTree Eco).

Objective: **C.** Develop a tree care program

Target: **Park and street trees are incorporated into the City's spatial asset management system and trees are maintained according to best management practices.**

Performance Indicators (2015 status highlighted in bold):

	LOW	MODERATE	GOOD	OPTIMAL
Tree inventory	No inventory.	**Partial inventory of publicly-owned trees in GIS.**	Complete inventory of street trees and intensively managed park trees in GIS.	Complete inventory of publicly-owned trees including natural areas (polygons) and significant private trees (if protected) in GIS.
GIS asset management system integration	No integration.	**Street trees and intensively managed park trees in citywide asset management system.**	Street trees and intensively managed park trees in citywide asset management system with values and costs accounted for.	Green infrastructure in citywide asset management system with values and costs accounted for.
Tree risk management	**Request based/reactive system. No formal risk management policy. The condition of the urban forest is largely unknown.**	Areas within the city are prioritized for assessment. Little annual budget is allocated to carry out the work. No formal risk management policy.	Formal risk management policy is in place and risk management program partially implemented.	Formal risk management policy in place and risk management program fully implemented.
Maintenance of publicly-owned, intensively managed trees	**Publicly-owned trees are maintained on a request/reactive basis. No systematic (block) pruning.**	Publicly-owned trees are maintained on a request/reactive basis. No systematic (block) pruning. All immature trees are structurally pruned.	All publicly-owned trees are systematically maintained on a cycle determined by workload and resource limitations. All immature trees are structurally pruned.	All mature publicly-owned trees are maintained on an optimal pruning cycle. All immature trees are structurally pruned.

Actions years 1-5:

Action 19. Continuously update (concurrent with the maintenance cycle) and improve the urban forest inventory within the corporate asset management system (Cartegraph) and, when possible, quantify the value of services they deliver, the cost of maintenance and their appreciating value over time.

Action 20. Develop and implement a legally approved tree risk management policy based on Urban Tree Risk Management: A Community Guide to Program Design and Implementation[16].

Action 21. Implement a zoned tree maintenance program consisting of:

- Structural pruning of young trees 3, 6 and 10 years after planting.
- A pruning cycle of 7 years for all street trees, and park trees with constant target occupancy.
- A pruning cycle of 12 years for park trees with frequent or occasional target occupancy.

Action 22. Implement a summer municipal tree watering program to water trees weekly in the first two years following planting, and to provide supplemental water to trees showing signs of drought stress funded through an urban forest parcel tax.

Action 23. Follow best management practices for tree care based on ISA's Best Management Practices Series for tree inventories, tree pruning and tree risk assessment and strive to achieve ANSI A300 industry standards.

Action 24. Due to the expense of ongoing maintenance, cease pollarding the plane trees on Shoppers Row and, guided by an ISA Certified Arborist with demonstrated experience in pruning, restore the pollards to a tree-like framework.

[16] http://www.na.fs.fed.us/spfo/pubs/uf/utrmm/

Objective: **D.** Improve urban forest diversity

Target: **The street and park tree population (excluding areas managed as native forest) is managed to meet optimal diversity measures.**

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Species distribution excluding areas managed as native forest	**Fewer than five species dominate the entire tree population citywide.**	No species represents more than 20% of the entire tree population citywide.	No more than 10% of any species, 20% of any genus and 30% of any family within the entire tree population Citywide.	No more than 10% of any species, 20% of any genus and 30% of any family[xxiv] at both the Citywide and neighbourhood levels.
Useful life expectancy[17] (ULE) distribution of street and intensively managed park trees in the community	Any ULE class deviates more than 30% from optimal.	Any ULE class deviates more than 20% from optimal.	**Any ULE class deviates more than 10% from optimal.**	60 % with a ULE of > 30 years, 30% with a ULE of 10 - 30 years, and 10% with a ULE of < 10 years.
Native vegetation	**Voluntary use of native species on publicly and privately-owned lands.**	The use of native species is encouraged on a project-appropriate basis in public intensively and extensively managed areas.	The use of native species is required on a project-appropriate basis in public intensively and extensively managed areas.	The use of native species is required on a project-appropriate basis in both public and private intensively and extensively managed areas.

Actions years 1-5:

Action 25. Ensure that new plantings in streets and parks (excluding areas managed as native forest) target no more than 10% of any species, 20% of any genus and 30% of any family at both the Citywide and neighbourhood levels.

Action 26. Spatially define the areas across the City where the use of native vegetation is to be prioritized, such as shoreline parks, natural area parks, ESA buffers, agriculture buffers and trails.

Actions in years 6 – 20 or earlier if opportunities arise:

Action 27. Assess the street trees that are within the zoned maintenance program for Useful Life Expectancy (see the Technical Appendix) to help manage age distribution and successional planting. Because Campbell River's urban forest is generally under 30 years of age and in good health, this assessment can be deferred to the end of the UFMP timeframe.

[17] The ULE is an estimate of how long a tree is likely to be viable in the landscape based on health, amenity, environmental services contribution and risk to the community. The methodology will be provided in a technical appendix to the Urban Forest Management Plan.

