Restoration Walks in Victoria

A Guide to Several
Ecological Restoration Projects
in Greater Victoria, BC

Valentin Schaefer and Jessica Miles

2013

University of Victoria

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Contents

Introduction

Cities contain valuable natural habitat that suffers from the pressures of urbanization. Habitat loss, pollution, heavy metal contamination, invasive species and other threats have degraded the urban environment. There are many people working to restore natural areas and ecosystem function in the city. We are usually unaware of their projects and efforts to improve urban biodiversity and our quality of life. This series visits a number of such projects in Victoria, BC to see firsthand all of the good work underway.

Restoration, not Replication

The Society for Ecological Restoration defines ecological restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed". In restoration, we first look at what is on site (a biophysical inventory), determine what we would like to see happen to the site (the restoration target or prescription), figure out how we are going to get there (an action plan or implementation plan), and carry it out (implementation).

The natural historical condition for a site—usually considered to be pre-European contact—can inform a restoration target but does not determine it. In urban areas, it is not always possible to replicate historical conditions, as soil and hydrology have been permanently altered by the urban landscape. This does not mean restoration is impossible; it is just not possible to replicate the original ecosystem. Some people believe if the historical ecosystem is not recreated, it is not restoration, but rehabilitation. Experts within the field maintain, however, such projects, including those outlined in this book, do indeed constitute ecological restoration.

Ecological restoration also addresses cultural landscapes that may have been maintained by fire, and managed landscapes like community gardens. Both landscapes play a role in maintaining natural areas on a regional scale. Also, novel ecosystems—especially those with alien invasive species—lead to ongoing, well-established new relationships that may better define what is appropriate for a site, rather than species-assemblages involving only native species.

Six Series of Walks

Presented here are 5 series of restoration walks, initially offered by the Restoration of Natural Systems Program of the University of Victoria, as well as one contributed walk. Demand for the walks was far greater than our capacity, so we produced this book for the benefit of those who would still like to experience what ecological restoration looks like in Greater Victoria.

Series 1. An Overview of Urban Restoration

1.1 James Bay

James Bay has been the focus of both marine restoration and invasive species control. The Fisherman's Wharf has been the site of foreshore plantings, bank stabilization and a tidal gate. The area is also part of the Victoria Harbour Pathway, offering numerous shoreline restoration opportunities—one example being the installation of reef balls to create subtidal habitat at the Ogden Point Breakwater. At Beacon Hill Park ongoing removal and control of invasive species, through the installment of cedar fence enclosures, can be seen.

1.2 Inner Harbour Waterfront

Take a walking tour of the Victoria Harbour and Gorge Waterway to view sites that include restoration, water management and conservation associated with urban shoreline development. Visit a variety of sites including the world-renowned Dockside Green project, the RailYards Development, Point Ellice House and Rock Bay remediation project. Sites for restoration projects include marine, freshwater and terrestrial locations.

1.3 University of Victoria Campus

The University of Victoria Campus has many examples of restoration projects, the majority of which were completed by students as part of their research or course work. There are also a number of commemorative gardens established with a restoration theme. Some examples include native plant gardens (Sedgewick, Finnerty Gardens), Social Sciences and Mathematics building courtyard gardens (and perhaps rooftop garden), South Woods invasive species removal, Garry Oak Meadow Ecosystem Restoration (GOMER) Project, and Bowker Creek and Hobbs Creek restoration.

1.1 James Bay

James Bay Walking Map

Fisherman's Wharf & Surrounding Area

Shoreline Trail

Part of the revitalization of the downtown waterfront in Victoria has involved the construction of an attractive trail along the shoreline. In the past, large boulders were used to armour banks from erosion by the tides. At this site, an area about 2 to 3 meters wide was landscaped using native vegetation. Oregon Grape, Kinnikinnick, Deer Fern and Red Osier Dogwood were chosen to re-vegetate this challenging site, which would be exposed to harsh dry summers and the occasional salt spray.

Salt Marsh

In one small pocket by the Bay Street Bridge, an area of perhaps 15 square metres, large boulders and sand were used to create a sandy bench, which was planted with Sea Asparagus. Located just at the high tide line, this salt marsh recreated a small patch of what used to be a much more extensive habitat at this site.

Tidal Gate

A storm drain serving James Bay empties into the harbour through a small inlet at Fisherman's Wharf. Part of upgrading the area's storm drain included installing a tidal gate to prevent saltwater from backing up into the system at high tide. To reduce flooding in the area—which during heavy rain events saw some roads 30 to 60 centimeters underwater—the City installed a much larger storm drain pipe in 2009 (Our Stormwater, 2012).

Seals

Fisherman's Wharf is known for its quaint floating shops. Barb's Fish & Chips, open mid-March until autumn, is a favourite destination for locals and tourists alike. Next to the fish and chips stand, a fish shop sells fresh seafood. Here, one can buy Herring to feed to the hungry seals frequenting the wharf. The seals put on quite a show when they reach out of the water for a dangling treat!

A seal at Fisherman's Wharf

Vortex Ceptor

Adjacent to Fisherman's Wharf is a playing field that sits atop a 5-meter mound of loose fill that was brought in over the years from various construction sites around the city. The site is unsuitable for building. The City recently installed a large ceptor to capture the sediment being carried by stormwater before it enters the ocean. This large concrete chamber about 5 meters deep contains a vortex, which slows the water, allowing sediment to collect in a regularly cleaned trap. This reduces turbidity in the receiving waters for the pipe.

Stream Daylighting

In the past, streams and small waterways in natural areas were confined in culverts and covered with fill to allow for developments overtop. More recently however, people have come to value the scarce open waterways of their communities, supporting projects to excavate and daylight these "lost streams". James Bay once boasted 6 streams, one of which flowed under a playing field. In 2012, the City of Victoria installed a large rain garden to manage runoff from 2 daylighted storm drains for a stream running through the park (Rain Gardens, 2012). The concept plan for the rain garden site is shown on the next page.

Several Black Locust trees line St. Lawrence Street. Native to eastern Canada, this species has naturalized in southern BC, mostly along forest edges and disturbed areas (Klinkenberg, 2012). It is planted in cities because it is hardy and grows fast. Unfortunately, it is invasive, though not very long-lived.

Shoal Point Condominium

The Shoal Point Condominium development has impressive landscaping, such as a waterfall tumbling down a rock face, planted with many shrubs. In urban environments, it is rare to find open fresh water. Open water with shrubs supports many native bird species. James Bay is known for its Bewick's Wren—a bird that sings frequently and can be heard on early morning walks in the area. More recently, a Pacific Wren has also been spotted in the area. Though the Pacific Wren is normally a woodland bird, it has made itself right at home in Shoal Point.

Canadian Coast Guard

Across the street from Shoal Point are the offices of the Canadian Coast Guard. A large cluster of willow shrubs not only creates habitat for local wildlife, but also offers an attractive view for office workers and passers-by. The building's green rooftop, with grasses and shrubs, helps maintain water on site rather than directing it to storm drains.

Next to the Coast Guard offices is Dallas Road, with rows of street trees—primarily Wheatley Elms. Indeed, elms make up a large number of the trees lining the streets of James Bay. The Wheatley Elm is invasive; many of the rows of what appear to be shrubs along parking lots are actually suckers of nearby elms. While Dutch Elm Disease has laid waste to most elms in Canadian cities, elm trees on Vancouver Island remain unscathed, as the disease has not yet made it to the island. If and when it does, it will devastate much of the urban forest of James Bay.

Ogden Point

Angler's Boat Launch

James Bay Anglers Association sign

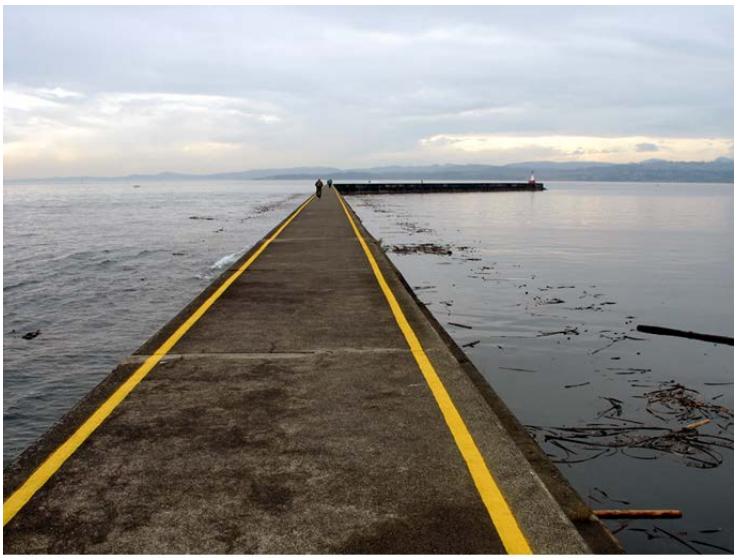
The James Bay Anglers Association has a boat launch close to Ogden Point. Many not-for-profit rod and gun clubs and other non-governmental organizations, such as the Sooke Salmon Enhancement Society, play a major role in ecological restoration in urban areas (Hatchery Projects, 2012).

One of the largest organizations restoring wetlands in Canada and the United States is Ducks Unlimited (DUC's Story, 2012). The Amalgamated Conservation Society of Victoria has a proposal to raise thousands of Pink Salmon fry in an open water pen next to Ogden Point, opposite the boat launch. This open water pen would provide protection for the growing salmon fry before they are released into the wild (Gorge Waterway Initiative, 2007).

Ogden Point

Ogden Point extends approximately 1 kilometer out into the Strait of Juan de Fuca. It consists of about 10,000 large granite blocks and helps protect Victoria's harbour. The breakwater also shelters pilot boats, which ferry pilots, as needed, to and from ships passing through the Strait of Juan de Fuca.

At the foot of the breakwater is the Ogden Point Cafe and Dive Centre.


The Ogden Point Breakwater

In the parking lot next to the dive shop are several concrete reef balls. These hollow domes are about 1 meter in diameter and were submerged in the subtidal zone next to the breakwater as part of a restoration

effort. Already a provincial underwater marine park rich with life, the reef balls are playing a distinct role in enhancing this habitat (Effectively Restoring, 2009).

Ogden Point is also part of the Victoria Harbour Bird Sanctuary. Established in 1923, the sanctuary extends along the shoreline, all the way from Esquimalt to Ten Mile Point. To discourage seagulls from roosting, the Greater Victoria Harbour Authority in 2008 installed an electronic noise device on the Ogden Point Pier 'Warehouse A' rooftop. However, the device was removed after the Canadian Wildlife Service found it was interfering with other birds protected by the sanctuary (Ringuette, 2009).

Reef Balls in the Ogden Point Parking Lot

Beach Front

Large sections of the banks along the beach are covered with Scotch Broom, a troublesome invasive shrub brought here by settlers in the 1800s. Scotch Broom is a legume and can fix nitrogen, enabling it to colonize disturbed soils. Once established, it keeps out local native vegetation by greatly increasing the nitrogen content of the soil (a situation hostile to many native species) and produces a chemical that suppresses the growth of other species (an allelopath). For these reasons, Scotch Broom has become a serious problem for local ecosystems, particularly Garry Oak ecosystems (Best Practices, 2002).

Erosion is another problem along the beach front—further intensified by squatters, who set up camp at the foot of the bluff and dig into the bank. While a great deal of effort has been made to stabilize the bluffs, armouring slopes with large boulders or cement walls to halt erosion altogether would have adverse effects along the coast. Without the influx of sand from such sites, distant beaches would disappear. At the top of

Waterfront next to Ogden Point Breakwater showing a gravel beach covered with logs

the bank at Holland Point, one can see outlines of raised earth mounds associated with First Nations settlements dating back thousands of years. Burial sites and artefacts associated with shell middens have been found at these settlements.

LifeCycles Garden

Straight up Menzies Road from Dallas Road, and close to the Parliament Buildings, is a small allotment garden in the corner of a parking lot on Michigan Street. Founded in 1994, the garden is operated by the LifeCycles Project Society (Projects, 2012). Allotment gardens play an interesting role in ecological restoration, as they are part of the practice of ecological restoration in a "working landscape", that is, a landscape in which conservation objectives are integrated with economic goals. A good example of this is the various nature trusts that have partnered with farmers to restore their lands, while simultaneously retaining their role as pasture for livestock. Allotment gardens are excellent examples of how the urban landscape can be restored to better serve the people and wildlife that inhabit it (Urban Agriculture, 2012). Indeed, gardens provide habitat for wildlife, while providing aesthetic appeal and/or foods for people. Gardens rich in flowers and vegetables support pollinators such as butterflies, bees and hummingbirds, and, in turn, support the suite of ecological services (e.g. pollination) that these organisms provide to the surrounding ecosystem and society. It is also interesting to note the cob house located in the LifeCycles allotment garden. Built from a mixture of clay, sand, straw, water and earth cob houses are an excellent example of eco-friendly building practices.

Beacon Hill Park

Invasive species control is a central issue at Beacon Hill Park. One prevalent invasive, English Ivy, creates thick mats on forest floors and even climbs up tree trunks. Countless individuals have volunteered hundreds of hours to protect the park from this invasive species, which, if left unmanaged, can outcompete native plant species. Carpet Burweed recently arrived to the off-leash area of the park. It first appeared in British Columbia in 1997 in Ruckle

Volunteer removing English Ivy in Beacon Hill Park

Park, Saltspring Island, and has since spread to campgrounds and recreation sites in other parts of the province (Carpet Burweed, 2012).

The split cedar rail fence enclosure intended to isolate an infestation of carpet burweed and keep it from spreading

For 27 years, Beacon Hill Park was home to a large colony of Great Blue Herons. Great Blue Heron colonies typically last for 10 years before the guano (excrement) from the birds kills the trees used for nesting (Hawthorn, 2012). During the birds' stay, Victoria Parks actively maintained the trees to protect them from the damaging impacts of the guano. A single nesting pair of Bald Eagles lived by the heron colony; but when the male died, many eagles entered the undefended territory. The transient Bald Eagles preyed upon the young herons from the 2007 nesting season, devastating the colony. Another contributing factor to the heron colony's dispersal from Beacon Hill Park was a *Phytophthora* fungus infection, which killed a number of the Lawson Cypress trees inhabited by the herons. The death of these Cypress trees resulted in a more open canopy, further exposing the heron nests to predation. The heron colony then dispersed from Beacon Hill Park, with smaller groups of herons later sighted in various locations around the Saanich Peninsula. Some of the colony (about 50 active nests) returned to the Park in 2012.

1.2 Upper Harbour/Inner Harbour Waterfront

Dockside Green

The U.S. Green Building Council developed a system for rating buildings to assess their sustainability called LEED (Leadership in Energy and Environmental Design). This system of rating allocates points to a maximum of 69 points and, from these points, rates

buildings as Certified, Silver, Gold or Platinum. LEED rating depends on a host of different factors: sustainable sites, water efficiency, energy and atmosphere, materials and resources, innovation and design, and indoor environmental quality (LEED, 2012). Dockside Green, located on abandoned industrial land, was built to meet the LEED Platinum standard (Duffy, 2012).

Tyee Road Entrance

From the Tyee Road entrance, one can see the concrete on the curbs is "broken" with grates. This allows rainwater to flow from the street onto the property, thereby keeping it out of the storm drain. The water can infiltrate into the ground in the boulevard or flow between the buildings to a stream in the greenway. Retaining drain water onsite is one example of low-impact development at Dockside Green.

Trough bringing water to wetland | Small wetland filters water from road

Greenway

The greenway, which runs through the centre of the Dockside Green development, extends the length of an entire city block and receives water from the building's decks and the sewage treatment plant. Rainwater also enters from the street front, first emptying into a small constructed wetland with rushes, which trap pollutants from the street. Dockside Green has made a number of efforts to celebrate water—as is seen by the open troughs that collect rainwater from the building's decks, sending it cascading from one level to the next, like a waterfall, until it eventually spills into the stream. The bottom of the stream is fitted with a plastic liner, which caps some of the toxic soil left on the site. The sewage treatment plant is located at the end of the stream; clean water from the sewage treatment plant is continually pumped to the head of the stream to maintain water flow.

Galloping Goose Trail

Waterway through centre of Dockside Green

A trail along the water next to Dockside Green is part of the Galloping Goose Trail. An old 60-kilometer-long railbed, it is now a major walking and cycling route in the region. Where Harbour Road meets the Galloping Goose Trail, a totem pole stands. Created by Charles Elliott, a Coast Salish Master Carver, it is the first installation of First Nations public art here, and will be followed by First Nations art-inspired manhole covers, path stones and historical site signage. Community engagement at Dockside Green can be seen in school children's murals adorning the chain link fences. The trail here also features solar-powered lighting, with photovoltaic cells on the posts. The solar-powered lights also illuminate the dock where harbour ferry shuttles stop to pick up tourists and commuters.

Water Keepers Totem

Inner Harbour Lookout

There is a good view of downtown Victoria from this location. Victoria's downtown shares several common features with downtown Vancouver and many other urban centres—one being highly contaminated soil; another being high-density housing; and, a third, a concrete plant with the need for piles of aggregate (sand and gravel).

Historically, both downtown Victoria and Vancouver were sites for coal gasification plants and shipbuilding (Victoria's Gas Company, 1995). Coal that was used to produce gas for street lamps had the unfortunate by-product of toxic coal tar, resulting in the contamination of plant sites.

A second feature of urban centres is the high-density housing that is constructed on toxic sites. In Vancouver, the Expo Lands, once barren, are now home to many highly desirable condominium towers. Victoria harbour's shoreline is now similarly lined with condominium towers.

A third feature of city centres are piles of aggregate—sand and gravel used for making concrete, and asphalt for construction. Because moving aggregate is expensive, barges bring aggregate where it is most needed: into the

heart of the city. Once there, it is converted into concrete and asphalt. The concrete plant in downtown Victoria began operations in 1973.

Downtown View

There is a good view of downtown Victoria from the lookout. Victoria's downtown shares several common features with downtown Vancouver and many other urban centres—one feature being highly contaminated soil. Historically, both downtown Victoria and Vancouver were sites for coal gasification plants and shipbuilding. The unfortunate by-product of coal used to produce gas for street lamps—toxic coal tar—resulted in the contamination of plant sites. The coal gasification plant in Rock Bay, Victoria, which operated from the 1860s until the 1950s, was one of the most contaminated sites in Victoria until remediation began in 2004. While some soil was treated on site, the majority of it was trucked away to be treated offsite. A second feature of urban centres is the high-density housing constructed on toxic sites. In Vancouver, the once barren Expo Lands are now home to highly desirable condominium towers. Victoria's harbour seems to have followed suit, with condominiums lining the shoreline.

