

Environmental Guidelines for Urban and Rural Land Development in British Columbia



Section Three

This section of *Develop with Care* describes the objectives, requirements, and guidelines for good environmental development and management at the site level.

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Cover photos: Judith Cullington



Site Development and Management

“Just as the health of the human body is dependent on the health of the individual cells in it, so too is the urban region dependent on the health of the individual sites that comprise it” (James Taylor Chair in Landscape and Liveable Environments, University of British Columbia <http://www.jtc.sala.ubc.ca/about.html>)

This section of *Develop with Care* is written for people who are responsible for designing, approving, and building urban and rural land developments at the site level—local governments, landowners, and the development community.

The natural environment is being changed as a result of landscape and site-level decisions. While these individual decisions may appear to have no major consequence, the cumulative effects of site-level decisions can have a significant impact on the natural environment—for better or for worse. The guidelines in this section are intended to reduce or mitigate the negative effects of site-level development and even to enhance the natural environment, especially in those places where it has already been modified by human activities.

Even modified ecosystems play an important role in preserving **biodiversity**¹ and community greenspace, and can help to attenuate rainwater and reduce air pollution. This section of the document provides guidelines for protecting and enhancing general environmental values for all sites, including places where no special environmental values have been identified. This site-level planning should reflect community and landscape level information, as discussed in [Section 2: Community Planning](#).

[Section 4: Environmentally Valuable Resources](#) provides additional guidelines to be followed in areas where high environmental values are found on or near the development site.

3.1 Benefits of Environmental Protection at the Site Level

Environmental planning at the site level brings many benefits to the community, local government, and developer.

- ♦ Retention of trees and greenspace helps **sell properties faster** and for **higher prices**. Homeowners are willing to pay at least 5–15% more for properties near natural open space.²



Chocolate Lily.
Photo: Mark Kaarremaa

¹ **Highlighted** words are defined in the [Glossary](#).

² Quayle and Hamilton 1999; Curran 2001



"Natural areas within the settled regions of Canada provide numerous goods and services that have economic values, not only for the people within or adjacent to these natural areas but also for the communities farther away. Serving as sources of natural capital, these areas provide such goods and services as clean water supply, water flow stabilization, greenhouse gas mitigation, erosion control, nutrient cycling, genetic resources, biodiversity, pest management, habitat, recreation and cultural pursuits. Yet, these natural areas continue to be lost across Canada. Undoubtedly, this occurs in part because the goods and services provided by natural areas are not precisely known, despite the fact that recent studies outside of Canada suggest that the economic value of these natural areas to society far outweighs any gains from converting them for human uses such as urban development or intensive agriculture" (Olewiler, 2004)



Trees add to property value.
Photo: Judith Cullington

- ◆ **Costs can be lower.** 'Green infrastructure' in Surrey's East Clayton development reduced development costs by 20% and lowered the base cost of housing by 25% per square foot.³ Integrated rainwater management can reduce the costs associated with traditional stormwater management approaches for protecting water quality.
- ◆ Urban trees help reduce air pollution, keep buildings cool in the summer and protect them from winter storms, and provide habitat for birds and bats which in turn keep insect populations in check. The U.S. National Association of Homebuilders encourages the planting of trees because it **increases the marketability** of new developments.⁴
- ◆ The approval **process may be easier and faster**. Developers can spend a great deal of time (and money) in the approvals process. Where councils and the public support the environmental benefits of a project, it is more likely to move faster through the approvals process.⁵
- ◆ Wetlands help to **reduce downstream flooding**, protect water quality, and replenish groundwater sources.
- ◆ Wetlands, grasslands and forests help store carbon, thus **reducing the impacts of climate change**.
- ◆ Thoughtfully-placed walking and cycling pathways encourage reduced use of vehicles (which helps reduce greenhouse gases) and provide people with opportunities for healthy living within their neighbourhoods. Natural open space and walking/biking paths are among the most **important features for potential homebuyers**.⁶

For more information, see [Appendix C: Benefits of Environmental Protection](#).

3 Smart Growth BC 2002
4 Petit 1998
5 Curran 2001
6 Curran 2001



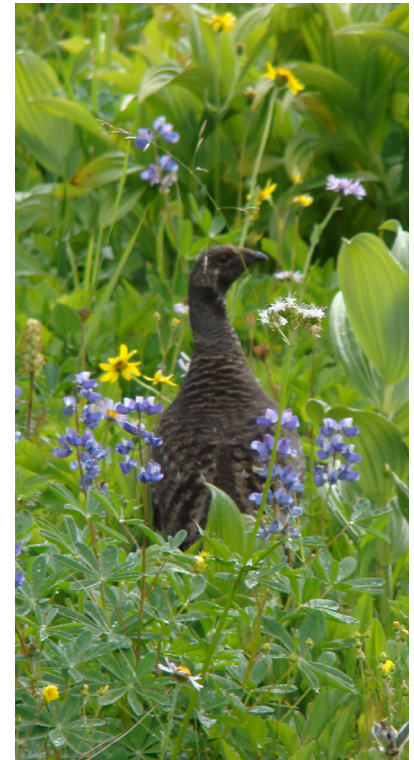
3.2 Objectives

Local governments and the development community should meet the following environmental objectives during site development.