Objective: **E.** Adapt the urban forest population to a changing climate

Target: **By 2035, 100% of managed (park and street) tree species are suitable for local climate and site water conditions.**

Performance Indicators (2015 status highlighted in bold):

	LOW	MODERATE	GOOD	OPTIMAL
Species suitability	Less than 50% of trees are of species considered suitable for the site and broader area.	50% to 75% of trees are of species considered suitable for the site and broader area.	**More than 75% of trees are of species considered suitable for the site and broader area.**	All trees are of species considered suitable for the site and broader area.
Storm response	**Response plan is based on visual assessment and call-out requests.**	A call-out procedure, roles and responsibilities, and criteria for prioritizing tree hazards and removing debris is in place.	A comprehensive action plan for responding to storm damage in the urban forest is in place.	A comprehensive action plan for responding to storm damage in the urban forest is in place and a response drill occurs periodically.
Pest and Disease Management	No integrated pest management plan and no pest management.	No integrated pest management plan and reactive pest management.	**No integrated pest management plan but IPM policy is in place and IPM is practiced**.	An integrated pest management plan is in place and implemented.

Actions years 1-5:

Action 28. Select species for urban tree planting that are anticipated to be suitable for projected future climate including, but not limited to, consideration of water use requirements, drought tolerance, structural strength, fire resistance and insect and disease resistance.

Action 29. Implement a storm response plan (refer to the Technical Appendix) and allocate rolling funding for emergency tree risk assessment and tree removal associated with storm events.

Action 30. Update the City's integrated pest management policy and incorporate best management practices based on the ISA's Best Management Practices Series – Integrated Pest Management.

Actions years 6 - 20:

Action 31. Once the tree inventory and the tree care program are implemented, mine tree removal data to identify any patterns that indicate repetitive site or species performance issues and correct them. This action can be deferred until adequate data is available for this analysis.

Objective: **F.** Manage the urban forest to reduce greenhouse gas emissions and improve air quality

Target: **Strategic tree selection and placement criteria are incorporated into Development Permit Area Guidelines to increase building energy efficiency and to improve air quality**.

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Building energy efficiency and air quality improvement	**Landscapes planted without consideration of the location for building energy efficiency and air quality improvement.**	Energy Conservation Development Permit Area Guidelines incorporate tree and landscape considerations for building energy efficiency and air quality improvement.	Energy Conservation Development Permit Area Guidelines incorporating tree and landscape considerations are implemented and value of energy efficiency and air quality improvements is quantified.	Energy Conservation Development Permit Area Guidelines incorporating tree and landscape considerations are implemented and design outcomes are certified by a nationally recognized certification program.
Waste biomass utilization.	**Waste from the urban forest is not utilized.**	Waste from the urban forest is measured and tracked over time.	Business case made to Council for utilization of woody waste.	Waste wood from the urban forest is utilized to meet existing demand.
Corporate emissions and carbon neutrality	Carbon storage and GHG emissions reductions by city trees not measured and tracked over time.	**Carbon storage and GHG emissions reductions by city trees is measured and tracked over time but is not reported on in community climate initiatives.**	Carbon storage and GHG emissions reductions by city trees is measured and tracked over time and reported on in community climate initiatives.	Carbon storage and GHG emissions reductions by city trees is measured and tracked over time and reported on in community climate initiatives, and is recognized as contributing to Climate Action Charter commitments.

Actions years 1-5:

Action 32. Develop strategic tree selection and replacement criteria to increase building energy efficiency and improve air quality. Amend Development Permit Area Guidelines to include these criteria.

Actions years 6-20 or earlier if opportunity arises:

Action 33. Assess the feasibility of compost, mulch, up-cycling, or re-use of woody debris generated during urban forest management activities.

Action 34. Consider the purchase or retention of treed environments as a Climate Adaptation Strategy. Encourage the Province and UBCM to embrace carbon stewardship and to

provide options for local governments to officially tally the purchase of treed ecosystems towards their carbon neutral Climate Action Charter commitments.

Objective: **G.** Integrate the urban forest into watershed, stormwater and flood management.

Target: **Urban forest canopy and green infrastructure are incorporated into new developments to meet DFO/MOE Stormwater Criteria and meet effective impervious area targets.**

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Permeability of surfaces for water infiltration	Permeability of surfaces is not factored into watershed, stormwater and flood management planning initiatives.	**Extent of impermeable surface is known and the benefit of increasing permeability is recognized in local government planning documents.**	Extent of permeable surface is known, Development Permit Area Guidelines incorporate permeability considerations and benefits and costs are quantified in an asset management system.	Permeability targets and canopy cover targets are established in the Official Community Plan and benefits and costs are quantified in an asset management system.
Passive and active water capture for vegetation	**Passive and active water capture are not intentionally designed into vegetated landscapes.**	Development Permit Area Guidelines incorporate passive and active water capture considerations for vegetated landscapes.	Development Permit Area Guidelines incorporate passive and active water capture considerations for vegetated landscapes, and the value of avoided wastewater treatment and irrigation costs is quantified in an asset management system.	Development Permit Area Guidelines incorporate passive and active water capture considerations for vegetated landscapes, assets are captured in the asset management system, and design outcomes are certified by a nationally recognized certification program.
Green infrastructure, including tree canopy, designed for stormwater management.	**Tree canopy and/or green infrastructure is not managed or accounted for as wastewater management assets.**	Development Permit Area Guidelines incorporate considerations for tree canopy and/or green infrastructure stormwater management.	Development Permit Area Guidelines incorporate considerations for tree canopy and/or green infrastructure stormwater management, and the value of avoided wastewater treatment cost is quantified in an asset management system.	Development Permit Area Guidelines incorporate considerations for tree canopy and/or green infrastructure stormwater management, vegetation assets are captured in an asset management system, and design outcomes are certified by a nationally recognized certification program.