Waterfront Park

One hundred metres or so towards the Bay Street Bridge, on the south side is a small waterfront park on the Gorge Waterway that has not been named. This site used to be a dumpsite for concrete and asphalt rubble, which covered the banks along the water. Dense thickets of invasive blackberries and Scotch Broom grew where there was any soil. Now the site has been restored: the concrete and pavement debris has been taken away, the invasive species have been removed; and the bank was stabilized with 3 rows of boulders. The remainder was left as open ground and planted with native vegetation. Many truckloads of sand were brought in to create a beach and a mudflat in a small tidal channel. Large logs were anchored into the banks of the channel to add some structural complexity. A large propeller from a freighter was brought in as a play feature celebrating the maritime history of the region. A few Arbutus trees growing on the site were left as striking accents.

Bay Street Bridge

The Bay Street Bridge crosses the Gorge Waterway. The waterfront park is at the foot of the Bay Street Bridge. On the underside of the bridge are a number of large steel braces, which were installed to make the bridge more earthquake resistant. One can see Sea Asparagus growing on the banks on the north side of the bridge from the waterfront park. The bank with Sea Asparagus is the beginning of several stretches of mudflats containing some of the few remaining salt marshes in the area. This particular site was used as the reference

ecosystem for designing the salt marsh at Dockside Green, as it served as a model for local salt marshes and provided donor plants. Lying on the mudflats are also some balls of Eelgrass. This is a good sign as Eelgrass supports highly productive marine ecosystems with its biomass. More animals feeding on Eelgrass actually thrive on the dead remains of the plants (the *detritus*) rather than the green, living Eelgrass.

Point Ellice House

On the other side of the Gorge Waterway is Point Ellice House, the oldest intact Victorian-style heritage house in Victoria (Point Ellice, 2012). The site is home to numerous mature Arbutus trees that are impressive, not only for their size, but their magnificent growth forms. The Arbutus trees range from a perfectly shaped, very tall tree, to a massive tree with half its length growing adjacent to the ground—the latter features a twisting formation that defies imagination. English Ivy has overgrown parts of the site, with some stems growing as thick as tree trunks. A dedicated group of volunteers has begun to restore the site by removing the ivy and planting the exposed ground with native vegetation. Numerous historical artefacts have been discovered with the removal of the ivy, adding a new element to the restoration project—archaeological excavation.

Gorge Waterway

The Gorge Waterway extends inland from the Inner Harbour, between Saanich and Victoria West, and has long been a major recreational site, frequented by rowers, kayakers, joggers and walkers. The Gorge Waterway Initiative is a partnership of several environmental and government groups dedicated to restoring the Gorge. These groups are: Veins of Life, The Land Conservancy, the University of Victoria's Restoration of Natural Systems Program, and the Capital Regional District. One of the initiatives is to create more "soft edges" along the shoreline, as large areas of the shoreline are armoured with boulders or concrete walls (Gorge, 2007). Before this extensive armouring took place, the Gorge Waterway would have had, in areas free of bedrock, native vegetation growing down to the water's edge on gently sloping mudflats. The Gorge Waterway Initiative has worked with landowners to re-install soft edges along the shores of their properties. Marine shorelines located in city centres often show signs of "necrosis", a dying off of the ecosystem due to disturbance and pollution. The necrosis is usually evident in poor diversity, low densities of organisms, and even fungal growth not normally seen in healthier situations. However, the gorge shows little sign of a problem—its rocky shoreline is rich with rockweed and barnacles and the mudflats are host to Sea Asparagus and Eelgrass.

1.3 University of Victoria Campus

Ian Ross Memorial Garden

Rooftop Garden on top of the SSM Building

The University of Victoria's on campus gardens help illustrate various ecosystems. These gardens can be classified as restoration work, as they recreate small assemblages of the plant species found in the surrounding local ecosystems. The Ian Ross Memorial Garden, located in the courtyard of the Social Sciences and Mathematics (SSM) Building, is dedicated to Ian Ross, one of the owners of the Butchart Gardens, who contributed to its creation (University, 2008). The Ian Ross Memorial Garden has 6 themed gardens within it: a Garry Oak meadow, a coastal bluff (with drought-tolerant sedums), a marsh (with Kellogg's Sedge), a bog (with plans for Labrador Tea), a shady creek (with Salal and Red Osier Dogwood) and a native planting (with Red-flowering Currant, Thimbleberry and Salmonberry). Each themed garden contains several species that are characteristic of the habitat. As is the case with many restoration projects, the Ian Ross Memorial Garden has changed a great deal from its original 13 themed gardens. The changes were in large part due to the construction of a rooftop garden on the SSM building, which was not part of the original design. Water expected to feed the memorial garden was instead retained to feed the rooftop garden. The shady creek has a Devil's Club specimen, planted because of the important role it plays in local First Nations culture (Turner and Hebda, 1990). The garden has suffered a lot of damage—both from rabbits that once overran the campus and from deer, which are especially fond of Red Osier Dogwood (Dealing with Deer, 2012).

Rooftop Gardens

Students from the Restoration of Natural Systems Program at the university were largely responsible for propagating more than 6,000

native grass plugs used for the rooftop garden. Once the grass plugs were started, they were sent to the Pacific Forestry Centre to grow until mature enough for planting. The rooftop garden contributes to rainwater management and stands as an example of low-impact development. The SSM Building was built to LEED Gold standards; and the rooftop garden was one of the requirements that had to be met in order to achieve this level of certification (Groves, 2011).

Lorene Kennedy Garden

The Lorene Kennedy Garden was created in honour of Lorene Kennedy, a noted botanist and benefactor of the university's School of Environmental Studies. It was designed using Naturescape principles, a program in British Columbia promoting the use of native species in urban areas (Naturescaping, 2012). Native plants in this garden include several species of fern: Sword Fern, Lady Fern, Deer Fern and Maidenhair Fern. There are also several species of native shrubs present, such as Salal, Thimbleberry, Hardhack and Tall Oregon Grape.

Hardhack is a good species to use in ecological restoration projects where recolonization of invasive plant species is a concern (Hebda, 2012). Hardhack forms very dense stands, which prevent other plant species from establishing. The use of Tall Oregon Grape in this garden is interesting to note—usually on the coast, at lower elevations, one normally finds Dull Oregon Grape. However, Dull Oregon Grape requires shade and moisture, whereas Tall Oregon Grape, characteristic of drier, sunnier sites at higher elevations, is better suited to growing in urban conditions and close to buildings. Native strawberry is also a common sight in the garden. While smaller than the grocery store variety from California, native strawberries are prized for their sweet, intense flavour. Douglas-fir and Grand Fir are both found here. Grand Fir is slightly less tolerant of dry conditions and is expected to do poorly with climate change in the southern parts of its range, as is Western Red-cedar. In the BC forest industry, Grand Fir is also known as "balsam". Individuals from eastern Canada might find this name

Lorene Kennedy Garden

confusing, as the Balsam Fir tree—native to the east—is a different species than the Grand Fir, or, "balsam" (Grand Fir, 2011)

University Club Pond

The university's Gordon Head campus is located on top of a hill. From this hill, rain falling on the campus drains off into 4 different creeks, or watersheds: Bowker Creek, Hobbs Creek, Finnerty Creek and Cadboro Creek. Bowker Creek travels 8 kilometers through Victoria's Shelbourne Valley, often in culverts—some so large you can stand in them. Eventually, Bowker Creek drains into Oak Bay by the marina; though the creek begins at a pond behind the University Club (History, 2012). This pond contains Red-eared Slider Turtles, which have displaced the native Western Painted Turtle. These non-native turtles, which were likely introduced to the pond as abandoned pets, have become quite abundant. On a sunny day, one can see turtles stacked on top of each other, sunning themselves on logs. Yellow Flag Irises are found growing around the shore of the pond. Once acceptable for wetland plantings, this iris is now considered non-native and invasive.

Red-eared Slider turtles in the University Club pond

Bowker Creek

Bowker Creek drains from the pond next to the University Club parking lot. Nothing more than a small ditch at this point, at times, the drainage channel is difficult to observe in the flooded forest floor. This creek once provided habitat for Coho Salmon and Cutthroat Trout, and is being actively managed by the Bowker Creek Management Plan to restore and rehabilitate unprotected areas of the creek (Integrated Stormwater, 2012).

Many large Black Cottonwoods can be found in the forest next to the University Club parking lot. These fast-growing poplars can dwarf cedars and alders of the same age (Nesom, 2008). Though cottonwoods are excellent wildlife trees, they begin dropping large branches at a relatively young age, making them a hazard and less suitable for planting in park restoration projects or near trails. The healthy abundance of alders in the area might lead one to believe the

population has relatively high genetic diversity. However, like other asexually reproducing species, alders produce clones through vigorous asexual reproduction (Operational Summary, 1997)—a characteristic which must be considered when assessing the diversity within populations and their resilience.

Bowker Creek culvert

Elliott Garden

Students from the Environmental Studies Program at the university are often eager to participate in restoration projects, many of which restore parts of the university campus. One Environmental Studies class—ES341 "Ecological Restoration"—created a garden within a fenced grassy area outside the Elliott Building. The area was enclosed by a split-rail fence and various amendments were added (e.g. leaf mulch) to create a more hospitable environment for native plants. Students designed several themes for the native plantings, some of which included: an edible berry patch, a Garry Oak meadow, and a Douglas-fir understory. The Garry Oak meadow was planted with 150 bulbs of Common Camas and Fawn Lily. However, an unfortunate delay in the installation of a rabbit-proof fence meant that about 100 young shrubs from the initial planting fell

University Students planting native shrubs in the Elliott Garden

to the rabbits. On a positive note, the initial planting day was turned into a successful community event, which saw the Provost of the university partake in the planting of a large Garry Oak seedling. Symbolic gestures, such as this, play an important role in the success of restoration projects, as they encourage project support from the broader community.

Garry Oak Meadow Experimental Plots

Just west of the Cedar Hill entrance of the campus is a grassy field enclosed by a split cedar rail fence. This field is an experimental site known as the Garry Oak Meadow Restoration Project, or "Quercus". An experiment to evaluate the effectiveness of various site treatments in establishing a Garry Oak meadow was set up in 2004. Nine different types of experimental plots were studied: control, mowing, tilling to a depth of 15 centimeters in early April, tilling in late July, early mulching with 30 centimeters of mulch, late mulching, solarising with clear polyethylene foil, scalping the top 15 centimeters, and scalping the top 15 centimeters with mulch added. Different planting densities were also tested. After several years, scalping with mulch seemed to give the best results. The University of Victoria Alumni Association adopted the site in 2008; and in 2012 it became the focus of restoration efforts by students in the Environmental Studies Program at the University of Victoria.

The Quercus Meadow

Upper Hobbs Creek

Hobbs Creek originates from Cedar Hill Cross Road drainage and passes through Mystic Vale, a large ravine on campus, before emptying into Cadboro Bay. Climbing many trees in the Upper Hobbs Creek area, English Ivy also covers large areas of the forest floor. For many years, both the university and countless students have been working to remove ivy from the area (UVic, 2003). This will be an ongoing problem that, as far as ecological restoration is concerned, can best be controlled but probably not eliminated. On December 19, 2006, a large windstorm swept across Vancouver Island and the lower mainland, causing extensive damage to trees (including over 1,000 downed trees in Stanley Park, Vancouver). Many tree tops were broken off throughout Mystic Vale and the South Woods. Added to the snags already found in the forest, these standing trunks will become valuable wildlife habitat.

Usually removed because they are considered to be a safety hazard or unsightly, snags are often in short supply in urban areas. While bird nest boxes and bat roosting boxes imitate snag habitat, they fail in replacing all of their functions.

Infestations of Witch's Broom are found in parts of the Upper Hobbs Creek forest. This deformity is created by a dense mass of shoots, with several causes, such as viruses, fungi, insects and the mistletoe plant.

Series 2. Silent Streams: Bringing Life Back to Victoria's Creeks

Cities contain valuable natural habitat that suffers constant pressures of urbanization. This 3-part series of interpretive restoration walks on "silent streams" examines what efforts are being made in Greater Victoria to restore "lost" streams and improve their value as natural habitat. Examples of restoration efforts taken on by local environmental groups, volunteers, the Capital Regional District and municipalities include: wattling (a bioengineering technique, which uses living plant material) to stabilize banks, removing invasive species, planting native species to improve riparian areas, installing log weirs to create pools and riffles, cleanups, releasing salmon fry, and the ultimate restoration practice—daylighting streams.

2.1 Bowker Creek

The Bowker Creek watershed has been in transition since the 1800s, when it was altered from its natural state to accommodate agricultural needs. Currently, Bowker Creek is used for a mix of residential, commercial and institutional purposes. Over the years, much of the original creek channel has either been straightened or enclosed in underground pipes. Today, only about 2.5 kilometers is still above ground. From its headwaters at the University of Victoria, the 8-kilometer main channel flows south through the Shelbourne Valley, meandering through neighbourhoods in Saanich, Victoria and Oak Bay, before entering the ocean near the Oak Bay Marina. Demonstration gardens, invasive species removal, and stream bank stabilization with wattles are just some of the restoration activities that can be seen across the watershed.

2.2 Cecelia Creek

Cecelia Creek drains a large urban area of about 900 hectares in Saanich and Victoria. The City of Victoria possesses the only unculverted 130-meter long section of the creek, which flows into the Gorge Waterway. Tidal waters inundate as much as one-quarter of its length. Fringed with a salt marsh, the 3.75-hectare Cecelia Creek estuary is the second largest estuarine mudflat in the Gorge Waterway. Cecelia Ravine Park flanks both sides of the creek between Burnside Road and the Gorge, and includes the only accessible portion of the creek. The creek faces many challenges, including industrial oil pollution, urban run-off from storm drains, and hardened shorelines. Restoration efforts are underway to improve water quality and habitat of Cecelia Creek.

2.3 Colquitz Creek

One-third of Saanich is drained by the salmon-bearing Colquitz River. Stormwater flows south from the Christmas Hill area into Swan Lake and north through Rithet's Bog. Both systems reach the Colquitz River, before draining into Portage Inlet and, eventually, the Gorge Waterway. Thousands of salmon fry have been released into Colquitz Creek over the years; and there have been numerous restoration projects to stabilize the stream bank and improve wildlife habitat.

2.1 Bowker Creek

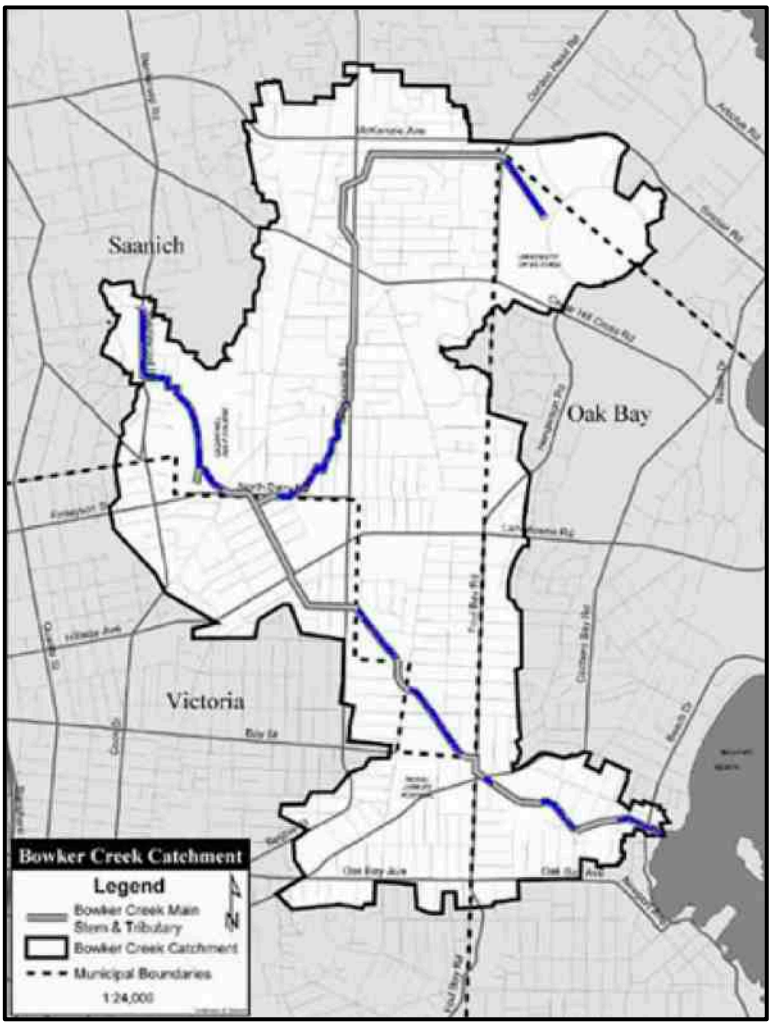
About

Bowker Creek begins as a wetland at the University of Victoria campus. It enters an underground storm drain system at Gordon Head, flowing parallel to westbound McKenzie Avenue and then southbound Shelbourne Avenue. It then cuts across Fort Street and Foul Bay Road, meandering through Oak Bay and eventually flowing into the ocean by Willows Beach and Glenlyon Norfolk School. Bowker Creek runs through 3 municipalities: Saanich, Victoria and Oak Bay. The majority of the creek—59 percent—is located within the limits of Saanich. Sculpin and stickleback fish live in the creek; and the waterbody once supported salmon and trout. Today, more than 50 percent of the water system is contained in pipes and culverts, leaving only about 2.5 kilometers of the stream channel above-ground. The creek was most recently culverted during construction of the Hillside Mall in 1965. With half the surfaces surrounding Bowker Creek being impervious and approximately 30,000 residents living in the watershed, Bowker Creek faces many restoration challenges (Friends of Bowker Creek, 2012).

First Nations and Early History

Bowker Creek is located within the traditional territory of the Songhees First Nation. During the 1800s and early 1900s, Bowker Creek was known in the Lekwungen dialect as "Kohweechella", meaning "where there are many fish" (Songhees Legacy, 2012). First Nations groups have lived in the area surrounding Bowker Creek for at least 5,000 years before present (BP), as evidenced by radiocarbon dating of shell middens at Willows Beach. In the mid-1800s, Scottish settlers began referring to the headwaters of Bowker Creek as "Cedar Plain", meaning open, flat grassland. An 1855 Hudson's Bay Company map marks the stream as "Tod's Stream". By 1861, Bowker Creek was unofficially—and quite grandly—being referred to as the "Thames", lending its name to a hotel on Richmond Road called "Richmond on Thames". It was James Douglas who recorded his impressions after visiting the creek with Lady Jane Franklin and her niece, noting the

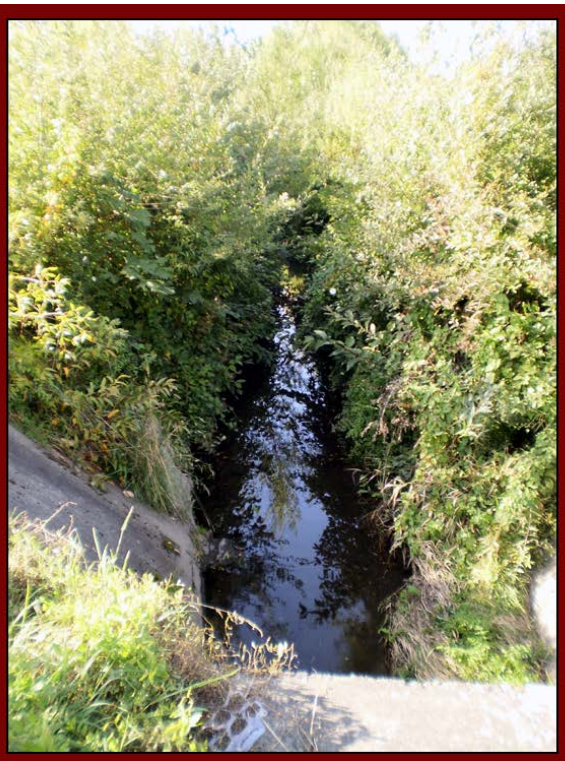
considerably high water levels and the river's resemblance to England's famous Thames (Hunter, 2005). Eventually, the council of Oak Bay decided to officially call the creek Bowker Creek, in honour of John Bowker, who received property beside the creek as a wedding gift.