- ♦ Identify environmental values before developing a site plan, as outlined in the Bio-inventory Terms of Reference ([Appendix B](#)).
- ♦ Ensure the development avoids **Environmentally Valuable Resources** (see [page 2.5](#)), uses buffers and corridors to link and protect sensitive habitats, and protects the hydrology on and near the site.
- ♦ Avoid areas with natural hazards.
- ♦ Design energy- and water-efficient developments that conserve natural resources and minimize greenhouse gas emissions, and consider future climate impacts.

Local governments are encouraged to address these objectives within their official community plans and other planning and public consultation processes. Developers should be able to demonstrate to local governments and the public how they have addressed these objectives and incorporated them into their development plans. See [Appendix E: Checklists](#) for more detailed considerations.

A summary of legislation related to environmental protection during land development is provided in [Appendix A: Summary of Legislation](#).



Ruffed Grouse.
Photo: Judith Cullington

3.3 Guidelines for Environmental Planning at the Site Level

3.3.1 Site Inventory

GATHER ENVIRONMENTAL INFORMATION BEFORE DESIGNING THE DEVELOPMENT

Environmental mapping and inventory should be conducted **before** designing the development layout and **before** initiating land clearing activities.

- ☒ Gather available information from community or regional level mapping and inventories. Not all maps and inventories are available in digital format; seek out information including unpublished sources.

Information sought should include presence (or absence) of Environmentally Valuable Resources such as:



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Rotten logs provide important wildlife habitat.
Photo: Marlene Caskey

- ▲ sensitive ecosystems, ecosystems at risk, and designated sites including important wildlife areas and **Important Bird Areas**;
- ▲ species at risk (known or suspected presence);
- ▲ regionally significant species (see [Section 5: Regional Information Packages](#));
- ▲ aquatic or riparian ecosystems and fish spawning/rearing areas;
- ▲ specialized wildlife habitats such as veteran trees or snags, talus slopes, and caves; and
- ▲ **wildlife corridors**.

Areas with potential for wildlife conflicts or other hazards should also be identified.

Note that inventory is incomplete for some areas, so a lack of information on Environmentally Valuable Resources does NOT mean that those values are not present. For more inventory sources, see [Appendix D: Sources for Environmental Mapping and Inventory](#).

- ☑ Identify any **conservation covenants** on the property. These will be registered against the title of the land. More information is available from the [B.C. Lands in Trust](#).
- ☑ Identify the site's [water balance](#) and water flow patterns including seasonal runoff channels. See **Section 3.7.1** for more information.
- ☑ Identify potential hazards areas (see [Section 2.8](#) and **Section 3.9**).
- ☑ Identify opportunities for ecosystem restoration and enhancement (e.g., daylighting of culverted streams or replanting riparian buffers).

CONDUCT INVENTORIES

The completion of a site survey is a critical component of a detailed mapping and inventory review. Regional mapping (such as [Sensitive Ecosystems Inventories](#)) has been done at a broad scale and may miss small but important sites. A site-specific assessment can confirm and update information from other sources and provide assurance regarding the presence or absence of Environmentally Valuable Resources.

- ☑ Conduct a preliminary site survey following the guidelines in [Appendix B: Bio-inventory Terms of Reference](#). Repeat the survey during different seasons, especially if the presence of species at risk is suspected.
- ☑ If the review of existing environmental information or preliminary site survey indicates that the development site is on or near Environmentally Valuable Resources, use appropriately qualified professionals to conduct more in-depth site inventories as outlined in [Appendix B](#).



Conduct bio-inventories and identify heritage features.

Photo: Carmen Cadrin

☑ Provide the results of these studies to the local government and any findings of species at risk and ecosystems (ecological communities) at risk to the [Conservation Data Centre](#) and regional species at risk staff.

IDENTIFY HERITAGE FEATURES

Most archaeological sites are automatically protected by the [Heritage Conservation Act](#) and may not be disturbed or altered without a permit. There are substantial penalties for unauthorized site alteration. The Archaeology Branch has produced the [British Columbia Archaeological Resource Management Handbook for Local Governments](#) to assist in integrating archaeological resource management into local government planning and application review processes.