Actions years 1-5:

Action 35. Consider amending the Zoning Bylaw to establish permeability targets for each zoning type (see justification in the Technical Appendix).

Action 36. Update Development Permit Guidelines to include considerations for passive and active water capture from hard surfaces for the maintenance of vegetated landscapes.

Action 37. Update Development Permit Guidelines to include considerations for tree canopy and/or green infrastructure for stormwater management, including alternative tree planting systems for hard surfaces (i.e. sidewalks) including soil cells, structural soil, permeable pavement, suspended pavement and pavement bridge systems to increase soil and water storage volume.

Action 38. Consider requiring new developments to model plans through the BC Water Balance Model (waterbalance.ca) tool to demonstrate how DFO/MOE Stormwater Criteria and effective impervious area targets are being met. Built infrastructure and costs and benefits should be transferred into the corporate asset management system (Cartegraph).

Action 39. When developing the Parks Irrigation Strategy and the young tree watering program, identify opportunities for active water capture for the maintenance of vegetated landscapes.

Action 40. Influence Integrated Stormwater Management Plan (ISMP) pilot project design options to maximize tree canopy, including considerations of below ground soil volume to support mature, healthy trees and enhance stormwater mitigation.

Action 41. Incorporate the effect of tree canopy and other green infrastructure interventions into ISMP stormwater interception and flooding analysis, and compare costs associated with traditional stormwater systems to manage that same volume.

Objective: **H.** Strengthen the ecology and biodiversity of natural areas within the municipality.

Target: **The urban forest is developed within the context of a strategically planned green infrastructure network to support local and regional biodiversity.**

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Publicly-owned natural areas management planning and implementation	No biodiversity strategy or implementation is in effect.	**Reactionary stewardship in effect to facilitate public use (e.g. hazard abatement, invasive species management, trail maintenance).**	Area specific management plans in effect focused on management, protection and restoration each ecosystem type or feature.	Biodiversity strategy, or similar vehicle, in effect to manage, restore and protect an existing and future green infrastructure network throughout the municipality.
Publicly owned natural areas inventory (trees managed extensive; e.g. woodlands, ravine lands, etc.)	**No or little information about publicly owned natural areas.**	Publicly owned natural areas identified with defined ownership and/or management responsibility.	Publicly owned natural areas identified and mapped in GIS with defined ownership and/or management responsibility.	Publicly owned natural areas and green infrastructure are captured within a GIS based 'Ecological Inventory' that classifies ecosystem types, habitat features, ownership and/or management responsibility is defined.
Invasive species	No information and no management plan.	Invasive species are recognized.	**An invasive species management plan is in place.**	An invasive species management plan is in place and fully implemented.

Actions years 1-5:

Action 42. Through a biodiversity strategy, or similar vehicle, develop a green infrastructure network of open spaces and corridors to meet multiple objectives (tree protection, recreation, stormwater management, biodiversity and improving local and regional connectivity) and to inform future development planning.

Action 43. Update the General Development Permit Area Guidelines and Streamside Development Permit Area Guidelines to require that the applicable buffer or setback recommended by the Qualified Environmental Professional be signed off by a Registered Professional Forester to ensure any forested edges are windfirm and have adequate root protection. In addition it should be signed off by a Geotechnical Engineer to ensure any slopes are adequately protected.

Action 44. Update the Streamside Development Permit Area Guidelines and the Environmental Protection Bylaw 3551, 2014 to include provisions (beyond the existing minimum 2 m building setback) to be applied in an effort to protect and maintain the integrity of the areas adjacent to riparian areas in order provide an appropriate buffering of the development from the Streamside Protection and Enhancement Area (SPEA). Provisions could include landscaping provisions, fencing standards, tree retention etc.

Action 45. Within areas defined as a priority for planting native vegetation plan and fund naturescaping on public lands to support and enhance biodiversity, and to demonstrate best practices for naturescaping to private landowners.

Action 46. Develop a native tree and plant list for use within areas defined as a priority for planting native vegetation (Action 26), and to serve as a resource for private landowners, and include guidance for FireSmart landscaping when planting close to structures.

Action 47. Spatially inventory ESAs and define their land status (i.e., City owned, privately owned with covenant, etc.) and integrate them within the City's corporate asset management system. Establish management goals, terms of reference and reporting protocols for ESAs by land status and fund implementation through the City's 'Green Fund' and grants.

Action 48. Work with Greenways Land Trust to formalize agreements for community work undertaken within ESAs according to the outcomes of Action 47 and for work within the natural and semi-natural components of the urban forest.

Objective: **I.** Engage and partner with the community to build ownership of the urban forest.