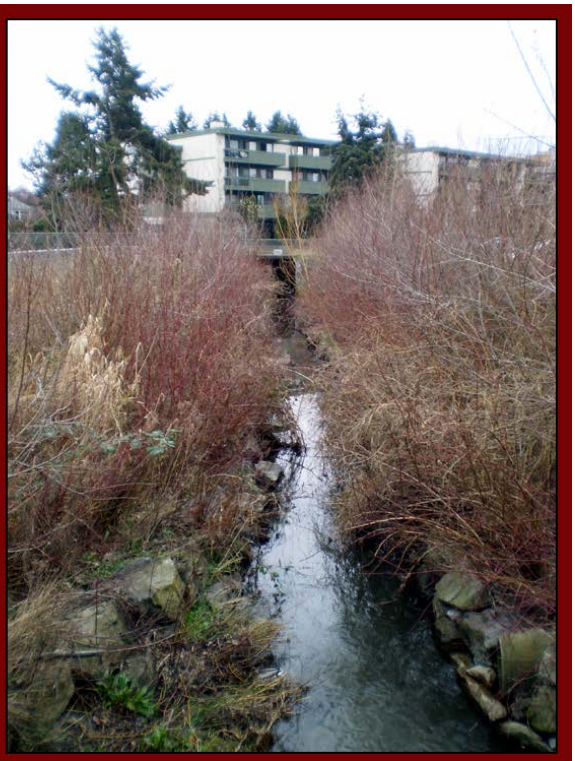


St. Patrick's Elementary School

Restoration Demonstration Site

This restoration demonstration site was created by the Capital Regional District in 2005 (Malmkvist, 2006). This area serves as an example to property owners what a more natural streamside property looks like and how to improve degraded areas of the creek. Because of its vulnerability to flooding, the site was included in the Capital Regional District Master Drainage Plan (Kerr Wood Leidal Associates Ltd, 2007).





Demonstration site at St. Patrick's School

Before restoration, this section of the creek had steep eroding banks, resulting in poor water and habitat quality. Restoration efforts included: reshaping the banks using heavy machinery, converting the new slope into terraces using the bioengineering technique of willow wattles, and re-vegetating the banks with native plants. The project involved St. Patrick's Elementary School students, the Bowker Creek Initiative and funding organizations. By 2009 (4 years after restoration), wattles had sprouted into healthy trees and native plants had grown so much, they partly obscured the channel.

Rain Garden

In September 2009 a rain garden was created in front of the St. Patrick's Elementary School parking lot. The rain garden, planted with native vegetation, filters stormwater before it enters Bowker Creek—a good example of low-impact development.

Rain Garden in parking lot of St. Patrick's School

Daylighting Opportunity

The Bowker Creek Initiative presented a potential daylighting opportunity to the Oak Bay Council in 2007. The proposal included the removal of the tennis bubble beside Oak Bay High School. In 2012, the daylighting project was incorporated into the redevelopment of the site. Not only did the project benefit Bowker Creek, it also created an educational opportunity for Oak Bay High School students.

Creek to Canal

Bowker Creek Park, located at St. Ann Street and Cranmore Road, is an example of a "beautification" project—turning the creek into a canal. The park provides more public access than other areas of the creek. An annual rubber ducky race takes place at St. Ann's creek, located within the park.

Bowker Creek Park

Monteith Street

Bioengineering Project

A bioengineering project beside Bowker Creek is a structurally sound example of erosion control along a stream bank, although Willow growth is variable

Willow wattles at the bioengineering project on Monteith Street

Allotment gardens at Monteith Street

(Completed Initiatives, 2008). This restoration effort illustrates an inexpensive, effective and ecologically sound way to control erosion, increase the presence of native plants and provide bank stability. Willow cuttings are typically involved in bioengineering, but Cottonwood and Dogwood cuttings can also be used (Polster, 2002).

Allotment Gardens

Adjacent to the bioengineering project at Monteith Street is an allotment garden. While this is a great example of community-based agriculture, runoff from the garden in such close proximity to the creek poses restoration challenges.

Flooding

Insufficient culvert capacity has resulted in overland flow through park and private property, including the flooding of 1741 Monteith Street in both November 1990 and January 2007.

Future Bioengineering Project

A vacant municipal lot adjacent to Monteith Street is perfect for bioengineering. The plan is to turn the area into a demonstration site and native plant hub.

Bowker Creek Stewardship Blitz

The Bowker Creek Stewardship Blitz is a community gathering, which takes place in 3 different locations: Saanich, Victoria and Oak Bay. The purpose of the stewardship blitz is to celebrate the watershed by removing invasive species and creating art prints (Bowker Creek,

Outflow of Bowker Creek near Glenlyon-Norfolk School

2009).

Bowker Creek Stewardship Online Pledge

The Bowker Creek Stewardship Online Pledge encourages community members to improve the Bowker Creek watershed through basic pledges, including: leaving your car at home one day of the week, gardening pesticide free, learning about and creating rain gardens, removing invasive species from your property, and washing your car on your lawn or at a car wash.

CommuniTea

CommuniTea is a tea party and informational event focused around the revival of Bowker Creek. Community members are invited to create mosaic stepping-stones to mark the lost creek.

Rubber Ducky Race

The Rubber Ducky Race is an annual community event, organized by the Friends of Bowker Creek Society and Oak Bay High School students. Community members take part in cleaning up the area and raise funds to support efforts rehabilitating Bowker Creek. Rubber ducks are sold for $2 and the winner of the rubber ducky race receives a prize.

Bowker Creek Greenways Project

The Bowker Creek Greenways Project strives to create greenways from the University of Victoria headwaters, through commercial and residential areas, all the way to the ocean at Willows Beach.

Bowker Creek Integrated Storm Management Plan

Participants in the Bowker Creek restoration walk

The Bowker Creek Integrated Storm Management plan provides the basis for making informed watershed management decisions. It addresses stormwater and rainwater management, riparian health, water quality, community use of the watershed, low-impact development, and flooding and erosion factors. The Bowker Creek Integrated Storm Management Plan is an example of a triple

bottom line approach as it addresses the social, environment and economic aspects of the watershed.

Bowker Creek 100-Year Vision

The Bowker Creek 100-Year Vision is a detailed implementation plan focused on developing engineering solutions for flooding and erosion (Bowker Creek Blueprint, 2010). Working with Andrew Weaver, Climatologist at the University of Victoria, the Bowker Creek Initiative incorporated climate change principles into its plan.

Water Quality Testing

To provide a baseline to which future tests can be compared, water quality at Bowker Creek is tested annually. Sampling of benthic invertebrates in 2008 revealed that the water and habitat quality of Bowker Creek is very poor, though, on a positive note, no pesticides were detected (Annual Report, 2008). It is hoped that, with low-impact redevelopment and better stormwater management practices, water and habitat quality of the creek can be improved.

2.2 Colquitz Creek

Part of the Colquitz River watershed, Colquitz Creek begins at Elk/Beaver Lake Regional Park, and weaves through many areas of Saanich (including the famous birdwatching grounds of Panama Flats). The creek eventually discharges into the Portage Inlet.

Colquitz Creek occupies 60 percent of Saanich and is one of Victoria's last salmon-bearing creeks for Coho and Chum Salmon. Unlike many streams in Victoria, none of Colquitz Creek is contained in culverts; and only approximately 20 percent of impervious surface surrounds it. However, many sections of the 10-kilometer long creek are highly degraded and the water quality is poor.

Salmon carcass at Goldstream Provincial Park

First Nations and Early History

Colquitz Creek is located on the traditional territory of the Saanich and Lekwungen First Nations. The Lekwungen word “colquitz” means “a stream tumbling down” (Paul et al., 1995). Historically, Colquitz Creek was surrounded by closed coniferous forest, Garry Oak ecosystem and healthy lakes. Salmon in Colquitz Creek was so abundant in the early 1900s that farmers used the

Headwaters of Colquitz Creek at Elk/Beaver Lake Regional Park

fish as fertilizer and could allegedly walk across the river, it was so thick with salmon.

Swan Lake Nature Sanctuary

Swan Lake was formed some 12,000 years ago, during the last glacial recession. Surrounded by marshy lowlands, it provides vital habitat for birds and small animals. Muskrats, river otters, minks, and other wildlife, make their homes in the marsh grasses, cattails and walls of the lake. Swan Lake drains into Colquitz Creek, eventually discharging into the ocean via the Portage Inlet. During the 1900s, Swan Lake was used as a dumping ground for raw sewage, dairy farms and a winery.

The main inflow stream, Blenkinsop Creek, enters at the northeast side of the lake, while the unique outflow stream, Swan Creek, is located to the southwest. Several storm drains empty into Swan Lake wetlands, and it is likely some of these once consisted of natural streams. The site can be classified in several general vegetation types and land cover. Invasive grasses are the dominant wetland vegetation type, followed by a tall shrub community (largely Willow and Red Osier Dogwood). With a large proportion of the site being flat, it is subject to flooding

Swan Lake Nature Sanctuary

from winter precipitation. Terrestrial ecosystems are also highly disturbed and contain a large proportion of invasive species. A mixture of old fields, shrub thickets, Garry Oak and conifer forest are found in these areas.

A clean-up effort began in the 1970s; and, today, the lake is protected as a nature sanctuary, and provides important habitat for wildlife. Although the District of Saanich owns the lake, the Swan Lake Nature Sanctuary Society has run the nature education centre as a charitable organization since 1975 (Restoration Projects, 2012). The society encourages people to develop an understanding and appreciation of nature, fostering personal stewardship for the natural environment.

Walkers on Swan Lake boardwalk

In 1984, a federal government program provided funding for a project in Swan Lake that removed garden shrubs and a gazebo, filled in a swimming pool with soil, created a trail system, and planted native plants salvaged from various development sites in Victoria. A lawn area was removed, which exposed bedrock underneath, creating an eroding rock wall for reptile habitat. In 2000, the Capital Regional District provided funding for a water-conserving irrigation system, including the creation of a pond and a drip fountain to receive water from the nature house roof. Future plans include planting more native plants and a butterfly garden.

Infiltration Area (789 Blackberry Road)

A stormwater infiltration area was constructed beside the parking lot of Christmas Hill Suites, an apartment building just north of Swan Lake and McKenzie Avenue.

Built by Aqua-Tex Scientific Consulting Limited, this site is a good example of low-impact development. The area provides infiltration for stormwater before it reaches Swan Creek—a tributary that eventually connects with Colquitz Creek. From the

Photo: Lise Townsend

Infiltration area

parking lot, run-off flows through a cut in the curb toward McKenzie Avenue, then through river rock (the infiltration area), before entering a small overflow catch basin, placed past a grass swale.

Willowbrook Subdivision (650 McKenzie Avenue)

Photo courtesy Cadillac Homes

Willowbrook Subdivision restoration area

Cadillac Homes, which built the Willowbrook Subdivision, won for both "Project of the Year" and "Environmental and Revitalization Achievement" from the Saanich Environmental Awards in 2002 (Environment, 2012). The awards acknowledged the company's work in rehabilitating the portion of Swan Creek, which runs through the 35-home Willowbrook Subdivision. Working in conjunction with Aqua-Tex Scientific Consulting Limited, it was determined the creek had deteriorated to a non-functioning state, placing at risk the entire watershed, including Swan Lake, Blenkinsop Lake and Colquitz Creek watershed. Cadillac Homes designated the area surrounding the creek as parkland and funded restoration efforts. Behind the homes, ponds were engineered, taking 100 percent of the stormwater from the neighbourhood, slowing it down and naturally filtering it before re-introducing it to the creek. Rocks, logs, and more than 40 species of plants were planted to restore the riparian vegetation. It is hoped that spawning salmon will eventually return to the area. Since the restoration efforts, a working equilibrium surrounding the watershed has been created—something not seen in more than 2 decades. However, the problem of invasive species, namely Himalayan Blackberry, still remains. Students from the University of Victoria, Saint Michaels University School, the Pacific Christian School, and volunteers from Saanich Tree Appreciation Day, were involved in plantings and removal of invasive plant species removal.

Capital City allotment gardens

Capital City Allotment Gardens (641 Kent Road)

One of the first community gardens in Victoria, Capital City Allotment Gardens is located beside Colquitz Creek. It serves as a great example of urban gardening and a potential restoration opportunity.

Quick's Bottom Park

Quick's Bottom Park, which covers about 19 hectares of the Colquitz Creek watershed, can be accessed from Markham Road or Wilkinson Road. The wetland was found to be functioning at risk, due to anthropogenic activities within the general watershed system (Malmkvist et al., 2005). Reed Canary Grass had heavily invaded the park, cutting it off from the Colquitz River, resulting in low dissolved oxygen levels. Riparian restoration work consisted of: restoring the historical inflows and outflows from the wetland to facilitate fish passage; enhancing fish and bird habitat; and achieving Proper

Functioning Condition (PFC) for the water system. Future monitoring efforts will include controlling the Reed Canary Grass, maintaining the open channel, and providing a variety of habitat for birds and fish.

Pebble Mosaics at Colquitz River Park

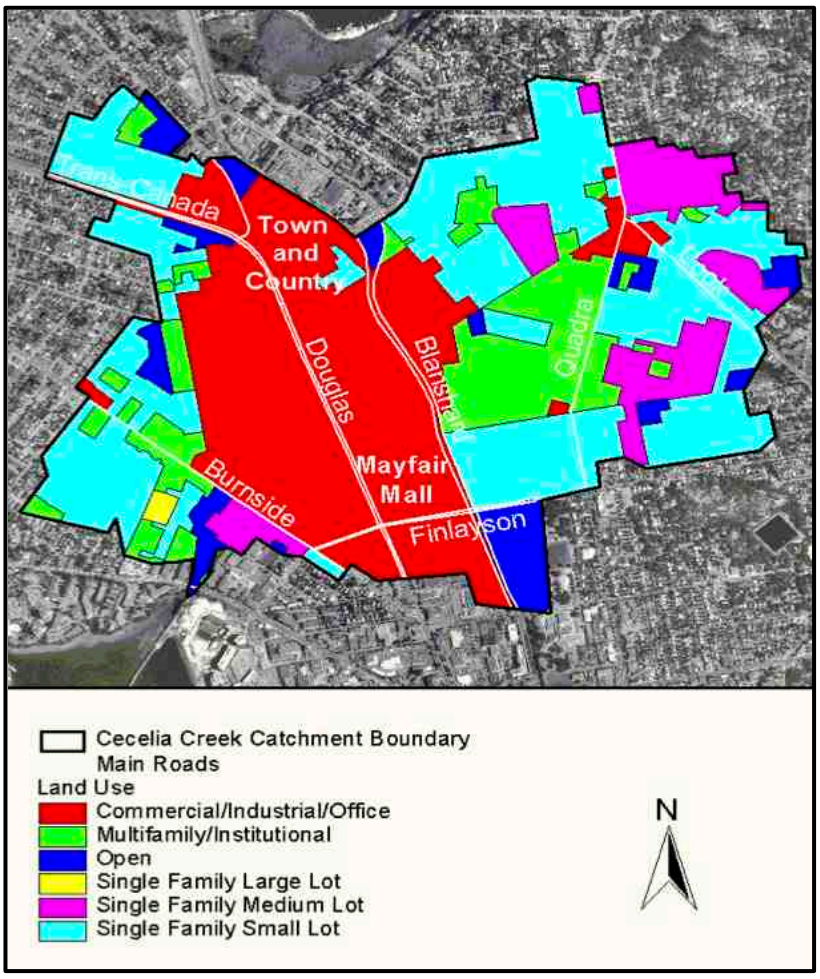
In 2009, with the help of local artists, Colquitz Middle School students created an environmental art project promoting awareness and stewardship of Colquitz Creek. Funded by the BC Arts Council, pebble mosaic artwork was embedded along the Colquitz River Park Trail. The mosaics can be viewed from the trail next to the creek.

Colquitz River Park

Colquitz River Trail System

In one of the first efforts to protect urban streams at a municipal government level, the Municipality of Saanich created the Colquitz River Trail System in 1967 (Colquitz River Trail, 2012). Saanich slowly began acquiring land surrounding the creek, and continues to do so today. Currently, the trail system starts at the George R. Pearkes Recreation Centre, passing through Cuthbert Holmes Park, Brydon Park and Elk/Beaver Lake Regional Park. It is anticipated the trail system will eventually include 25 kilometers of trails.

2.3 Cecelia Creek



About

Buried for the last 100 years, Cecelia Creek begins at Mount Tolmie Park and stretches across the municipalities of Victoria and Saanich. The creek loops around Mayfair Mall and Uptown Shopping Centre, eventually emptying into an estuary at Selkirk Trestle in the Gorge Waterway. With over 50 percent of auto-related businesses in Greater Victoria being located in the watershed, Cecelia Creek is likely the most polluted creek in Victoria and the Capital Regional District.

Cecelia Creek differs from other streams in Victoria as it endures intense flooding, is predominantly contained in culverts, and the area surrounding the creek is highly industrialized. Despite this, it receives less public attention than many other streams in Greater Victoria, such as Bowker Creek and Colquitz Creek (Cecelia Creek, 2012).

The area known as Cecelia Ravine encompasses about 4 hectares, including 3 city parks: Cecelia Ravine Park, Viaduct Park and Cecelia

Cove Park. Cecelia Creek faces many restoration challenges, including severe flooding, large amounts of sediment, pollution and contamination, invasive species and public safety concerns.

Daylight Project

Public attention for Cecelia Creek suddenly increased with the establishment of the Galloping Goose Regional Trail in 1996. In 1998, only a 200-meter section of Cecelia Creek remained above ground. When an area of the creek near Burnside Gorge Community Centre required sewage and storm drain replacement, it presented a restoration opportunity for daylighting a section of the creek. Interestingly, daylighting this particular section of the creek was found to be cheaper than replacing the culverts. In 2000, a 133-meter section of the creek in Cecelia Ravine Park was daylighted (Cecelia Creek Cleanup, 2012). Simultaneously, an art project with the words "Water is the Blood of the Earth" was created in the park.