☑ Identify potential heritage and archaeological features on the development site, including First Nations sites that are protected under the [Heritage Conservation Act](#). Contact the [Archaeology Branch](#) for the location of known archaeological sites and information on the archaeological resource management process. The Remote Access to Archaeological Data (RAAD) web application can be used to identify known archaeological features and areas with the potential to contain unknown sites automatically protected by the Heritage Conservation Act. If you do not have RAAD access, a [data request](#) can be made to the Archaeology Branch.

☑ Contact local First Nations⁷ to determine if there are cultural features (such as culturally modified trees, burial sites, or bathing holes) that may be affected by the proposed development. First Nations have many sacred and sensitive areas within their traditional territories.

☑ Respect cultural values. Sites with heritage value should be developed only in a manner that protects them and accords them the respect they deserve before, during, and after development.

There are significant penalties (\$50,000–\$1 million) under the Heritage Conservation Act for failure to prevent damage to heritage sites.

First Nations culture is strongly linked to the natural environment. Development can harm spiritual and cultural values in ways non-First Nations people may not recognize. For example, if trees surrounding a bathing hole used for purification are removed, the local First Nations can no longer use this area for their ceremonies. Development may impact plants or animals that are a source of medicines or food. Developers should contact local First Nations before designing a development.

⁷ To find out which First Nations live in your region, click on the map on the [Ministry of Aboriginal Relations and Reconciliation](#) website. Contact information can also be found in the [Guide to Aboriginal Organizations and Services in British Columbia](#).



3.4 Guidelines for Ecosystems and Species Protection

3.4.1 Site Design

To protect ecosystems and the plants and animals that live in them, we need to protect the ecosystems' **features** and **functions**.

Ecosystem features are physical attributes that create many different types of habitat for different species. Examples include snags (standing dead trees), ground cover, and large woody debris in streams.

Ecosystem functions are processes that keep an ecosystem operating. Examples include infiltration of surface water, evapo-transpiration, pollination, and nutrient cycling.

The Ministry of Transportation and Infrastructure has information on ways to protect and/or mitigate impacts from road planning, design, construction, and highway operations on natural, biophysical, and socio-community resources. For more information, see http://www.th.gov.bc.ca/mot_org/hwyeng/environmenthome.htm.

RETAIN AND PROTECT EXISTING ENVIRONMENTALLY VALUABLE RESOURCES

- ☑ Ensure that site-level plans and designs meet or exceed the environmental goals and objectives of the official community plan and other community or watershed-level plans.
- ☑ Encourage local naturalist clubs, stewardship groups, and similar organizations to provide input into development proposals. Property values are enhanced by natural landscapes that are on or near the development property.
- ☑ If the surveys, inventory or mapping identifies Environmentally Valuable Resources on or near the development site, follow the additional guidelines in [Section 4: Environmentally Valuable Resources](#).
- ☑ Utilize natural elements (such as rock outcroppings, wetlands, and significant trees) to design a unique and attractive development.

RETAIN AND ENHANCE ECOSYSTEM FEATURES AND FUNCTIONS

- ☑ Design the site to retain and enhance ecosystem features such as significant trees, treed fence lines, hedgerows, and windbreaks.
- ☑ Design buildings, infrastructure, and other development so that established trees can be retained with enough undisturbed space around them (up to 1 ½ times the height of the tree) to protect their root systems.

Fence off the Environmentally Valuable Resources from the construction zone.

Photo: Marlene Caskey





“Wildlife corridors provide animals with an opportunity to move freely between two or more habitat patches or habitat types in an otherwise fragmented landscape. This movement is essential to provide genetic links between populations and prevent inbreeding, and to compensate for temporary population declines in one of the habitat patches. The habitat needs of all priority species should be incorporated into the design of the corridor. Corridors must be suitably wide, with appropriate habitat features to provide security cover during movement. Corridors usually consist of linear habitats such as streamside riparian areas... Development and roads should avoid these zones, and mitigation will be required where roads and other developments transect the corridor”
(Clarke et al. 2004).

- ☑ Build well away from floodplains. Allow natural flooding cycles to continue, thus supporting flood-dependent ecosystems and species. Note that climate change is altering flood regimes (see [Section 2.8.1](#)).
- ☑ Ensure that natural (pre-development) hydrological cycles are maintained during and after development, including the presence of small **seeps** and wetlands. Changes in drainage patterns can impact onsite or neighbouring ecosystems by providing too much or too little water.
- ☑ Where required for wildfire management, reduce fuel loads and manage **ladder fuels** by trimming lower dead branches while maintaining green shrubby vegetation. Fire-proofing plans may suggest that shrubby vegetation close to buildings be removed, however removal within a **riparian protection area** will degrade these fragile ecosystems and may contravene the [Fisheries Act](#). Avoid this conflict by siting development well away from riparian areas.