Target: **The City has an urban forest stewardship program that provides education and partnership opportunities to a broad range of stakeholders and fosters ownership of the urban forest.**

Performance Indicators (2015 status highlighted in bold):

	Low	Moderate	Good	Optimal
Community action	No organized community action.	Isolated or limited number of active groups and locations with intermittent activities.	**Community groups partner in urban forest management but involvement is ad hoc.**	Community groups partner in urban forest management and formal agreements are in place.
Involvement of large private land and institutional land holders	**Low or no understanding of issues**	Educational materials and advice available to landholders.	Clear goals for tree resource by landholders. Incentives for preservation of private trees.	Landholders develop vegetation resource management plans (including funding).
Development community cooperation	**Limited understanding or support for city-wide goals and objectives.**	Understanding of city-wide goals and objectives but with limited support and understanding of the role of the urban forest and the value added by green infrastructure.	Some sectors of the development community understand the role of the urban forest and the value added by green infrastructure is often reflected in design and built outcomes.	The development community understand the role of the urban forest and the value added by green infrastructure is always reflected in design and built outcomes.
Municipality-business interaction	**Limited understanding or support for city-wide goals and objectives.**	Understanding of city-wide goals and objectives but limited support and understanding of role of urban forest and value added by green infrastructure.	BIAs understand and support urban forest management in their neighbourhoods.	BIAs partner in urban forest management to fund urban forest projects at the neighbourhood level.
General awareness of trees as a community resource	Trees seen as important to the community but a drain on budgets.	**Trees acknowledged as providing environmental, social, and economic services.**	The general public understands the role of the urban forest.	The general public understands the role of the urban forest and advocates for protecting and enhancing the value it provides to the City.

Actions years 1-5:

Action 49. Work with the Downtown BIA to obtain grants (e.g., TD Green Streets Innovative Community Forestry Projects), plan and construct urban forestry projects within the BIA.

Action 50. Continue to use co-op and work experience partnerships to expand field data and update the baseline inventory using both secondary (Carihi and Timberline) as well as post-secondary education institutes.

Action 51. Develop and fund an Urban Forest Stewardship Program, coordinated through a City staff position, that:

- Defines partners and their role (e.g., Greenways Land Trust, Downtown BIA) and links to partner contact information.
- Coordinates a 'Neighbourwoods' program to supply appropriate trees to private and institutional landowners through local nurseries.
- Coordinates an 'Adopt a Tree' program where individuals or businesses can provide funds for the planting and maintenance of a City tree with varying levels of recognition from an individual tree (website) to a street of trees (signage in place).
- Identifies and establishes strategic partnerships with community groups, private enterprise, and local government to co-fund and resource urban forestry projects.
- Explores partnership opportunities with school districts and other institutional land owners to increase canopy coverage through tree planting programs.
- Develops an online profile for the urban forest through the City's website and social media to provide links to urban forest benefit calculators, share city urban forest data, provide regular updates about City and partner urban forest activities and opportunities for participation.
- Posts public signage, and sends out educational materials related to urban forest benefits in areas where tree vandalism is occurring.
- Develops and sends out information about trees and associated benefits to residents when a new tree is planted in front of their house.
- Coordinates the Significant/Heritage Tree Register with partners (refer to the Technical Appendix).
- Develops a 'Citizen Urban Forester' program for the community to participate in urban forest management, with support from partners. For example, Citizen Urban Foresters could be trained in proper tree planting and formative pruning to lead volunteers in annual projects for parks and ESA or native vegetation planting, and potentially to support young tree maintenance.
- Develops a 'Neighbourhood Urban Forest Watch' pilot program for the community to identify and participate in cleanup of yard waste dumping in urban greenbelts.

Actions years 6 – 20 or earlier if opportunity arises

Action 52. Make the urban forest inventory available to the public online in a format that displays ecosystem service benefits, enables people to add trees to the inventory, and permits people to submit information about trees in the City.

Action 53. Consider starting an annual or semi-annual "bioblitz"[18] event as a platform to raise awareness around ecosystem services, carbon stewardship and biodiversity.

[18] Bioblitz: an intense period of biological surveying in an attempt to record all the living species within a designated area.

5 Implementation framework

5.1 Priority actions

The actions outlined in this plan will be implemented over a 20 year time period to achieve the community's long-term vision for the urban forest resource. However, the bulk of the effort in terms of implementation is concentrated in years 1 to 5.

In total, 42 actions have been prioritized for implementation assuming an approved budget increase in the next five years (cost estimates allocated in Table 2). Summarized at a very high level, these priority actions relate to implementing:

- A planting program for public land and an incentive program for tree planting on private land.
- A tree protection, removal and replacement bylaw.
- A tree care program.
- Updated policy and procedures relevant to the urban forest that strengthen City management of greenhouse gas emissions, stormwater and natural areas.
- An urban forest stewardship program that engages the Campbell River community in management of the urban forest resource and encourages private landowners to partner in achieving the community's urban forest vision.

In the event that all items cannot be actioned within approved budget levels, Table 2 provides the actions ranked by ease of implementation to enable selection of a subset of recommendations. Of the 42 actions:

- 15 are considered easy to implement in that there is no cost other than some existing staff time and no policy modifications are required;
- 16 actions are considered moderately easy to implement because they have a moderate cost or minor policy modification requirement; and
- 11 actions are considered difficult to implement because there is a high additional cost, new resourcing requirement and/or a major policy modification requirement.

5.2 Monitoring and review

Progress over time should be measured against the performance indicators, and ultimately the targets established for each objective. In general, it is recommended that progress against the performance indicators be assessed at 5 year intervals and that the management actions resulting from urban forest management plan be reviewed and modified to improve assumptions and achieve targets (e.g., increase or decrease number for planting program based on actual canopy area changes observed). This 5-yearly review should be recorded as a brief 'interim update' attachment to the UFMP to summarize any revisions to actions.