Cecelia Creek

Daylighted area of the creek

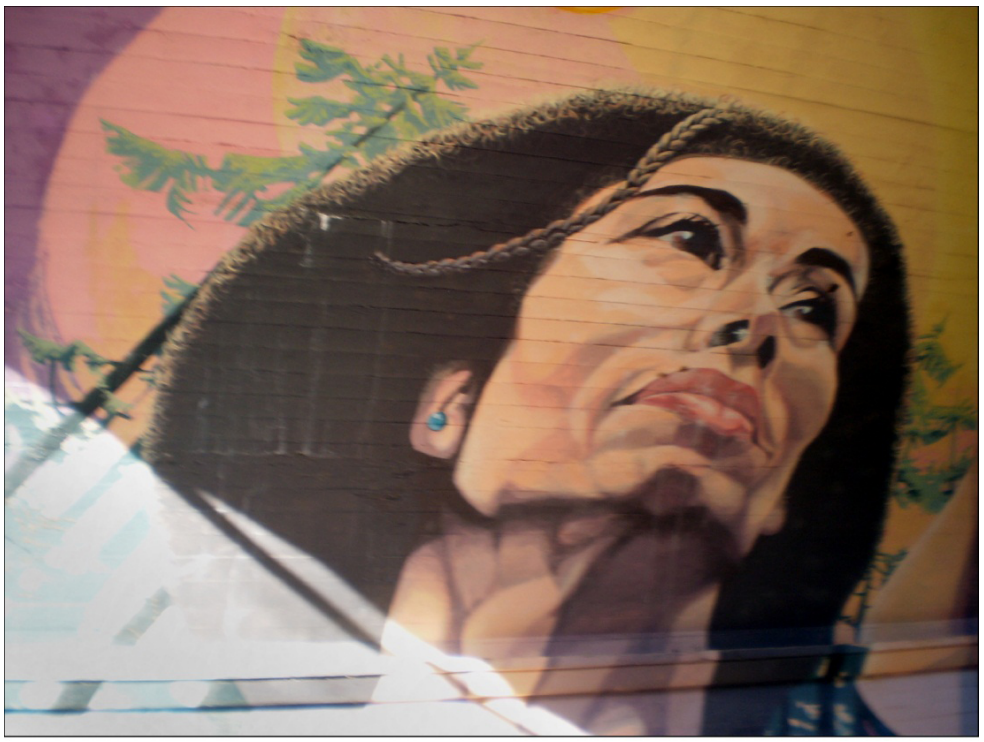
Mudflats, Estuary and Outflow

Cecelia Creek Estuary is 3.74 hectares, consisting mostly of mudflats but also marsh grasses. Cecelia Creek outflows into the Gorge Waterway, into one of the only mudflats in the City of Victoria. Mudflats are important habitat for migratory birds; at low tide, many birds can be seen feeding on infaunal invertebrates in the mudflats. Currently, this area is sufficiently surrounded by vegetation to keep domestic animals, such as dogs, from disturbing the mudflats.

The mudflats are a highly productive ecosystem—rich and diverse in plants, animals and microorganisms. Mudflats fulfill important ecological functions, such as filtering water and acting as a sink for carbon and sediment

The mudflats are a highly productive ecosystem—rich and diverse in plants, animals and microorganisms. Mudflats fulfill important ecological functions, such as filtering water and acting as a sink for carbon and sediment. The health of Cecelia Creek is particularly important because it empties into the Cecelia Creek Estuary, the second largest mudflat on the Gorge Waterway and one of the waterway's few remaining lengths of natural shoreline. Marine sediment contamination in the mudflats includes mercury, zinc and hydrocarbons. The input of large volumes of contaminated sediments can destroy insect habitat and smother the eggs of any possible fish stocks.

Cecelia Creek estuary mudflats at high tide



Galloping Goose Regional Trail mural, adjacent to Cecelia Creek

The following invertebrates can be found in the Cecelia Creek Estuary: Bent-nosed Clams, Littleneck Clams, Nereid Worms, Heart Cockles, juvenile crabs, Piddock Clams, and anemones. Numerous species of birds and a large family of river otters are also common residents of the estuary. Eelgrass beds growing in the estuary provide important habitat for juvenile fish, such as Herring, Cutthroat Trout and Coho, in their early marine life history stages.

Water Quality

The stream quality of Cecelia Creek is very poor. Fecal coliform data collected by the Capital Regional District consistently shows the presence of sewage (Cecelia Creek Cleanup, 2012); and it is not uncommon to see toilet paper and feces in the stream, especially during storm events. Containing over 400,000 fecal coliforms (FC/100 mL), the creek is not suitable for primary contact; yet it is not uncommon to see dogs swimming in the creek and children playing in and around it. Sewage overflow and contaminants have contributed to high pH levels, as well as mercury and nitrates in the waterbody.

Storm drain near daylighted area of Cecelia Creek

With more than half of Greater Victoria's auto-related businesses located within the watershed, contaminants such as soapsuds, paint, toxins and oil residue flow directly into the creek. Tubifex Worms or "sewer worms" have been found in the creek, sometimes in such abundance they can form patches 2 meters wide. Some of the storm drains around Cecelia Creek are more than 100 years old and built out of brick, which has caused cross-connections of sewage and storm pipes. Large amounts of sediment also enter the creek, producing further problems for restoration. When the bylaw to smoke outside of restaurants and other establishments was implemented, the amount of cigarette butts in the creek increased exponentially. Not only can wildlife mistake them for food, cigarette butts also spread


Visible pollution in Cecilia Creek

carcinogenic pathogens, such as formaldehyde, hydrogen cyanide, benzene and other toxic emissions into the water.

Ecology and Invasive Species

Cecelia Ravine riparian area overrun by invasive plants

Cecelia Ravine consists of 4 distinct ecosystems, including an intertidal estuary, riparian areas, woodland and vegetated banks. The riparian zones of the stream are particularly degraded. Cecelia Creek is heavily overrun by invasive plants such as English Hawthorn, English Holly, English Ivy, Traveler's Joy Clematis, Himalayan Blackberry, Reed Canary Grass, thistles, Oyster Plant and Golden Willow. In addition, the creek is home to invasive plants that can be hazardous to humans and have potential toxic effects on the surrounding ecosystem, including Common Laburnum, Nightshade, Creeping Buttercup and Poison Hemlock. The riparian areas of Cecelia Ravine lack the energy and nutrients required for healthy benthic macroinvertebrate populations. In other words, no bugs or fish live in the creek.

Burnside Gorge Community Centre

Burnside Gorge Community Centre

The Burnside Gorge Community Centre opened in September 2007 and is an award-winning Gold LEED building. This means the community centre is certified for its sustainable design, construction and operation. Built on the embankment of

Native plant garden

Cecelia Ravine Park (set into the hillside), the concrete structure boasts the first accessible green roof in the province. Not only does the green roof provide a pleasant and educational experience for visitors, it also minimizes water runoff into Cecelia Creek. A total of 24 different Garry Oak ecosystem species form a self-sustaining ecosystem, with good drainage and high moisture retention, requiring minimal maintenance. The exterior of the building is equipped with bike racks, a permeable parking lot, native plant gardens and interpretive signage. Other sustainable features include: heat recovery, high thermal mass, energy efficient lighting, natural ventilation, light pollution measures, and stormwater control.

Bike racks at the Centre

The non-profit Burnside Gorge Community Centre is also a registered charitable organization. Its purpose is to encourage a preventive approach to the maintenance and improvement of social conditions in the Burnside Gorge community. Because Cecelia Creek, including Cecelia Ravine Park, comprises some of the only green space within the community, the centre has taken an active role in rehabilitating the creek for community use (Cecelia Creek Cleanup, 2012).

Stop Leak Program and BMPs

To enforce better clean-up standards for auto companies within the Cecelia Creek watershed, in 1999 the City of Victoria and Capital Regional District began a Stop Leak Program (Current Initiatives, 2012). Best Management Practices (BMPs) were distributed throughout the automotive sector, including auto recyclers, auto maintenance and repair shops, service stations, car washes, the business sector and auto detailing centres. Auto sector BMPs include educating businesses, employee training programs, inspection of facilities for maintenance of oil/water separators, catch basins, and

landscaping. In total, 35 businesses are involved. The Stop Leak Program encourages people to deal with car leaks immediately, even subsidizing 25 percent of the repair.

Future Restoration Efforts and Public Consultation

Cecelia Creek may never be returned to the state it was in 100 years ago; but rehabilitation efforts can at least improve the ecological integrity of the creek. In 2010, public consultation with park users helped determine management objectives for the area. Currently, the park is not meeting its potential as a successful public green space for many reasons, including maintenance, use patterns, safety concerns, facilities, invasive plants and topographical constraints. In the last 30 years, development objectives have included providing space for passive use and enhancing the natural environment. These objectives have yet to be realized.

There are many options for restoration in Cecelia Creek—all satisfy different objectives, ranging from improving water quality for aesthetic appeal to bringing back salmon. If the objective of a restoration project is improving the ecological integrity of the creek, efforts might address the volume of pollution and sediment, water quality issues, and build the riparian areas to attract wildlife. If the objective of a restoration project is enhancing the accessibility of the park to the public, efforts might address the safety and aesthetics of the park.

Participants of Cecelia Creek restoration walk

Interesting Facts

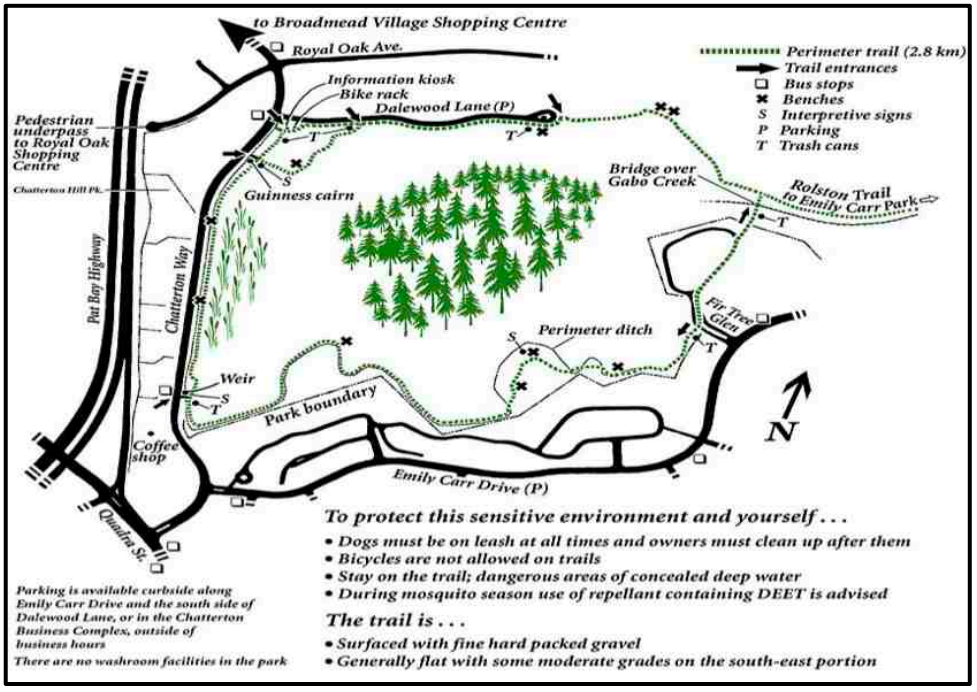
- The total impervious surface area in the watershed of Cecelia Creek is 63 percent, which is considerably higher than what researches shows as healthy for water systems.
- A third of Cecelia Creek is located in Victoria and two-thirds in Saanich.
- Cecelia Creek is likely the most contaminated creek and storm drain in Victoria and the Capital Regional District.
- Cecelia Creek has been tested for the following pollutants: fecal coliforms, metals (cadmium, copper, lead, mercury and zinc) and hydrocarbons.
- Since the creation of the Galloping Goose Regional Trail in 1992, more social and political attention has been paid to Cecelia Creek.
- Cecelia Creek watershed is 353 hectares or 872 acres.
- In 1998, Cecelia Creek was 212 meters long. Since the daylighting of Cecelia Ravine Park, the creek has gained an additional 134 meters, for a total of 345 meters.
- Blue-green algae obtain nutrients directly from sewage in Cecelia Creek and can be hard to identify.
- Public safety issues in the park include drug-dealing and homelessness. In fact, police have proposed vegetation be removed to eliminate areas for hiding.

Series 3. Wetland Wonders: The Stories of Two Wetlands and a Breakwater

Wetlands are areas saturated with soil and include bogs, fens, swamps and marshes (both freshwater and saltwater). Along with estuaries, they support the greatest amount of biodiversity of all ecosystems. In the past, wetlands and cities didn't mix, with wetlands often drained to make room for buildings and roads. Today, however, wetlands are increasingly seen as an integral part of low-impact development. Developers are now making wise use of them in managing water on the landscape—e.g. allowing rainwater to infiltrate into the ground, as opposed to collecting in pipes. Integral to maintaining healthy ecosystems in the region, wetlands also play an important role in stormwater management and assist in removing toxins from urban runoff.

3.1 Rithet's Bog

Rithet's Bog is part of the watershed of Gabo Creek, which forms part of the Colquitz Creek watershed. In addition to the bog, the site has wet meadows, marshes and a bog forest. Donated to Saanich in 1994, it is protected as a Saanich Park: the Rithet's Bog Conservation Area. Stewardship of the bog is led by the Rithet's Bog Conservation Society. Several rare plant species can be found here, including Purple Sanicle.



3.2 Viaduct Flats

When a beaver constructed a dam in 1993, it transformed the former agricultural land into a unique wildlife habitat and Viaduct Flats was born. Over the years, the Horticulture Centre of the Pacific, the Victoria Natural History Society and the Municipality of Saanich have been working to improve the marsh through wetland restoration efforts.

3.3 Esquimalt Lagoon

Part of the Coburg Peninsula, Colwood's Lagoon Road is built on a spit, one continually being reshaped by ocean currents and the sediment they carry. Esquimalt Lagoon was formed over 13,000 years ago when an ice sheet retreated, leaving a large depression that then flooded with seawater. The area is home to a special variety of plants able to withstand shifting sand, high saline conditions, water shortages and severe winds. The spit is a sand dune and has been an active area for dune restoration projects. Esquimalt Lagoon is also a migratory bird sanctuary. Some past restoration efforts have targeted fringe marsh ecosystems and Bee Creek.

3.4 Ogden Point Breakwater

Though the famous oceanfront walk along Dallas Road reveals stunning ocean scenery, the Ogden Point Breakwater allows visitors to get an even closer view of the surrounding marine environment. Peering over the edge of the breakwater, one can find barnacles, sea stars, jellyfish, kelp and more. This walk explores the natural history of the breakwater and foreshore, as well as what is being done to restore the underwater protected area, so rich in marine life.

3.1 Rithet's Bog

About

Rithet's Bog, which is part of the Colquitz Creek drainage system and Gabo Creek basin, is managed by Saanich Parks and Recreation, Ducks Unlimited and the Rithet's Bog Conservation Society. The 38-hectare site is arguably no longer a bog, as only one small patch of Sphagnum (Peat Moss) exists today. This important habitat area features Shore Pine forests, wetlands, developing fens, Garry Oak ecosystems, grassy meadows,

Purple Sanicle Beds at Rithet's Bog

Eastern and Western Cattail at Rithet's Bog

Douglas-fir and Cottonwood stands and shrub swamps. The "bog" is also home to endangered species such as Purple Sanicle, the Vancouver Island Ringlet Butterfly and Beggarticks (Hartwell, 2006).

The bog was purchased by Robert Patterson Rithet in 1983, and was used for agricultural production. After years of farming, the land was donated to Saanich, in 1994 (Human History, 2012). Since 2002, a bog restoration project has been underway, including the installation of a weir for water control, removal of invasive species, and a monitoring program.

Eastern Cattail Removal Pilot Project

Western, eastern and hybrid Cattail grow at Rithet's Bog. The eastern and hybrid varieties can become extremely dense, choking out habitat for birds.

Willow Removal

Part of the bog restoration project included clearing invasive Yellow Willow to keep it from taking over the natural habitat of Chatterton field.

Ducks Unlimited Weir

Ducks Unlimited, in partnership with Saanich, installed a weir at the western side of Rithet's Bog to control water, block run-off and maintain water levels (Hartwell, 2006).

Ducks Unlimited weir

Species at Risk Restoration

Purple Sanicle is a provincially red-listed species, which still exists at Rithet's Bog, but is threatened by Scotch Broom, Himalayan Blackberry and invasive grasses.

3.2 Viaduct Flats

About

Part of the Pacific Horticulture College and The Gardens at HCP, Viaduct Flats is a series of wetlands and forested areas. Once covered with ice, after the glacial recession the area became a shallow ocean, then freshwater lake, then marsh. Viaduct Stream flows into surrounding wetlands, eventually discharging into the Colquitz Creek drainage system.

Photo: Hoke Holcomb

Viaduct Flats

The area is protected by a covenant agreement, as it is a major waterfowl stop, home to Red-tailed Hawks, Peregrine Falcons, Osprey, Bald Eagles, Great Blue Herons, American Coots, Canada Geese and more (Carson, 1996).

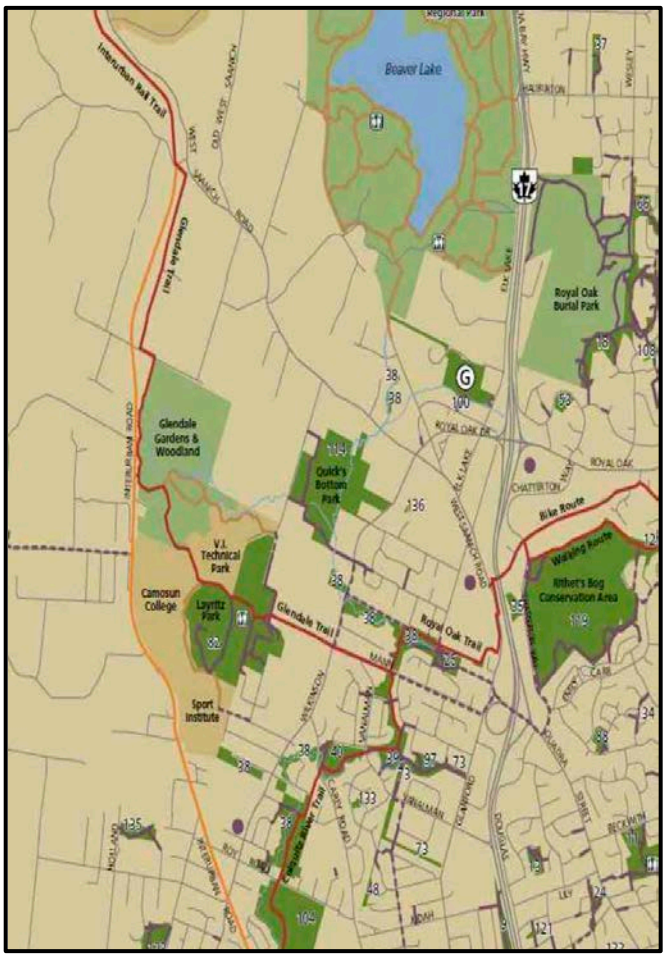
Photo: Hoke Holcomb

The transformed wetland

Viaduct Flats was created when a beaver dammed Viaduct Creek in 1993. The dam transformed the former agricultural land (mainly potato farming) into a unique wildlife habitat. The Horticulture Centre of the Pacific, The Gardens at HCP (formerly Glendale Gardens & Woodland), the Victoria Natural History Society, and the Municipality of Saanich have been restoring the wetland over the years to improve the marsh (Invasive Species, 2009). The goal for the site is to create a self-sustaining conservation park, focused on facilities, gardens, wetlands, sensitive terrestrial habitat, forestry, agroforestry, and agriculture.