Four quantitative metrics will require periodic data collection in order to assess performance indicators:

1) Percent canopy cover (update in 2020, 2025, 2030, 2035)
2) Number of trees planted per year (assess annually)
3) Percent in each species, genus and family (update in 2020, 2025, 2030, 2035)
4) Percent in each ULE class (measure in 2035)

Adaptive Management Recommendation:

Action 54. Measure urban forest progress against performance indicators and prepare an 'interim update' to the UFMP at 5 year intervals to reflect progress and changes to management actions.

5.3 Funding and resourcing 2015-2020

Four main funding sources are proposed to cover the actions itemized in Table 2. These funding sources consist of:

1. 20 year **Urban Forest Parcel Tax** estimated at approximately $20 per year (assuming 15,000 parcels) increasing at approximately 3% per year to allow for ongoing maintenance (excluding inflation). Beyond 20 years, maintenance and replacement costs would be ongoing but the rate of new planting would be much lower thus substantially reducing annual program costs.
2. Development contributions paid into **'Green Fund'** driven through bylaw and triggered:
    - Where public trees are approved for removal for the purposes of development, the Development Permit Applicant to pay for the replacement costs for public trees removed for development, including an amenity value as assessed by the CTLA Appraisal method or alternative approved by Council.
    - If approved landscape plan proposes less than 40% canopy cover retained/replaced on site, then Development Permit Applicant is to provide funds in-lieu of canopy cover at a rate of $2.80 per square metre[19] up to the total area required to meet 40% canopy cover.

[19] $2.80 per m^2 is based on the cost of planting 32 trees per hectare with an average canopy extent of 126 m^2 at $350 per tree. Thirty-two trees of this size would achieve 4000 m^2, or 40%, tree canopy per hectare.

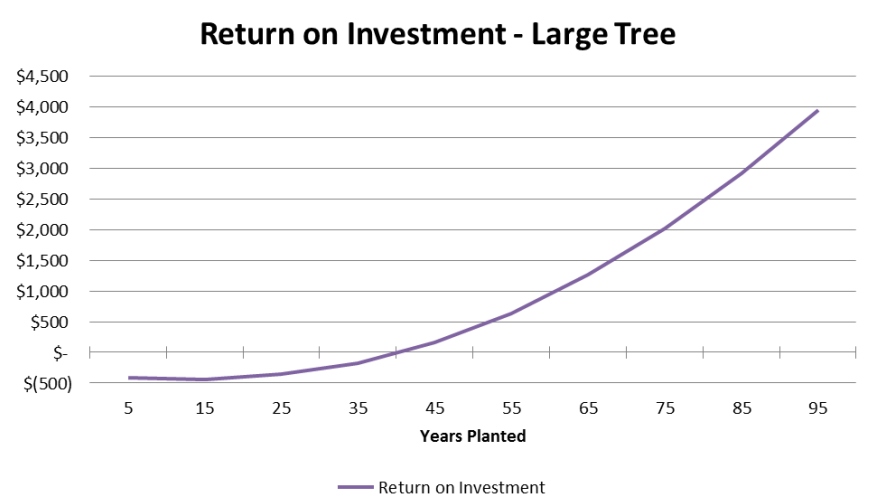
3. **'Adopt a Tree'** partnerships (one-off payment for 5-year sponsorship term):
    a) Bronze $ 100 minimum: Maintenance for 1 tree (acknowledged online)
    b) Silver $ 450 minimum: Planting and maintenance of 1 tree (or equivalent in maintenance of multiple trees (acknowledge online)
    c) Gold $ 4,500 minimum: Planting and maintenance of a block of trees (acknowledgement by signage on street)
4. **Grants**: TD Green Streets available to BIAs and municipalities. Partner with BIA to obtain grant for innovative urban forestry projects in downtown streets.

The anticipated in-house resourcing requirement to implement the plan consists of:

1. Either one new FTE 'Urban Forester Position' encompassing the roles listed below, OR the individual positions listed:
    - Planning arborist (0.25 FTE) – Street tree planning and contractor supervision
    - Stewardship coordinator (0.5 FTE) – Urban Forest Stewardship Program coordination
    - Bylaw enforcement (0.15 FTE) – Enforcement of Tree Protection, Replacement and Removal Bylaw
2. Many of the actions listed do not have a new staffing component. However, there are work load implications for existing staff that would need to be addressed internally.
3. As trees mature, leaf fall loads will increase requiring additional street sweeping and leaf pick-up.

Expected cost benefit: A large (>12 m) street tree is expected to return approximately:
- $2.70 in benefits for every $1 spent if it remains in the landscape for 100 years.
- $1.70 in benefits for every $1 spent if it remains in the landscape for 70 years.
- Break even if it remains in the landscape for approximately 40 years.

The costs included are planting, establishment and maintenance. This estimate only includes benefits for stormwater, air quality and carbon dioxide sequestration. It excludes building energy savings and potential economic benefits related to real estate value increases and increased commercial spending, and the many intangible benefits related to the health and well-being of Campbell River residents.



Funding Recommendations:

Action 55. Implement an urban forest parcel tax of $20 per year to fund public tree planting and maintenance, an Urban Forest Stewardship Program, and a 'Neighbourwoods' program for private tree planting.

Action 56. Establish a 'Green Fund' for receiving financial compensation for the removal of public trees, and for developments that do not meet 40% canopy cover retention/replacement. Funds should be specifically used for public realm urban forest enhancement projects that will improve tree health and canopy cover outcomes.

Action 57. Establish an 'Adopt-a-Tree' program, and pursue grants, to further support urban forest implementation and build partnerships.

Action 58. Fund either one new FTE 'Urban Forester Position' OR the partial individual positions for a planning arborist, stewardship coordinator and bylaw enforcement officer.

Action 59. Once an internal champion is assigned overall responsibility for the plan, review departmental responsibility for actions and identify the workload implications for existing staff positions and options for managing implementation timing or resourcing.

Table 2 outlines the priority actions within the plan and ranks them according to ease of implementation. The values for ease of implementation are defined as follows:

- H = Ease of implementation is high, there is no cost except existing staff time and no Council approved policy modifications are required (15 actions).
- M = Ease of implementation is moderate, there is either a moderate cost or a minor Council approved policy modification required (16 actions).
- L = Ease of implementation is low, there is a high additional cost, new resourcing requirement and/or a major Council approved policy modification (11 actions).

Table 2. Priority actions ranked by ease of implementation and with associated cost and resourcing estimates.

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 2 **H**	Developer to install trees in new developments, with City maintenance following dedication of infrastructure	Already a cost			In Action 1 (*Parks*)
Action 5 **H**	Follow BMPs for tree planting				In Action 1 (*Parks*)
Action 8 **H**	Work with departments across the City to establish more trees in the urban environment				Addition to existing workload
Action 16 **H**	Work with departments across the City and public agencies to establish common goals				Addition to existing workload
Action 19 **H**	Continuously update and improve urban forest inventory				In Action 1/Action 21/ Co-op Student (*Parks*), GIS
Action 24 **H**	Restore Shoppers Row pollards to trees		Will lower existing costs		Addition to existing workload (*Parks*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 25 **H**	Target no more than 10% of any species, 20% of any genus and 30% of any family in planting program				Addition to existing workload (*Parks*)
Action 26 **H**	Spatially define the areas across the City where the use of native vegetation is to be prioritized.				Addition to existing workload (*Parks/Long-range Planning & Sustainability*)
Action 28 **H**	Select species for urban tree planting that are anticipated to be suitable for projected future climate				Addition to existing workload (*Parks*)
Action 30 **H**	Update the City's integrated pest management policy				Addition to existing workload (*Parks*)
Action 32 **H**	Develop strategic tree selection and replacement criteria to increase building energy efficiency and improve air quality				Addition to existing workload (*Parks/ Long-range Planning & Sustainability*)
Action 39 **H**	When developing Parks Irrigation Strategy and young tree program, identify opportunities for active water capture				Addition to existing workload (*Parks)*
Action 40 **H**	Influence ISMP pilot project design options to maximize tree canopy				Addition to existing workload (*Long-range Planning & Sustainability /Utilities*)
Action 46 **H**	Develop a native tree and plant list				Addition to existing workload (*Parks*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 50 **H**	Continue to utilize co-op students				Addition to existing workload (*Parks/ Long-range Planning & Sustainability*)
Action 3 **M**	The existing security amount of $265 per tree should be increased to $350 per tree in order to cover a second year of young tree maintenance and better reflect the average cost of tree planting.	$85 per tree increase in security			Addition to existing workload (*Development Services*)
Action 4 **M**	Require soil preservation detail in landscape plans	Add to Landscape Plan cost			Addition to existing workload (*Development Services*)
Action 15 **M**	Reinforce canopy cover targets within the OCP and general development permit guidelines when next updated				Addition to existing workload (*Development Services*)
Action 20 **M**	Develop and implement a legally approved tree risk management policy and program				In Action 1/Action 21/ Internal expertise as required (*Parks/Legislative Services*)
Action 22 **M**	Fund and implement a summer tree watering program		$0.36 per m3 Estimated usage 600 young trees receiving 20 L/week for 8 weeks +/- drought Watering truck (or contractor)	Urban Forest Parcel Tax	In Action 1/Action 21 (*Parks*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 29 **M**	Implement a storm response plan (refer to the Technical Appendix)			City budget - existing contingencies	Addition to existing workload (*Parks/Fire/Legislative Services*)
Action 36 **M**	Update Development Permit Guidelines to include considerations for passive and active water capture				Addition to existing workload (*Development Services/Utilities*)
Action 37 **M**	Update Development Permit Guidelines to include considerations for tree canopy and/or green infrastructure for stormwater management				Addition to existing workload (*Development Services/ Utilities*)
Action 38 **M**	Consider requiring new developments to model plans through BC Water Balance Model	Cost of entering plan scenarios			Addition to existing workload (*Development Services/ Utilities*)
Action 41 **M**	Incorporate the effect of tree canopy and GI into ISMP stormwater interception and flooding analysis				Addition to existing workload (*Long-range Planning & Sustainability /Utilities*)
Action 43 **M**	Update the General DPA and Streamside DPA Guidelines to require that the applicable buffer or setback recommended by the QEP be signed off by an RPF as windfirm, and signed off by a Geotechnical Engineer to ensure any slopes are adequately protected.	Cost to QEP report			Addition to existing workload (*Long-range Planning & Sustainability / Development Services*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 44 **M**	Update the Streamside DPA Guidelines and the Environmental Protection Bylaw 3551, 2014 to include provisions to protect and maintain the integrity of the areas adjacent to riparian areas in order provide an appropriate buffering of the development from the SPEA.	Cost to provide appropriate provisions (e.g., tree retention, fencing, landscaping etc.)			Addition to existing workload (*Long-range Planning & Sustainability / Development Services*)
Action 47 **M**	Spatially inventory ESAs and define their land status		$5,000 one-off	City Budget/ Grants	Addition to existing workload (*Parks/ Long-range Planning & Sustainability*)
Action 48 **M**	Formalize agreements with Greenways Land Trust work on City managed lands				Addition to existing workload (*Parks/ Long-range Planning & Sustainability*)
Action 49 **M**	Work with the Downtown BIA to obtain grants				In Action 6 (Stewardship coordinator) (*Parks/ Long-range Planning & Sustainability*)
Action 54 **M**	Measure urban forest progress against performance indicators and prepare an 'interim update' to the UFMP at 5 year intervals to reflect progress and changes to management actions				Action 1/ Co-op Student (*Parks/ Long-range Planning & Sustainability*)
Action 1 **L**	Plant 550 trees per year (public land). Fund neighbourwoods program with target of 200 trees per year		$195,000 per year City planting $10,000 per year Neighbourwoods	Urban Forest Parcel Tax/ 'Adopt a Tree'	Planning Arborist 0.25 FTE, In house planting and/or contract crew (*Parks*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 6 **L**	Develop, fund and implement 'Neighbourwoods' program		In Action 1	Urban Forest Parcel Tax/ Grants	Stewardship coordinator (0.5 FTE) (*Parks*)
Action 7 **L**	Amend the Subdivision and Development Servicing Bylaw as outlined in the Technical Appendix				Addition to existing workload (*Development Services*)
Action 13 **L**	Consider implementing a tree management and protection policy to regulate cutting public and private trees (refer to the Technical Appendix)	Retention/ replacement of 40% canopy on site including roadways. Arborist/RPF professional report for tree protection and tree removal. Cost of tree protection. Cost of City tree removal if approved.			Action 1/ Bylaw enforcement (0.15 FTE) (*Parks/Development Services/Legislative Services*)
Action 14 **L**	Create a 'green fund' to receive developer payments for public tree removals and payments in lieu of tree planting				Addition to existing workload (*Finance/Parks*)
Action 21 **L**	Implement a zoned tree maintenance program		$70,000 in year 1, then increasing $20 per year for each new tree planted	Urban Forest Parcel Tax/ 'Adopt a Tree'	In Action 1/Contractor (*Parks*)
Action 23 **L**	Follow BMPs and maintain industry standards for tree care				In Action 1/Action 21 (*Parks*)