Photo: Hoke Holcomb

Potato farming at Viaduct Flats before the site was flooded



Map courtesy CRD

The Horticulture Centre of the Pacific

The Horticulture Centre of the Pacific Society was established in 1979 to promote horticultural practices. It started by establishing pavilions and agricultural demonstration fields on the 62-hectare Crown land site. Prior to the mid-1990s, the organization was funded by industrial support contingent on matching funds from government agencies. However, matching funds were not obtained, and the society became a group of horticulturalists focused on developing demonstration gardens and training horticulture workers (A Brief History, 2011).

Interurban viewing platform

Interurban Viewing Platform

In September 2006, the Horticulture Centre of the Pacific, Victoria Natural History Society and the Southern Island Contractors Association constructed the Interurban

viewing platform. The addition of a parking lot improved public access to the site. The viewing platform both increases visibility of the site and provides a venue for environmental education—all while protecting sensitive habitat.

Trumpeter Swans at Viaduct Flats

Birding at Viaduct Flats

Viaduct Flats has always been a popular area for birdwatching, especially since bird activity increased in 1993 after the beaver dam created a large wetland from what used to be an agricultural field (Carson, 1996).

Swamp Sparrow, Ruddy Duck, Ring-necked Duck, Cinnamon Teal, Wood Duck and many more species have been spotted in the area. The Victoria Natural History Society reports as many as 16 species of waterfowl have been spotted in a single day; and more than 1000 individual birds have been seen at one time at the site.

Constructing the fish-passable weir at Viaduct Creek

Fish-Passable Weir and Creek Restoration

As mentioned earlier, in 1993—soon after the agriculture lease on the land expired—a beaver dammed Viaduct Creek at the downstream end of the flats (Ecologically Sensitive, 2004). Water remained during summer and winter, increasing bird activity and turning the flats into an overnight migratory waterfowl sensation. Today, a weir system

Reed Canary Grass at Viaduct Flats

installed on the east side of the property provides the same function as the beaver dam. Birding observations in the mid-1990s indicated a greater diversity and abundance of water-based birds on a year-round basis than any other site on southern Vancouver Island. A covenant agreement was developed to ensure preservation of the site.

Spring-fed Viaduct Creek is a tributary of the Colquitz River. The weir system is fish-passable; and, indeed, salmon come as far up the river as Quick's Bottom. Restoration efforts are focused on placing large woody debris in the creek to help slow water and reduce bank erosion. The hope is to return salmon to this area of the creek.

Marsh restoration at Viaduct Flats

Forest Restoration

The Gardens at HCP has been working to restore the forest surrounding Viaduct Flats. The core reforestation principle is to establish 3 forest corridors to connect 6 isolated patches of second growth Douglas-fir forest. From 2000 to 2002, 5,259 trees were planted; however, less

than half of the trees survived. This was due to the fact commercial reforestation techniques were used, with no pre-planting site preparation, tree protection or follow-up watering and weed control. An additional 3,655 trees have been planted since 2003. Thanks to pre-planting invasive plant control, good tree protection, and post-planting watering and weeding, more than 90 percent of these trees survived.

Himalayan Blackberry and Scotch Broom

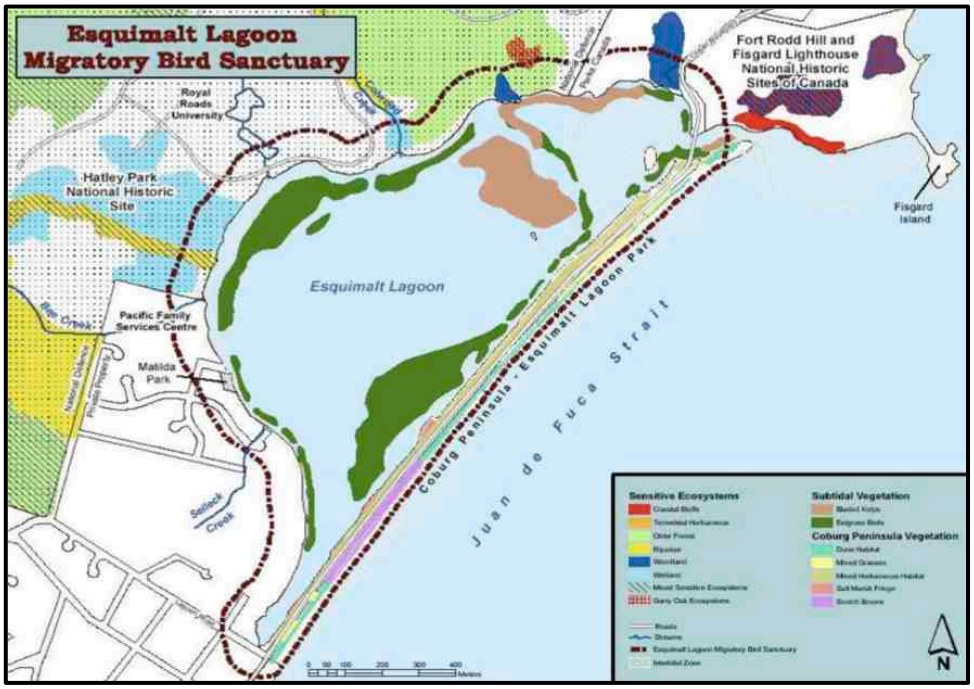
Invasive Species Control

Invasive species such as Himalayan Blackberry, Scotch Broom and Reed Canary Grass heavily invade Viaduct Flats. Since 2000, efforts to remove these unwanted species have been underway, including replanting with native species.

3.3 Esquimalt Lagoon

About

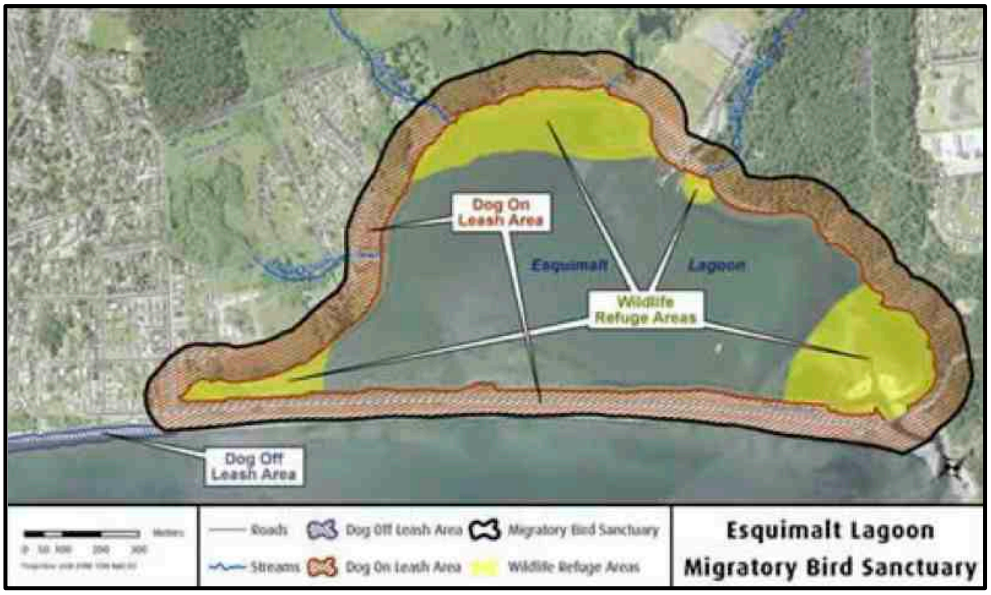
Part of the Coburg Peninsula, Colwood's Lagoon Road is built on a barrier spit continually being shaped by ocean currents and the sediment they carry. Esquimalt Lagoon was formed more than 13,000 years ago after an ice sheet retreated, leaving a large depression which later flooded with seawater (Esquimalt Lagoon, 2011). The area is home to a special variety of plants capable of withstanding shifting sand, high saline conditions, water shortages and severe winds.



Map courtesy CRD

Esquimalt Lagoon

Located on the traditional territories of the Songhees and Esquimalt First Nations, Esquimalt Lagoon is an important urban area and a Federal Migratory Bird Sanctuary, supporting a diverse community of plants and animals (Migratory, 2012).



Map of Wildlife Refuge Areas at Esquimalt Lagoon

Federal Migratory Bird Sanctuary

Esquimalt Lagoon is one of 7 Federal Migratory Bird Sanctuaries in British Columbia (Migratory, 2012). More than 300 feet of terrestrial buffer surround the waterbody; however, heavy recreation use—including motorized and non-motorized aquatic activities—and a long "commuter" road running through the area contribute to restoration challenges. Since 2009, Wildlife Refuge Areas have been established within the lagoon to prevent disturbances to birds. Although most Great Blue Herons in Canada migrate south for winter, many make this area their year-round home. The largest and most distributed heron, adults stand up to 1 meter in height.

A wealth of different bird species at the Lagoon

Juvenile seagulls at Esquimalt Lagoon

Dune Restoration Sites

The Esquimalt Lagoon Stewardship Initiative (ELSI) received a grant

from the Evergreen Foundation in 2006 to complete a pilot dune habitat restoration project on the Coburg Peninsula (Background, 2012). Native dune habitats were restored in a variety of plots. To raise awareness, an education program accompanied the project. To reduce trampling of important dune species, paths and access points to beaches were realigned. Beach Pea, a plant that produces inedible pea pods, is one example of a species found only in dune ecosystems. Beach Pea is often found growing in association with Gumweed, Sea Rocket and Beach Dunegrass, and is extremely sensitive to trampling.

Typical view of the beach

Bee Creek restoration project

Fringe Marsh Ecosystems

Fringe marsh ecosystems are found at Esquimalt Lagoon and provide birds with food, shelter and nesting habitat. They act as natural buffers, filtering contaminants from urban runoff.

Bee Creek

Efforts are underway to restore this ecosystem, with hopes that it will contribute to the reduction of algal blooms and associated fish die-offs. Unfortunately, algal blooms and fish kills have been prevalent at the lagoon in recent years.

Bee Creek Restoration

Bee Creek is a small stream that feeds into Esquimalt Lagoon. Efforts are underway to restore the upper portion of the creek and increase the overall health of the lagoon in hopes Coho and Chum

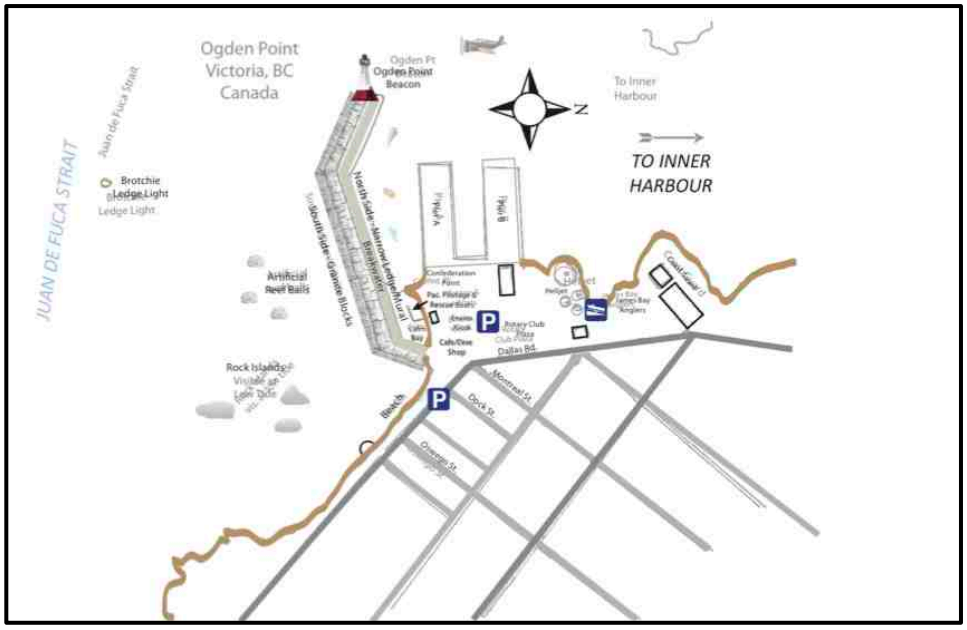
Salmon will return to this creek (Bee Creek, 2012).

Esquimalt Lagoon Stewardship Initiative

ELSI is a coalition of community, environmental groups, government agencies and First Nations, working together to protect the Coburg Peninsula (Background, 2012). ELSI works to protect, enhance and restore the health of the lagoon for present and future generations of people, plants and animals through a variety of measures, including: promoting lagoon stewardship and education; preventing further loss or destruction of habitat and wildlife; reducing contamination; and promoting environmentally protective recreation and restoration efforts, as well as environmentally protective land uses of the Esquimalt Lagoon area.

3.4 Ogden Point Breakwater

The Ogden Point Breakwater was discussed earlier as part of a restoration walk of James Bay. However, it is a very interesting place and is described here in more detail as its own restoration walk.



Map of Ogden Point Breakwater

About

Part of Victoria Harbour, the 762-metre breakwater faces the Juan de Fuca Strait and Olympic Peninsula and is a designated Federal Migratory Bird Sanctuary (Ogden Point, 2009). Rich in natural history and marine species, the point was constructed between 1914 and 1918 from granite blocks originating from Hardy Island. The area supports a large diversity of sea life including Bull Kelp forests. It is known as one

of the best spots for scuba diving in all of Canada, attracting a wealth of visitors annually (Schaefer and Schaefer, 2010).

Photo: Scott Stevenson

Giant Pacific Octopus, which can be found at the Ogden Point breakwater

The Giant Pacific Octopus is the largest octopus in the world and has been recorded weighing up to 600 pounds. Part of the mollusc family, it is an incredibly smart creature, known to mimic a rock for protection and move objects to build shelter.

In 2009, to honour the Salish Nations, the Greater Victoria Harbour Authority sponsored an enormous mural on the inner wall of the

First Nations mural at Ogden Point breakwater

Ogden Point breakwater. Na' tsa' math, the Unity Wall mural project was carried out in two phases. Over the course of two years, established First Nations artists, Butch Dick of the Songhees Nation and Darlene Gait of the Esquimalt Nation, mentored young emerging artists in creating a public art piece spanning the length of the breakwater (The Canvas, 2012).

First Nations mural at Ogden Point breakwater

Double-crested Cormorants, like the one below, can often be seen from the breakwater with their wings outstretched—a pose that helps them dry their feathers, which easily get wet due to poorly developed oil glands.

Double-crested Cormorant

Deploying reef balls off Ogden Point

Earlier in the book we mentioned almost 100 reef balls were submerged off the outer edge of the breakwater to create habitat complexity (Ogden Point, 2012). Shown here is one of the reef balls being placed into the water from the boat.

Series 4. Restoration Highs and Lows

The urban environment, particularly those areas with major changes in elevation, poses many challenges to natural ecosystems. Ravines and valleys contain creeks that are used to carry away rainwater from our streets and buildings, resulting in heavy water flows in winter that scour creek bottoms and erode banks. Hills are prime areas for residential development and recreational use, leading to habitat destruction and the introduction of invasive species. This section describes a ravine and 2 mountains in Greater Victoria, the challenges they face, and current restoration initiatives. Come see the issues firsthand, as well as what is being done to restore them.

4.1 Mystic Vale – Hobbs Creek

Located on the University of Victoria campus, Mystic Vale is a ravine formed by Hobbs Creek. Regular flooding from storm drains has made the upper part of the creek uninhabitable for fish. Furthermore, regular flooding has created major slope stability issues and silted the lower reaches of the creek. Mystic Vale is also heavily infested with invasive plant species. Restoration efforts include stabilizing the creek's banks and altering the pond structure to allow for riparian growth and recreational use.

4.2 Mount Tolmie

Mount Tolmie is a site being restored by the Mount Tolmie Conservancy Association (MTCA) and the District of Saanich's Garry Oak Restoration Project (GORP). MTCA volunteers began restoration work in the fall of 1994 and the MTCA officially became a society in September of 1995. The MTCA has been engaged in stewardship of this park for nineteen consecutive years, and is one of the longest running restoration projects in the region.

Mount Tolmie restoration challenges include invasive species, garden species, and human impacts. Although controlled burning is a recommended practice in restoring Garry Oak ecosystems, it is not permitted within the municipality because of the potential danger. However, in 2005, a fire on the mountain provided an interesting opportunity to observe what role controlled burning could have here.

4.3 Mount Douglas – Douglas Creek

Mount Douglas, like Mount Tolmie, is a GORP site. Restoration has focused primarily on invasive species removal and monitoring on the summit. High populations of European rabbits pose challenges to native species plantings. This walk, led by a member of the Friends of Mount Douglas, showcases restoration activities that have taken place at this popular recreation site.

"Restoration Highs and Lows" walking map of Mount Tolmie and Mystic Vale

Novel Ecosystems

Novel ecosystems result from human disturbance. The introduction of invasive species and extirpation or extinction of native species creates new communities never seen before in nature (Bridgewater et al., 2011). Similarly, climate change and the disruption of natural nutrient cycles further contribute to unique forms of ecosystem function. Both Mystic Vale and Mount Tolmie are perfect examples of novel ecosystems. The abiotic and biotic conditions of Mystic Vale are both altered to the point where restoration is difficult and/or impossible.

Attempts to deal with siltation in Hobbs Creek have had limited success. Extensive patches of English Ivy are so established that, realistically, they can only be managed, not eradicated. It is clear, this stream and its associated ravine need to be recognized as a novel ecosystem.

Mount Tolmie is a Garry Oak ecosystem impacted by encroaching development (Mt. Tolmie, 2012). It has a road through it, a parking lot and extensive established invasions by species such as Scotch Broom and Daphne-laurel.

4.1 Mystic Vale – Hobbs Creek

About

Mystic Vale is a 4.7-hectare area, acquired by the University of Victoria in 1993 (UVic Campus Plan, 2003). The vale straddles 2 cities: the portion in Saanich is protected in perpetuity, while the Oak Bay portion is identified as a Natural Protected Area, with a 10-year development moratorium. In 1993, Aqua-Tex Scientific Consulting Limited prepared a management plan for the site. The plan was updated in 2009 as the "Hobbs Creek–Mystic Vale Five Year Plan" (Aqua-Tex, 2009).