Ease of Implementation (H,M,L)	Priority Actions	New Developer Funding Requirement $/unit	New City Funding Requirement	Funding Source	New Staffing Requirement Full Time Equivalent (*Dept. Responsible*)
Action 35 **L**	Consider amending the Zoning Bylaw to establish permeability targets for each zoning type				Addition to existing workload (*Development Services/Utilities*)
Action 42 **L**	Develop a biodiversity strategy, or similar vehicle to deliver a green infrastructure network		$5,000 – 30,000 one-off depending on scope of work	City Budget/ Grants	Addition to existing workload (*Long-range Planning & Sustainability*)
Action 45 **L**	Within areas defined as a priority for planting native vegetation fund naturescaping		Variable restoration/ planting cost	Green Fund	Addition to existing workload (*Parks*)
Action 51 **L**	Develop and fund and Urban Forest Stewardship Program		$15,000 per year	Urban Forest Parcel Tax	In Action 6 (Stewardship coordinator) (*Parks/ Long-range Planning & Sustainability*)
	Estimated Total Costs and New Staffing Requirements	Variable depending on size of development	$290,000 per year (increase above current of $265,000) $5,000 – 35,000 one off		Planning arborist (0.25 FTE) Stewardship coordinator (0.5 FTE) Bylaw enforcement (0.15 FTE) **OR** new 1 FTE 'Urban Forester Position' to cover these roles.

[i] Nowak, D.J.; Noble, M.H.; Sisinni, S.M.; Dwyer, J.F. 2001. *Assessing the U.S. urban forest resource.* Journal of Forestry. 99(3): 37-42.

[ii] Diamond Head Consulting. 2014a. *City of Campbell River Community Consultation Summary Urban Forest Management Plan*. Consultant report submitted to City of Campbell River.

[iii] BC Stats. 2014b. *Sub-Provincial Population Projections - P.E.O.P.L.E. 2014*. BC Stats, Ministry of Technology, Innovation and Citizens' Services. Accessed October 6 2014 Online: http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationProjections.aspx

[iv] United Nations. 2014. *The World Population Situation in 2014: A Concise Report*. Population Studies, No. 354. United Nations, Department of Economic and Social Affairs.

[v] Seto, K.C.; Güneralp, B.; Hutyra, L.R. 2012. *Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools.* Proc. Natl. Acad. Sci., 109, 16083–16088.

[vi] Penner, I; Greenways Land Trust. 2014. *Phase 1: Urban Forest Inventory Draft*. Consultant report prepared for the City of Campbell River.