Photo: Aqua-Tex Scientific Consulting, 2010

Removing silt from Galimberti Pond at the mouth of Mystic Vale

Mystic Vale is a ravine formed naturally by Hobbs Creek. Normally, it would have mature Douglas-fir on its slopes, Bigleaf Maple along the floor by the creek, and a year-round flow fed by groundwater recharge. Instead, the creek's hydrology has been altered by extensive impervious surfaces throughout the watershed. It now dries up in summer because of an absence of groundwater recharge. A large storm drain at the top of Mystic Vale regularly sends floods through the ravine, scouring the stream bottom and eroding the banks. Extensive

use of the ravine by walkers and off-leash dogs has led to serious compaction of the ravine floor. Invasive species, especially English Ivy, dominate the forest floor.

Environmental Studies students installing a wattle of Pacific Willow and Red Osier Dogwood to repair a weir on Hobbs Creek

Mount Tolmie has long been maintained as a cultural landscape by the Coast Salish people. Its Garry Oak ecosystem would otherwise have disappeared long ago, succeeding to a Douglas-fir forest, which is the climax community for this area. Mount Tolmie has been invaded by Scotch Broom, Daphne-laurel and other invasive species, preventing the natural ground cover of Common Camas and other meadow flowers from re-establishing. Restoration in Mystic Vale has included constructing weirs to capture silt, installing wattles to stabilize the banks of Hobbs Creek, removing invasive species, and installing signage to reduce the impact of compaction and erosion from heavy use by hikers and off-leash dogs.

CJVI Lands – Cedar Hill Corner

Photo: Cronin & Naumann, 2009

View of the orchard on the CJVI lands on the University of Victoria campus

In Greater Victoria there is considerable interest in urban agriculture, organic farming and the slow food movement. There are many areas where farming is an integral purpose in restoring a landscape. This creates hybrid landscapes of agricultural and natural areas. The Cedar Hill Corner land, once an apple orchard, is now being considered in the short-term for agricultural use by students.

Garry Oak Meadow Restoration Project

This project was mentioned earlier when we described a restoration walk of the University of Victoria Campus. We will also pass by the Garry Oak meadow at the entrance to the campus by Henderson Road to see what has happened at the site. This 3,500-square-meter site was used as a field experiment to test the effectiveness of site preparation techniques and planting combinations to restore Garry Oak meadows. Site preparations included mowing; early till in April; late till in July; early mulch, with a 30-centimeter layer; late mulch; solarization; scalping a 12-centimeter layer of sod; scalping a 15-centimeter layer of sod and adding 15 centimeters of mulch; and a control with no site preparation. Planting treatments included seeds and seedlings of 14 species of Garry Oak meadow flowers. Results showed mulching and till were most effective in reducing plant cover when compared to scalping and solarization. Common Camas, Shooting Star and Fawn Lily were the most successful species planted and occurred in all plots.

Photo: Bein & Eastman, 2006

University students planting a mulched plot in the Garry Oak Meadow Restoration Project

4.2 Mount Tolmie

About

In the early days of Victoria, Mount Tolmie was used as parkland. This changed in 1958 when Mayfair Drive was re-routed; and the park, equipped with parking and paths. Further changes included the construction of a reservoir in 1967 (Lock, 2011). Although some of the original vegetation on this 18-hectare site remains, there are many invasive species, garden species and human impacts. Through site

stewardship by MTCA and GORP, many invasive species and some garden species (planted in the 1960s) have been removed; and some areas have been restored with native plants. The restoration work conducted by the MTCA now covers over ten hectares. Although controlled burning is a recommended practice in restoring Garry Oak ecosystems, it is not permitted within the city because of the obvious danger it presents. However, in 2005, a fire burned through Mount Tolmie, which provided an interesting opportunity to observe what role fire could have here (Cronin and Naumann, 2008).

Photo: Cronin & Naumann, 2008

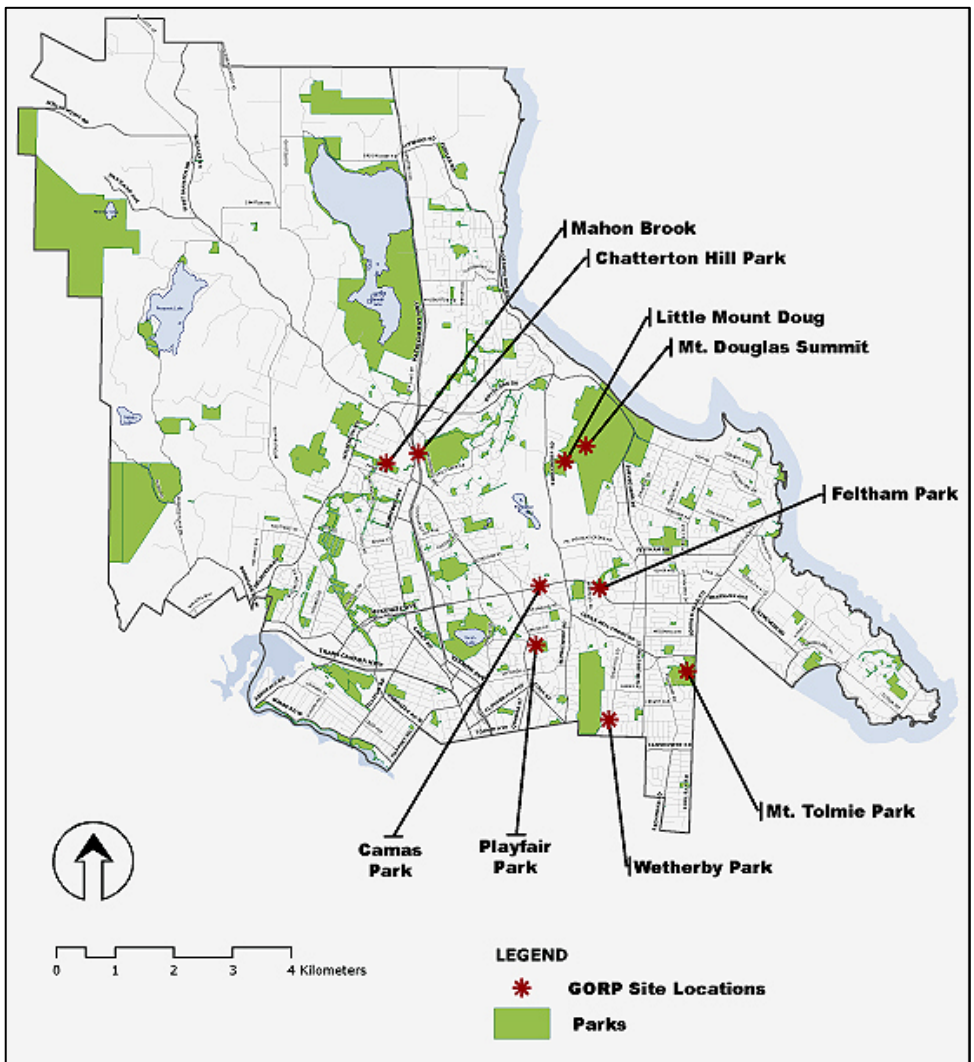
Area of Mount Tolmie Park affected by the August 2005 fire

Garry Oak Restoration Project (GORP)

Mount Tolmie is one of 9 sites of the Garry Oak Restoration Project (GORP), an initiative of the District of Saanich. GORP restores and maintains endangered Garry Oak ecosystems within Saanich Parks. The sites were chosen for their visibility and importance. The project fosters environmental stewardship, community building and partnerships. GORP focuses primarily on the removal of invasive species such as Scotch Broom, English Ivy, Himalayan Blackberry and Daphne-laurel.

Saanich recently combined the GORP activities with ongoing environmental stewardship by the District in non-park lands. This larger initiative is called the Saanich Pulling Together Volunteer Program, recognizing most of these actions involve removing invasive species (Pulling Together, 2011). The removal of invasive species is very labour-intensive and is beyond the means of municipalities to manage with paid staff. Rather than allowing habitats to degrade, municipalities support volunteer efforts on the part of environmental groups and communities to maintain and restore natural areas.

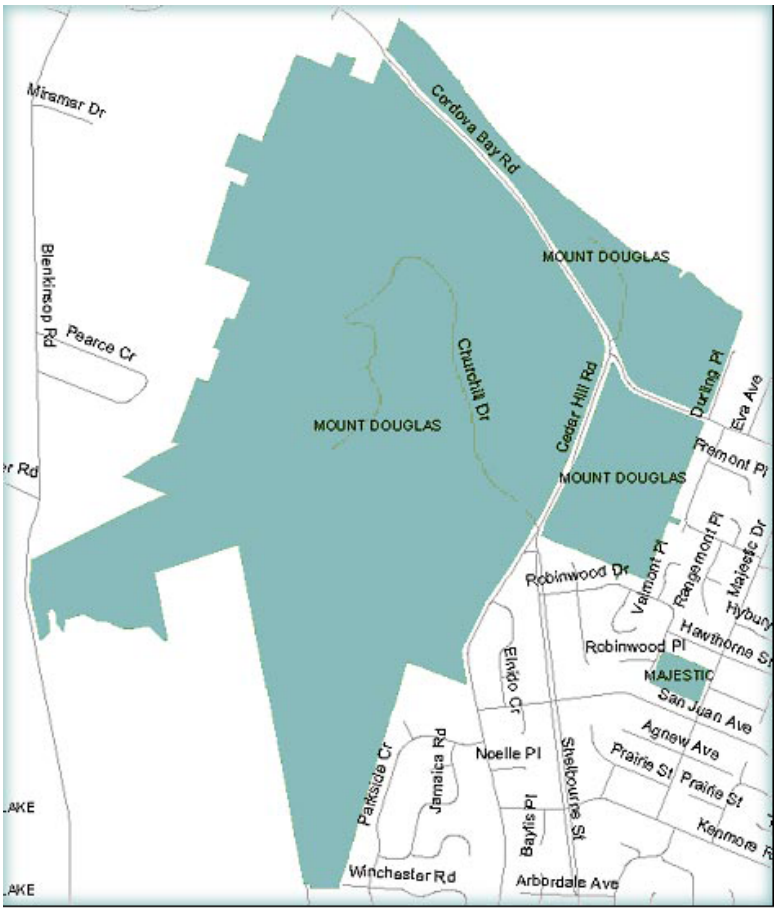
The nine GORP sites are Camas Park, Chatterton Hill, Mahon Brook, Little Mount Doug, Feltham Park, Mount Douglas, Mount Tolmie, Playfair Park and Wetherby Park. These are all described on the GORP website (http://www.saanich.ca/gorp) and all make interesting restoration walks.



Garry Oak Restoration Project (GORP) sites

Map courtesy GORP website

4.3 Mount Douglas – Douglas Creek



Map courtesy District of Saanich

Map of Mount Douglas Park

About

With a sweeping 360-degree view of the city and the Olympic and Cascade Mountains in Washington State, "Mount Doug" is a popular recreational area in Victoria. Approximately 182 hectares in size, Mount Doug was open to logging operations in the mid-19th century before coming under protection in 1889. The summit area and the south-facing slope of "Little Mount Doug" are GORP sites as they are both remnant Garry Oak ecosystems. Invasive plants, such as Scotch Broom, recreational use and an introduced rabbit population disturb this natural area. With the help of the Department of Fisheries and Oceans, the District of Saanich, and many other groups and agencies, The Mount Douglas Park Society has been working since 1996 to restore the upland areas of the park and Douglas Creek (Park Plan, 2008). The goal of restoring Douglas Creek was to return it to a condition capable of supporting the recovery of naturally sustainable populations of Coho and Chum Salmon. Restoration of Coho is

View from the top of Mount Douglas

particularly difficult, as their fry overwinter in these streams, leaving them vulnerable to pollution, flooding and droughts. Chum salmon do not stay in the stream long after hatching; instead, they migrate quickly to the estuary, where they feed and grow before heading out to the ocean.

Douglas Creek is at the eastern edge of the park. It is 0.8 kilometers long and drains a watershed of approximately 5.5 square kilometers. This area consists of more than 30 percent impervious surface, resulting in strong peak flows, which then drain into the creek. Peak flows can flush out salmon eggs and juvenile fish, erode spawning beds, and leave a poor substrate. Salmon cannot dig into the streambed and new gravel added in restoration projects is easily washed out of the system.

Erosion at Mount Douglas

There has been a great deal done to restore Douglas Creek. Efforts have included fry releases; salmon egg transplants; salmon carcass transplants from Goldstream River to introduce nutrients; installation of logs and root wads for habitat complexity; construction of weirs of logs and rock to create spawning beds and plunge pools; riparian plantings; and numerous studies on water quality and stormwater management (Bridgeman, 2006).

The picture of the excavator shown here is of a "spider" working in Douglas Creek. It has hydraulic legs instead of wheels which allow it to move down steep banks to the streambed and maneuver around obstacles. The spider has a claw that can rotate 360 degrees, enabling it to accurately place large boulders and logs. These objects usually need to be anchored by steel cables, which are threaded through holes drilled through the rock and wood; this enables them to resist the tractive force of the water surging through the creek after a major rain event.

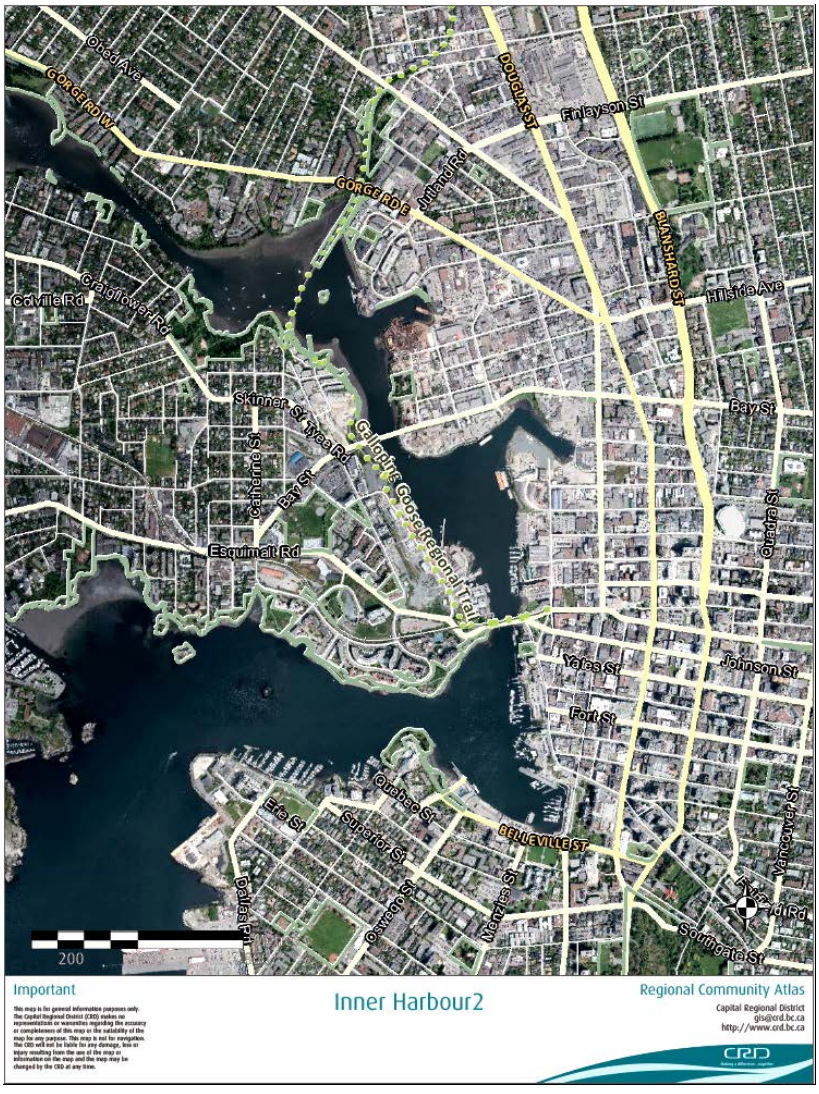
"Spider" excavator working in Douglas Creek

Restoration Walk Areas of Interest

Series 5. Restoration on the Bay

The coastline, bays and offshore islands around cities are often biologically very productive, but even so, they face many challenges in such close proximity to urban development. Oftentimes, urban developments threaten these sensitive ecosystems inhabited by rare and endangered species. The coastlines of the bays around Victoria are eroded by wave action from the Strait of Juan de Fuca; and the Inner Harbour has a legacy of sediment contamination from previous industrial activity and gasification plants. Offshore, there are underwater Marine Protected Areas (MPAs) and islands that are part of ecological reserves.

5.1 Victoria Inner Harbour/Rock Bay



Map courtesy CRD

Victoria's harbour extends from the Inner Harbour with Rock Bay and James Bay, Upper Harbour with Ross Bay and the Gorge Waterway, and around to the Outer Harbour with Ogden Point on the Juan de Fuca Strait. Restoration challenges facing the Upper Harbour include toxic sediments in Rock Bay, located just 1 kilometer from downtown Victoria.

In 1862, a coal gasification plant was built in Rock Bay—nearly two decades after the Hudson's Bay Company built nearby Fort Victoria on a site known to the Lekwungen as "Camosun", part of their traditional camas harvesting grounds (Songhees Legacy, 2012). The coal gasification plant shipped coal in loads of 2500 tonnes by barge from Nanaimo; and colliery owner and industrialist Robert Dunsmuir profited handsomely. The plant produced the gas for city lights and heat, sold asphalt pitch coal tar to municipalities for roads, but dumped industrial waste directly into Rock Bay and Victoria Harbour. Though the plant was shut down in 1952, coal gasification tanks remained on site well into the 1970s (MacDonald, 2012). Considered a "high priority project" by the Federal Contaminated Sites Action Plan, samples collected from Rock Bay in 1996 revealed a high probability contaminants were at levels toxic to aquatic life. Until remediation began in 2004, Rock Bay was one of the most contaminated sites in Victoria. The project has been a major effort for Transport Canada, BC Hydro and the City of Victoria for several years (Rock Bay, 2012).

Bargeload of crushed cars for recycling

Construction considerations around the remediation included disturbance to the surrounding community, vibration, air quality,

natural habitat, and stormwater outfalls. While some soil was treated on the 2.8-hectare site, the majority of it was trucked away to be treated offsite (Hofweber, 2007).

There was also a great deal of agency cooperation with the BC Ministry of Environment, Environment Canada and the Department of Fisheries and Oceans. In addition to cleaning up the site, institutional goals included stewardship, greening government, fiscal management, and the triple bottom line of environment, economy and sustainability (Rock Bay, 2012).

A metal recycling plant located within the Victoria Inner Harbour cuts scrap metal, shipping it away to be formed into new materials. Shown here is a barge of cars waiting to be cut into smaller pieces at the plant. This area—along with the property used to handle aggregate and the disturbance at Rock Bay from the old gasification plant—is not amenable for restoration. Nevertheless, as discussed earlier, a great deal of time and money has been invested in dealing with contaminants in Rock Bay.

5.2 Ross Bay/Gonzales Bay

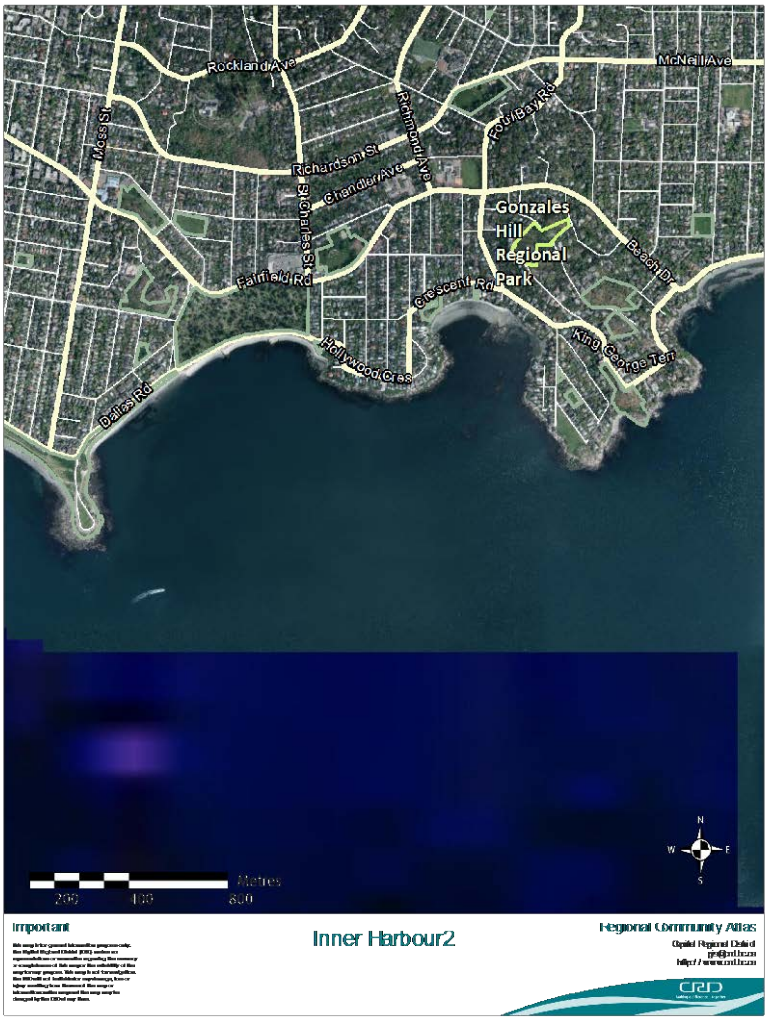
Clover Point pumping station

Ross Bay is located on the Strait of Juan de Fuca, below the neighbourhood of Fairfield. Clover Point forms the eastern boundary of Ross Bay. Much of Victoria's sewage is piped a kilometer into the Strait of Juan de Fuca—screened but untreated. The pump station and pipe are located underneath Clover Point Park, a popular place for people to walk their dogs, fly kites and hang-glide. Plans for the Capital Regional District's Core Area Wastewater Treatment Program, including the construction of a wastewater treatment plant, are expected to be completed by 2018 (Core Area, 2012). The secondary sewage treatment plant will most likely be at Macaulay Point in Esquimalt, at the entrance to Victoria Harbour opposite Ogden Point. The major concern with untreated sewage is it creates lower dissolved oxygen levels in the water and kills marine life. Primary treatment involves settling out about 50 percent of the organic material. Secondary treatment involves passing the effluent from primary treatment through large tanks filled with bacteria, which under controlled conditions will break down an

additional 45-49 percent of the remaining suspended organic material. The material left at the end of this process is called sludge, which is either composted or applied directly to mine sites for restoration. It can also be processed, however, into a soil product: Metro Vancouver, for example, produces Nutrifor, a soil amendment that helps restore forested sites (Moretto, 2008).

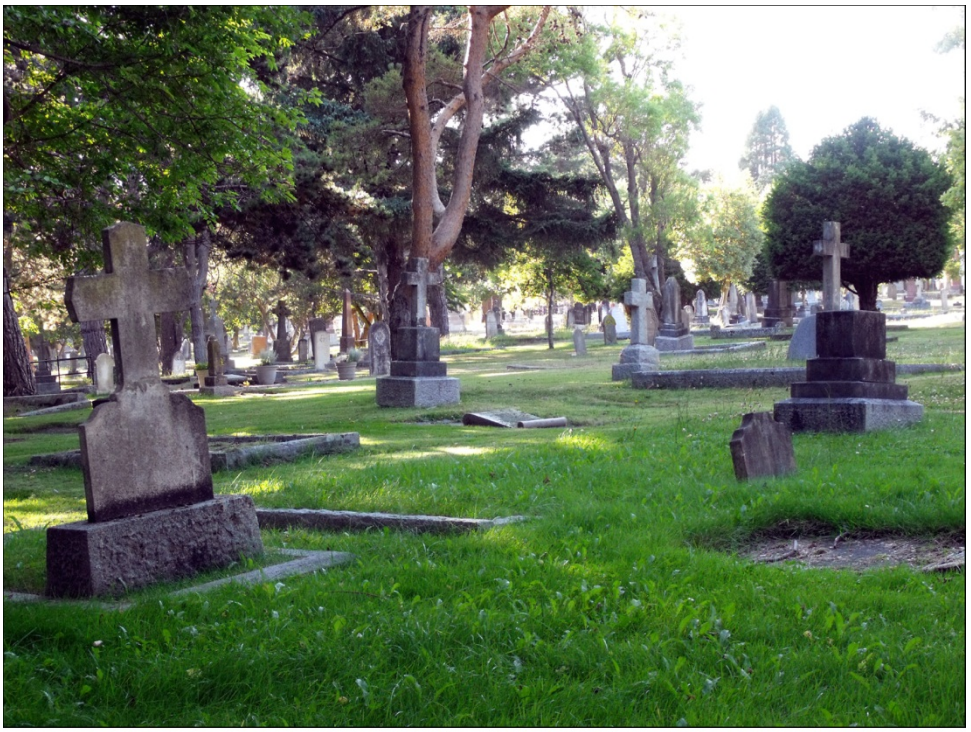
Wall damage

A major problem in Ross Bay is the erosion of the shoreline, especially during winter storms when the waves from the Strait of Juan de Fuca come in with considerable force. This is apparent from the damage to the reinforced cement wall along Dallas Road. Large chunks of concrete



Map courtesy CRD

from the wall are regularly broken off by logs hurled by waves. Before erosion control measures such as a cement wall constructed in 1911, some of the graves in the Ross Bay cemetery—established in 1873—were lost to the sea (Ross Bay Cemetery, 2012).



Ross Bay Cemetery

Ross Bay Cemetery is built in the Victorian garden style, intended to create a park-like setting. Many large trees were originally planted in the 1930s. Over the years, some of the trees have perished due to the stress of ocean spray and winds. The cemetery contains the graves of many notable British Columbian politicians, businessmen and artists, including James Douglas, James Dunsmuir and Emily Carr.

Groyne at Ross Bay

Along the shores of Ross Bay, 3 long weirs called “groynes” run perpendicular to the shore.

Constructed of large boulders, the groynes were put in place in the late 1980s. They help control shoreline erosion by preventing waves from gouging out sections of the beach. During construction, thousands

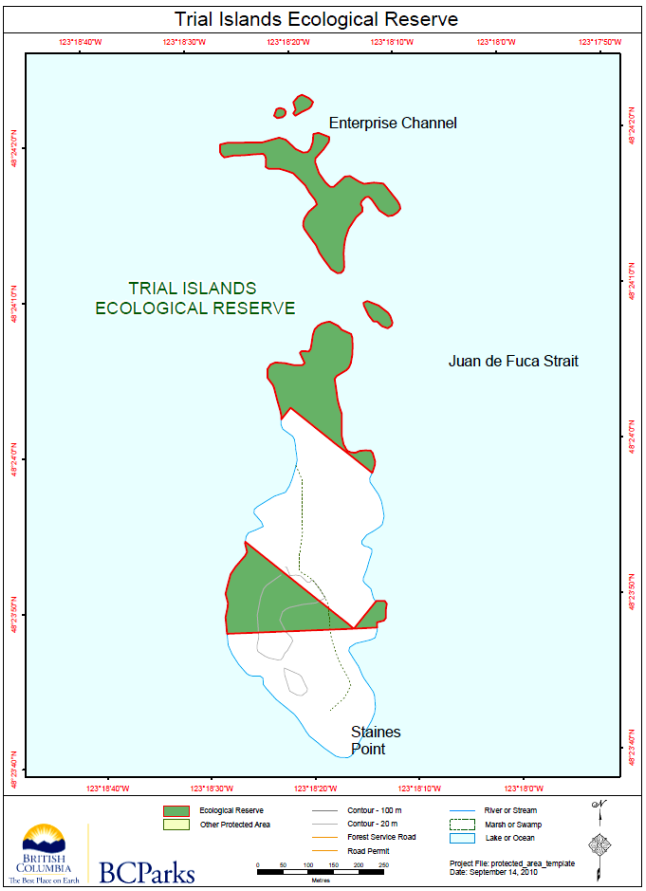
of tonnes of gravel were also added. The gravel moves around in the bay as a result of wave action, but has stayed within Ross Bay and has not been washed out. Beach Lupine, Gumweed, and Beachgrass have colonized the sandy area on the upper part of the beach, next to the cement wall. Across the street, along the edge of the Ross Bay Cemetery, is a row of Wheatley Elm trees. This is a common tree along Dallas Road, from James Bay to Fairfield. Considered invasive, Wheatley Elms produce suckers from their roots, which can form hedges along a road. Mixed in with the Wheatley Elms is some Tamarisk—recognized by its pink flowers in summer. This alien invasive evergreen shrub tolerates the saline conditions close to the ocean; it also occurs in areas around Victoria, such as Mount Tolmie.

Tamarisk at Ross Bay

5.3 Oak Bay Islands Ecological Reserve and Trial Islands Ecological Reserve

Trial Islands Ecological Reserve

Trial Islands Ecological Reserve was created in 1990 as part of the BC Ecological Reserves Program. The islands are small but are home to 20 rare vascular plants—11 of which are extremely rare. Several First Nations burial mounds are on the islands.



Map courtesy BC Parks

Permission to access the islands is by Park Use Permit only (Trial Islands, 2012).

The 2 maps show the location of Trial Islands off the southern coast of Victoria and the boundaries of the Trial Islands Ecological Reserve.

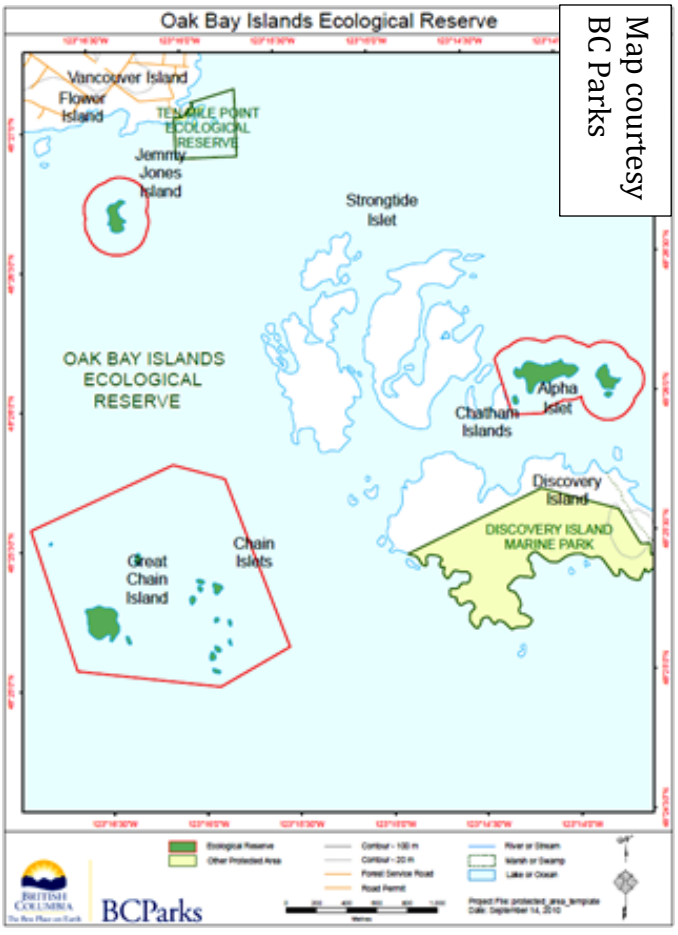
Map courtesy CRD

Plants on the islands include Golden Paintbrush, White-topped Aster, Bigelow's Plantain, Dense-flowered Lupine and Scouler's Popcornflower (Goulet, 2011). Also present is a newly described species, Victoria's Owl-clover; Trial Islands lays claim to 99 percent of the world's population of this red-listed species (Victoria's Owl Clover, 2012).

Lupine

The site is mowed to prevent shrubs and trees from colonizing. The Garry Oak Ecosystem Recovery Team (GOERT) undertook a restoration project for the Trial Island's 13 hectares of provincial Crown land, primarily removing invasive species such as Scotch Broom, English Ivy, Daphne-laurel and Gorse (Garry Oak Ecosystems Recovery, 2012). There is a similar program in place to remove invasive species from the federal Crown land, owned by Canadian Coast Guard.

Trial Island



Map courtesy BC Parks

Oak Bay Islands Ecological Reserve

Oak Bay Islands Ecological Reserve was created in 1979; and its boundary expanded in 1991 (Oak Bay, 2012). There are 7 hectares of islands, with at least 30 exposed rocky reefs, and more than 220 hectares of marine reserve. The largest islands, Great Chain and Alpha, are primarily vegetated with Baldhip Rose and Tall Oregon Grape. Meadow plants

Map courtesy CRD

include Great Camas, Bracken Fern, Dune Wildrye and Western Buttercup. Soil pockets can have Prickly Pear Cactus, Lance-leaved Stonecrop and Early Hairgrass.

The maps pictured show the boundaries of the Oak Bay Islands Ecological Reserve, and the location of Chain Islands off the eastern coast of Oak Bay.

Great Chain Island has one of the largest seabird rookeries in the Strait of Georgia. Recent numbers included: 600 pairs of Double-crested Cormorant, 400 pairs of Pelagic Cormorants, and 5,000 pairs of

Glaucous-winged Gulls, in addition to some Pigeon Guillemots and Black Oystercatchers (Oak Bay, 2012).

Across from the islands on the mainland shore are Willows Beach and Cattle Point. Willows Beach is the site of the outflow for Bowker Creek, as described earlier.

Vernal pools at Cattle Point

Next to Willows Beach is Cattle Point, where several vernal pools can be found. Vernal pools in Garry Oak ecosystems support a number of species at risk, such as: Bog Bird's-foot Trefoil, Tall Woolly-heads, Kellogg's Dwarf Rush, Water Plantain Buttercup, Rosy-owl Clover, and Dwarf Sandwort. An exclosure has been put around the vernal pools to protect these valuable plants (On Recovery Strategies, 2012).

An infestation of Carpet Burweed at Cattle Point is being contained by another exclosure on the site.

Carpet Burweed exclosure at Cattle Point

Series 6. Contributed Walks

6.1 Garry Oak Ecosystem Restoration and Species at Risk Recovery at Fort Rodd Hill and Fisgard Lighthouse National Historic Sites of Canada

by Aimée Pelletier

Site History

Located 14 kilometers west of downtown Victoria, Fort Rodd Hill and Fisgard Lighthouse National Historic Sites of Canada (hereafter Fort Rodd Hill) are more than just historic sites. The sites are managed by Parks Canada, a federal agency whose mandate is to protect and present nationally significant examples of Canada's natural and cultural heritage. Beyond its batteries and barracks lie some 54 hectares of protected land administered by Parks Canada, including significant examples of Garry Oak and Coastal Douglas-fir plant communities (see map on following page). These lands are part of the traditional territory of the Lekwungen people, ancestors of the Esquimalt and Songhees First Nations. Archaeological evidence suggests that the Lekwungen people occupied this point of land at least seasonally. Early in the settlement of Vancouver Island by Europeans, Chief Justice David Cameron established Belmont Farm on these grounds. The farm was in operation over 40 years. The British built the fort in the late 1890s to protect the Esquimalt Naval Base. Military personnel and their families used the land heavily as a summer training camp from the late 1890s to 1956.

The Administration Building at Fort Rodd Hill (formerly known as Journey's End), was built in 1928-32 as a residence for Muriel Dunsmuir, daughter to industrialist James Dunsmuir. The once manicured gardens surrounding the estate are one possible source of some of the horticultural invasive species at Fort Rodd Hill. The Canadian government declared coast artillery obsolete in 1956, and closed all of the forts along the coast. Parks Canada took control of Fort Rodd Hill in 1962, and in its first few years of operation crews removed brush consisting of native and introduced species from the designated historic site. From the mid-1960s through the 1980s, mowing and watering brought the grounds to the highly manicured state typical of national historic sites at the time.

The 1990s brought greater interest in the site's natural resources and, today, the Management Plan includes an extensive inventory of natural as well as cultural resources.