[vii] Warren, F.J.; Lemmen, D.S. (editors). 2014. *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*. Government of Canada, Ottawa, ON, 286p

[viii] Cirillo, C; Podolsky, L. 2012. *Health, Prosperity and Sustainability: The Case for Green Infrastructure in Ontario*. Green Infrastructure Ontario Coalition and Ecojustice. Accessed October 20 2014 Online: http://www.greeninfrastructureontario.org/report

Foster, J.; Lowe, A.; Winkelman, S. 2011. *The Value of Green Infrastructure for Urban Climate Adaptation*. Center for Clean Air Policy. Accessed October 20 2014 online: http://ccap.org/assets/The-Value-of-Green-Infrastructure-for-Urban-Climate-Adaptation_CCAP-Feb-2011.pdf

[ix] Kosatsky, T.; Henderson, S.; Pollock, S. 2012. *Shifts in Mortality During a Hot Weather Event in Vancouver, British Columbia: Rapid Assessment With Case-Only Analysis*. American Journal of Public Health: December 2012, Vol. 102, No. 12, pp. 2367-2371.

[x] Wolf, K.L. 2010. *Community Economics - A Literature Review*. In: Green Cities: Good Health (www.greenhealth.washington.edu). College of the Environment, University of Washington.

[xi] Coccola, C. 2012. *2011 Inventory of Air Quality Bylaws in British Columbia: Vehicle Idling, Open Burning, and Wood Burning Appliances*. BC Ministry of Environment. Accessed October 20 2014 Online: http://www.bcairquality.ca/reports/pdfs/bylaws-2011.pdf

[xii] Taylor, A. 2013. *Campbell River Air Quality Report: Analysis of Smoke Pollution Survey Results and Airshed Planning*. Accessed October 17 2014 online: http://www.campbellriver.ca/docs/default-source/your-city-hall/final-air-quality-report-(formatted)---2013.pdf?sfvrsn=0

[xiii] Hiemstra, J.A.; Schoenmaker – van der Bijl, E.; Tonneijck, A.E.G. 2008. *Trees: Relief for the City*. Accessed October 20 2014 online: http://edepot.wur.nl/20634

[xiv] World Health Organisation. 2014. *7 Million Premature Deaths Annually Linked to Air Pollution* [Media Release]. Accessed October 20 2014 online: http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/

[xv] BC Ministry of Environment. 2010. *Preparing for Climate Change: British Columbia's Adaptation Strategy*. Ministry of Environment, Victoria, BC. Accessed October 20 2014 Online: http://www.env.gov.bc.ca/cas/adaptation/pdf/Adaptation_Strategy.pdf

[xvi] Diamond Heat Consulting. 2014. *Campbell River Urban Forest Management Plan Background Report*. Consultant report submitted to City of Campbell River.

[xvii] Nowak, D.; M.H. Noble; S.M. Sisinni; J. F. Dwyer. 2001. Assessing the US Urban Forest Resource. Journal of Forestry, 99 (3), 37-42.

[xviii] McPherson, E.G.; J.R. Simpson; P.J. Peper; Q. Xiao; S.E. Maco; P. J. Hoefer. 2003. *Northern Mountain and Prairie Community Tree Guide: Benefits, Costs and Strategic Planting*. https://www.itreetools.org/streets/resources/Streets_CTG/CUFR_258_North_CTG.pdf

[xix] Intergovernmental Panel on Climate Change. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. Cambridge University Press, New York, NY, USA. Accessed October 27 2014 Online: http://www.ipcc-wg2.gov/SREX/images/uploads/SREX-All_FINAL.pdf

[xx] Nowak, D. J. and J. F. Dwyer. 2007. Understanding the Benefits and Costs of Urban Forest Ecosystems. Dordrecht, Springer Netherlands: 25-46. (From the book "Urban and Community Forestry in the Northeast", chapter 2)

[xxi] Geosyntec Consultants and Wright Water Engineers. 2014. International Stormwater Best Management Practices (BMP) Database Pollutant Category Statistical Summary Report Solids, Bacteria, Nutrients, and Metals. Accessed October 2015 http://www.bmpdatabase.org/Docs/2014%20Water%20Quality%20Analysis%20Addendum/BMP%20Database%20Categorical_StatisticalSummaryReport_December2014.pdf

[xxii] Ministry of Environment. 2002. Stormwater Planning: A Guidebook for British Columbia. https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAAahUKEwjpusHC-Z_IAhVBlYgKHZ0aDVo&url=http%3A%2F%2Fwww2.gov.bc.ca%2Fassets%2Fgov%2Fenvironment%2Fwaste-

management%2Fsewage%2Fstormwater_planning_guidebook_for_bc.pdf&usg=AFQjCNGwCx3pV8hGZO8Iumby6tMavyKaeQ

[xxiii] Department of Fisheries and Oceans; BC Ministry of Environment. *Land Development Guidelines* [Pending Publication]. Accessed October 27 2015 Online: http://www.rainwatermanagement.ca/wp-content/uploads/2014/04/Draft-BC-Land-Development-Guidelines-Section-4.pdf

[xxiv] Santamour, Frank S, Jr. 1990. *Trees for Urban Planting: Diversity, Uniformity, and Common Sense*. Accessed Online October 20 2014. http://www.ces.ncsu.edu/fletcher/programs/nursery/metria/metria7/m79.pdf.