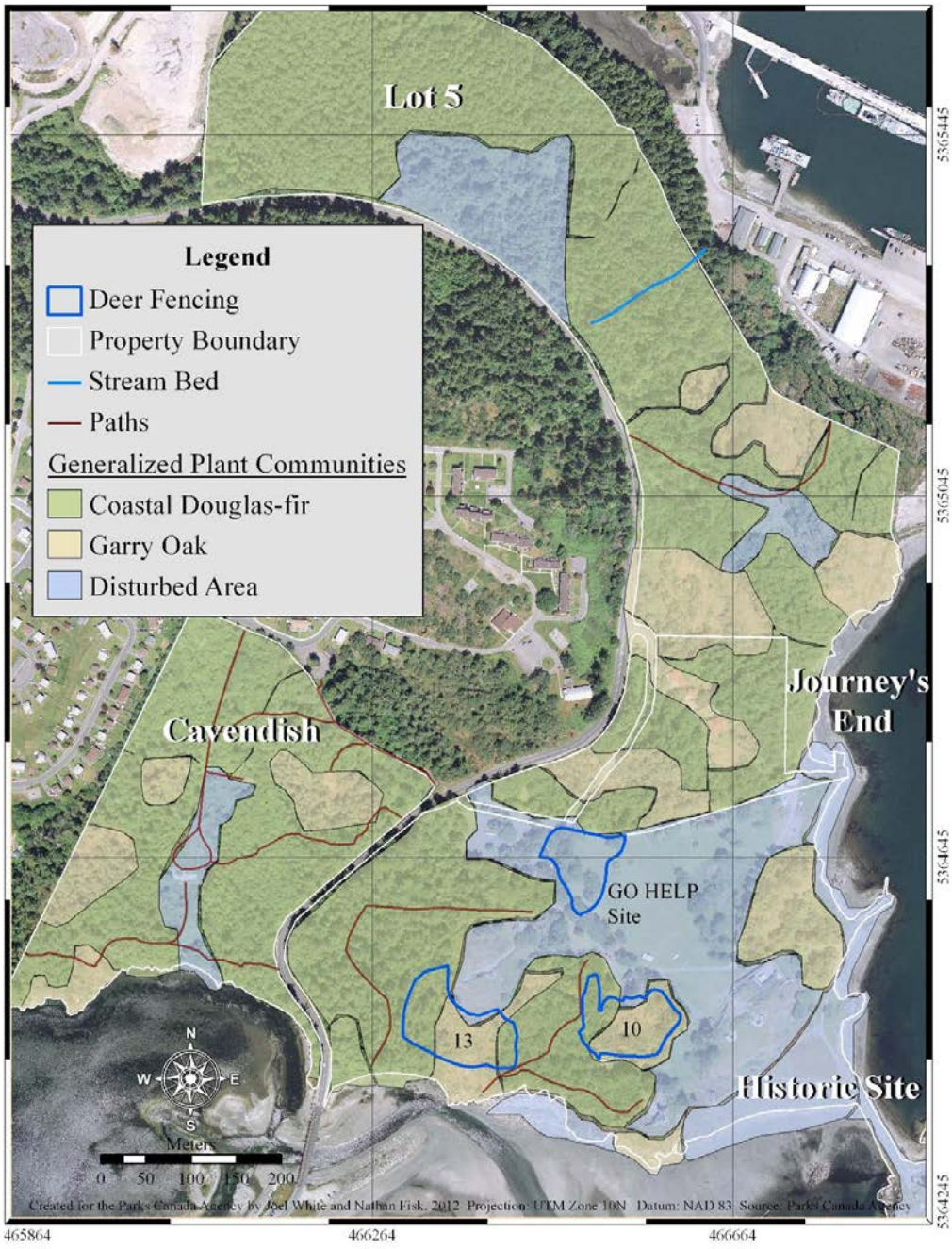


Image courtesy Parks Canada

Fort Rodd Hill and Fisgard Lighthouse National Historic Site and its adjacent properties (Lot 5, Journey's End and Cavendish)

Comprehensive vegetation inventories were conducted in 2002, documenting the occurrences of 7 rare plant species, including 2 which are federally listed under the Species at Risk Act as endangered. Similar to most Garry Oak and associated ecosystems located elsewhere in the region, those found at Fort Rodd Hill are subject to widespread biological invasion and habitat fragmentation as a result of the intensive human occupation and development that has occurred throughout the site's history. A further restoration challenge at Fort Rodd Hill has been the succession of open Garry Oak habitat to native conifer and shrub cover in the absence of historic disturbance regimes such as fire.

Ecological Restoration Program

The federal Species at Risk Act (SARA), proclaimed in June 2003, establishes prohibitions and legal requirements for the protection and recovery of species at risk in Canada. Parks Canada's legal obligations under the SARA are to protect and promote the recovery of species at risk in or on Parks Canada-managed lands and waterbodies. Parks Canada also plays a leading role in recovery planning for more than 40 species at risk that live within Garry Oak ecosystems, including several at Fort Rodd Hill. In 2002, Parks Canada began Garry Oak ecosystems restoration and species at risk stewardship at Fort Rodd Hill. Core

Volunteers show off a large pile of Daphne-laurel they removed from a restoration site at Fort Rodd Hill (Image credit: Parks Canada)

restoration program activities include rare species stewardship, invasive species control, research, native plant propagation, and outreach and engagement.

The major focus of restoration efforts at Fort Rodd Hill over the past decade has been to remove invasive species such as Daphne-laurel, Scotch Broom and Himalayan Blackberry from remnant Garry Oak ecosystems on site. Sites are prioritized for control using the General Decision Process for Managing Invasive Plant Species in Garry Oak and Associated Ecosystems developed by the Garry Oak Ecosystems Recovery Team (GOERT, 2007) and operational considerations such as site access and interpretive opportunities. Restoration sites are photo-monitored to help assess and record vegetation change. As the maintenance needed for these established sites decreases we are able to expand them and create new sites. Proceeding in this fashion, 2010 marked the first year where flowering Scotch Broom was removed from all 54 hectares of Parks Canada property at Fort Rodd Hill.

To the extent possible, removal sites are re-vegetated with native species. Techniques employed include direct seeding, live-staking and planting of plugs. The majority of what is planted is native grasses, propagated from seed collected on site.

With the development of a small native plant nursery on site in 2010, Parks Canada now undertakes some of its own propagation, while still contracting out some growing to local nurseries or partnering with excellent facilities and staff such as at the Pacific Forestry Centre, Canadian Forest Service. With the increased potential for propagation, a greater variety of species will be used for re-vegetation in seasons to come.

Native Plant Nursery

The native plant nursery, located in the field adjacent to the site entrance, features cold frames, raised beds, a sand plunge for propagating cuttings, and a heated propagation box for propagating evergreen cuttings. There are approximately 100,000 2-year-old camas bulbs growing in the nursery, in addition to some 30 other species of native shrubs, forbs and grasses. Volunteers are encouraged to help with nursery operation and have provided invaluable help watering, seeding, weeding, potting on and re-flatting bulbs. The majority of seed being propagated was collected by Parks Canada staff, either at Fort Rodd Hill, the Pacific Forestry Centre, or under permit in parks operated by the City of Victoria.

Volunteer Program

Sowing seeds at Fort Rodd Hill, fall 2010
Photo credit: David S. Tanner

A volunteer program dedicated to Garry Oak ecosystems restoration and species at risk recovery has been running at Fort Rodd Hill since 2003. By lending a hand, volunteers have the opportunity to be a part of one of Parks Canada's nationwide volunteer programs, which is achieving real outcomes on the conservation front. The objectives of the program are to provide stewardship for Garry Oak ecosystems and their constituent species at risk found at Fort Rodd Hill, and to help people form lasting relationships with Garry Oak ecosystems, Parks Canada, and the natural world. This very successful volunteer program has engaged hundreds of volunteers ranging from academic institutions, community groups, and local residents.

Camas (Photo credit: David S. Tanner)

Volunteer events are held year-round. To be notified of future volunteer events, please e-mail frh.volunteer@pc.gc.ca or call Susan MacIsaac at 250-478-5122 for more information. Individual volunteers or groups are also welcome to join us Monday-Friday, 8:30 am – 4:30 pm. We are recruiting long-term stewards for the native plant demonstration garden and a Garry Oak habitat enhancement project which

includes a native plant nursery. Volunteering at Fort Rodd Hill is a great way to meet new people, stay active, build your résumé, and of course, have fun!

Partnership with Academic Institutions

Over the last decade, the program has benefited from the dedication of more than 25 co-op students from local universities and colleges. Co-op opportunities are available year-round. A strong connection with local academic institutions, such as neighbouring Royal Roads University and the Restoration of Natural Systems program at the University of Victoria, has also enabled Fort Rodd Hill to serve as a "living laboratory" for students to conduct research in Garry Oak ecosystem restoration. Students can propose their own research ideas or choose to work on one of Parks Canada's research interests. In 2012 an advanced ecological restoration class from the University of Victoria based their fieldwork at Fort Rodd Hill, tackling diverse projects from invasive grass control to conifer removal. Class field trips are welcome too, and can include a guided "restoration walk" followed by some hands-on restoration.

Students from Vancouver Island University help with weighing and re-flatting Camas bulbs in the native plant nursery at Fort Rodd Hill (Image credit: Parks Canada)

Garry Oak Habitat Enhancement and Learning Project (GO HELP)

In 2010, a Garry Oak Habitat Enhancement and Learning Project (GO HELP) was initiated to restore 1 acre area of lawn near the entrance to the historic site, to a mesic deep-soil Garry Oak meadow and woodland. The site also includes a small rock outcrop, which will be restored. The project at Fort Rodd Hill endeavours to both enhance habitat for native species while fostering public engagement in the process of restoration.

Approximately half of the project area has an existing canopy of mature Garry Oak, Douglas-fir and Bigleaf Maple. The restoration area was heavily compacted from years of military and Parks Canada use. Baseline plant surveys indicated almost 100% invasive species cover. Site preparation for the project involved mulching with approximately 8 inches of shredded oak leaf mulch acquired from curbside collection programs in Saanich and Victoria (below). The mulch treatment has been very effective in eradicating invasive species and alleviating soil compaction.

A 7-foot deer fence was erected around the perimeter of the project area in 2011 to protect transplants from herbivory. Two access gates currently provide pedestrian access to the site, and a chip trail will be

Layered cardboard and leaf mulch were used to prepare a heavily compacted lawn for restoration (Image credit: Parks Canada)

installed in early 2013 to allow visitors to explore the site. Interpretive signage and rest areas will be added in the near future.

Image courtesy Parks Canada

Proposed plant communities in the GO HELP site at Fort Rodd Hill

Restoration of Natural Systems student Ross McCarter with a cold frame-grown Camas bulb at the Cowichan Garry Oak Preserve (CGOP). (Photo credit: Britton Jacob-Schram)

"Understanding how ecosystems are put together allows us to fashion strategies for restoring damaged ecosystems. Reference ecosystems provide a roadmap that shows how a historically intact ecosystem is put together. Unfortunately, there are few Garry Oak ecosystems that have not suffered some form of degradation; from fire management to invasive species establishment. The reference ecosystems for Garry Oak restoration therefore must be composed of a composite description (SERI, 2004) derived from a wide variety of sources" (GOERT, 2011).

In particular, few integral examples of mesic, deep soil Garry Oak meadow and woodland sites exist today. The Nature Conservancy of Canada's (NCC) Cowichan Garry Oak Preserve, Somenos Garry Oak Protected Area (BC Parks), and Beacon Hill Park (City of Victoria), are the closest approximation of remnant Garry Oak plant communities on southern Vancouver Island that offer guidance in defining a reference site and subsequent restoration goals for this project.

Restoration research and planning conducted by the NCC provided helpful guidance into the interpretation and application of Erickson and Meidinger's (2007) Garry Oak plant community classification system. Erickson and Meidinger's plant community descriptions and accompanying site characteristics were used to propose plant communities that will be restored in the GO HELP site.

Restoration targets for this project were further guided by NCC's restoration tool and prescriptive framework (Giesbrecht, 2012 [in progress]), which identifies ecological indicators and percent cover class guilds for several plant community associations as defined by Erickson and Meidinger (2007).

A variety of propagation and planting techniques will be tested in different areas of the project area, and the results of these trials used to identify site specific restoration prescriptions. The site has been divided into 4 planting phases, with a target of completing re-vegetation within 5 years. Planting in Phase 1 began in fall 2012 with the establishment of native shrub thickets and a few native trees.

Approximately 300 mature Camas bulbs were also planted in the immediate vicinity of the small rock outcrop feature, along with a variety of forbs (perennials and annuals) in soil pockets of the rock outcrop. The site will definitely be worth a visit in the spring to see the wildflower display.

Restoration along the Historic Nature Trail

Fort Rodd Hill is well-known, not only for its cultural history, but its natural riches. Taking you through open woodland past stunning ocean vistas, a walk down the Historic Nature Trail is an excellent opportunity to witness the achievements, and challenges, of the restoration program at Fort Rodd Hill. New interpretive signage along the trail is in development and will provide visitors with a chance to gain a deeper understanding of Fort Rodd Hill.

Shooting Star blooming in the native plant garden at Fort Rodd Hill (Image credit: Parks Canada)

Native grasses grown in the native plant nursery at Fort Rodd Hill
(Image credit: Parks Canada)

Planting native grass plugs along the historic nature trail at Fort Rodd Hill
(Image credit: Parks Canada)

In the fort's early years, the Royal Marine Artillery topped trees below Upper Battery to provide a clear line of fire from the gun to the water's edge. A walk along the nature trail takes one past several of these culturally modified trees (CMT), which now branch into several leaders at the same height. Hundreds of hours have been invested by Parks Canada staff, students and volunteers to bring invasive species under control along the nature trail, particularly dense thickets of Daphne-laurel and Himalayan Blackberry. The photo-monitoring record for this area documents a dramatic transformation and native species such as camas are rebounding. Many sites along the trail have been re-vegetated with native grasses and the coming years will see re-vegetation with a greater variety of native shrubs and forbs, although these will need to be protected initially from deer browse.

Two sites (10 and 13) along the Historic Nature Trail—each approximately an acre in size—have been enclosed in low visibility 7-foot deer fencing to exclude browsing by the abundant local Black-tailed Deer population (see previous map of Fort Rodd Hill and adjacent properties). Site 10, which was fenced in 2005, runs adjacent to the Historic Nature Trail behind the Warrant Officer's Quarters. The Battery Commander's Post (look for the flag pole) provides an excellent vantage point from which to view site 10. Site 10 was selected for intensive restoration based on its accessibility and interpretive potential, as well as the presence of a vernal pool containing 2 rare plant species. With release from the pressure of intensive grazing and trampling, the native ground and shrub vegetation has started to bounce back, and spring is an excellent time to visit this site to witness a wildflower show of Great Camas, Western Buttercup, Spring Gold, and Sea Blush.

Sea Blush blooming in site 10 at Fort Rodd Hill
(Image credit: Parks Canada)

Nursery-raised plugs of a variety of species have also being planted in this site and benefit from a much higher chance of survival and

establishment. The east corner of site 10, nearest the Lower Battery, has been the location of a research trial investigating control methods for Orchard Grass. An unintended effect of excluding deer has been the proliferation of Snowberry and succession of previously open woodland areas to shrub cover in moist, shady areas of the site.

The second fenced area, site 13, is located about 50 meters off the Historic Nature Trail towards Esquimalt Lagoon. This site, fenced in 2008, was selected for intensive restoration based on the presence of a small population of Deltoid Balsamroot, an endangered species listed on Schedule 1of the SARA.

Native Plant Garden

Renovation to the entrance kiosk in 2010 created the opportunity to develop a native plant garden near the site exit gate previously vegetated with invasive St. John's Wort and Himalayan Blackberry. The objective of the garden is to raise awareness of how native plants can be used in residential gardens in place of more commonly used exotic species. Plants for the garden were donated by the Canadian Forest Service, and were grown by Rob Hagel and his staff at the Pacific Forestry Centre. Fencing was installed to protected species more sensitive to herbivory. Seventeen species of native plants can be found in the garden, and plants are labelled to aid in identification.

The garden is maintained with the help of volunteer stewards.

If you have any questions about the Garry Oak ecosystems restoration and species at risk recovery projects at Fort Rodd Hill, contact Aimée Pelletier (aimee.pelletier@pc.gc.ca or 250-478-5140) for more information.

Additional Images of the NCC's Cowichan Garry Oak Preserve

A Garry Oak at the Cowichan Garry Oak Preserve (CGOP) dwarfs a group of Restoration of Natural Systems program students visiting from the University of Victoria in 2012. CGOP also protects BC's biggest Garry Oak tree (by wood volume), as measured by the Big Tree Registry

Sheep are being used in ongoing research at the Cowichan Garry Oak Preserve (CGOP) assessing "conservation grazing" as a means of controlling invasive species within Garry Oak meadows (Photo credit: Britton Jacob-Schram)

Conclusion

Urban areas are often synonymous with a loss of biodiversity. Despite their highly artificial composition, cities are not biological deserts. The city can be a complex suitable habitat for many species. Gardens, yards, parks and recreation areas provide significant areas of greenspace, with linkages capable of supporting a surprising array of plant and animal life (Schaefer and Sulek, 1997). Urban biodiversity is well worth conserving and restoring.

Ecological restoration in urban environments is different from that in natural areas. The landscapes are highly altered by buildings, impervious surfaces and human activities. Natural processes are disrupted, resulting in unique patterns of energy flow with fewer insect eaters (insectivores) and more seed eaters (granivores), more generalist species, more edge species, disrupted nutrient cycles, altered hydrology, the urban heat island effect, barriers to dispersal,

patch size and patch distribution considerations and different responses by wildlife (urban adaptors, avoiders and exploiters).

The uniqueness of urban restoration is in part due to the presence of parallel human systems for waste, water, energy and transportation in addition to comparable processes in nature. Decisions made for urban planning to insert the city into the natural environment are based on controlling the hydrology for roads and buildings, and for nature to provide services to people. Complicating matters further for natural ecosystems, invasive species move with people and their goods, causing even more disruption.

In response, communities are making themselves more sustainable—more energy efficient for electricity, gasoline and natural gas. Rapid transit systems reduce the need for even more roads and help to curb urban runoff and improve air quality. The move towards sustainability includes the natural environment and encouraging self-sustaining ecosystems; a big part of this involves ecological restoration.

The restoration projects described in this book primarily involve environmental stewardship. They are done by the community and in most cases involve gloves, secateurs, shovels and wheelbarrows. Projects restoring streams have addressed the urban stream syndrome of reduced biodiversity, high nutrient loading, elevated primary production, alien invasive species in the riparian zone, and bank erosion from increased flooding.

The best blend of expertise and interests in designing urban restoration projects includes people who are ecologists, landscape architects and urban planners. To be effective, restoration efforts must extend to urban planning to complement the efforts of environmental stewardship in achieving the goals of ecological restoration. Densification, the new urbanism grid, low-impact development, town centres, smart growth and green buildings, all play their part in reducing the environmental impacts of cities and promoting ecological health (Schaefer et al., 2004).

The stakes are high. Many cities are located on estuaries, floodplains or other biologically-productive, rare habitats. They often occur in unique and valuable natural ecosystems, such as the Fraser River estuary and delta, a major stopover on the Pacific Flyway for migrating birds (Pacific Flyway Council, 2012); the Garry Oak Woodlands and Coastal Douglas-fir forests of Greater Victoria; and in the case of Greater Vancouver, the site of the world's largest salmon run.

We are also increasingly aware of how nature in the city affects our physical (Ulrich, 1984) and emotional well-being and the normal development of our children as they grow. We are also aware of the

financial benefit that nature has for us in maintaining our cities—for example, stormwater management for Metro Vancouver alone in 2004 was estimated to be $2.4 trillion (Stormwater Management, 2011).

Victoria is rich with forests, marshes, old fields, bogs and agricultural land. All of the natural elements of the city are interdependent. Similarly, Victoria is interconnected with surrounding marine ecosystems of the Strait of Juan de Fuca and Haro Strait, and the adjacent forests of the Sooke Hills and Gowlland Range (Gowlland Tod, 2012).

The restoration projects for Greater Victoria described in this book demonstrate the extent of awareness and caring of people for nature. The projects rely on partnerships and a wealth of local ecological knowledge. They rely on people caring for nature and their willingness to volunteer countless hours of their time to conserve, protect and restore the natural environment.

This book is intended to draw attention to and celebrate the numerous restoration projects undertaken or underway in Greater Victoria. The Restoration of Natural Systems Program at the University has made an effort to learn about these projects; and the students who are local (many live off island) are involved in many of them. We hope reading through this book has been a process of discovery and that you have learned more about local ecosystems, restoration projects and the theory of ecological restoration.

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