Concentrated ‘hot spots’ of impervious surfaces can affect aquatic ecosystems, even if the overall imperviousness of the watershed is less than 10%. Individual impervious areas, such as parking lots and roads, can also have negative impacts if they are located too close to aquatic ecosystems (Guthrie and Deniseger 2001).

CONNECT HABITAT AREAS WITH WILDLIFE CORRIDORS

- ☑ Consider how wildlife will travel through the planned development, and provide ways for this to continue. Install passages under roads so that amphibians and other wildlife can travel safely between intact habitats. Road kill is one of the leading causes of reptile and amphibian mortality. For information on road crossing structures for reptiles and amphibians, see [Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia \(2014\)](#).
- ☑ Maintain and create wildlife corridors between the natural areas on the development site and those on adjacent properties. Riparian areas and natural gullies often function well as wildlife corridors.
- ☑ Protect habitat features that contribute to wildlife corridors. For example, a clump of trees or shrubs may provide a resting place for small birds as they travel between feeding and nesting areas. Maintain the natural vegetation in wildlife corridors as much as possible; placing salvaged large woody debris (logs, stumps) in these areas can enhance habitat and minimizes disposal costs.
- ☑ Consider restoring sites and corridors that will provide connectivity between natural habitats. The B.C. Chapter of the [Society for Ecological Restoration](#) can provide information on restoration planning.

iMapBC is a self-serve web-based mapping tool provided by GeoBC that supports collaboration between government, industry and the public concerning natural resource information. iMapBC users have access to the more than 500 natural resource datasets hosted in the BC Geographic Warehouse and can interactively visualize and query the data, combine the data with their own uploaded geographic data and produce maps that can be printed or emailed to others. http://www.data.gov.bc.ca/dbc/geographic/view_and_analyze/imapbc/index.page



MINIMIZE IMPACTS FROM ROADS

- ☒ Design roads to minimize habitat fragmentation. For example, place roads along the edge of forests or grasslands rather than through the middle.
- ☒ See the [Wildlife Crossing Structure Handbook](#) for information on providing safe passage for larger animals.
- ☒ Minimize the spread of invasive plant species by cleaning machinery prior to using in road-building.

MINIMIZE IMPACTS ON NEIGHBOURING PROTECTED AREAS

Developments adjacent to parks, ecological reserves, and other protected areas must be undertaken with care in order to protect the ecological values of these sites. Proximity to protected areas adds to property values; so maintain the value of your development by ensuring it does not damage the protected area.

- ☒ When developing next to a protected area (e.g., regional or provincial park), talk to the site manager about how best to protect the environmental values.
- ☒ Leave adequate natural vegetated buffers between the protected area and houses or roads. See [Table 4-1](#) for suggested buffer widths. Do not install services (e.g., water, sewer, gas, power) in areas where they might impact the adjacent protected area.
- ☒ Retain native vegetation where possible, and replace lost vegetation with appropriate native plant species, particularly along adjacent boundaries to natural areas. Ensure that any landscaping uses species that will not invade adjacent natural areas. Avoid plants that may attract unwanted wildlife (e.g., fruit trees attract bears).
- ☒ Place fencing with interpretive signage between the development and protected area to encourage landowners to properly manage yard wastes and pets
- ☒ Avoid or minimize outdoor lighting adjacent to the protected area. Outdoor lighting can affect some wildlife by altering their day/night cycle and hence their feeding and hunting activities.



Heronry.
Photo: Susan Latimer

CONSIDER OPPORTUNITIES FOR RESTORATION

Restoring degraded ecosystems can provide benefits such as habitat enhancement for fish and other wildlife, parks for people, and pleasant views.



Fence covenanted areas to protect them during construction.

Photo: Marlene Caskey

- ☑ If developing a **brownfield** or **greyfield** site, seek opportunities to restore natural areas and wildlife corridors, to daylight culverted streams, or to replant riparian buffers
- ☑ Where sites are being restored, allow natural succession to proceed with minimal intervention or disturbance wherever possible. Active management may be necessary, however, to enhance or maintain the habitat values or to control vegetation that poses fire or safety hazards.

3.4.2 During Construction

PROTECT ECOSYSTEM FEATURES AND FUNCTIONS DURING CONSTRUCTION

- ☑ Construct permanent or temporary fencing around Environmentally Valuable Resources and their buffers before starting to clear the site.
- ☑ Develop and post a site map of sensitive features that can be referred to during construction, and ensure all subcontractors and site workers have seen it.
- ☑ Minimize the size of the area being cleared for construction, and retain as much natural vegetation as possible.
- ☑ Set up temporary fencing around trees to prevent any disturbance within their root zone. For mature trees, the root zone may extend well beyond the drip line. Preserve snags, downed logs, stumps, and other forest features unless they present a danger to workers or the public. Rather than removing an identified hazard tree, consider stumping it (at 3–5 m or more) and retaining it as a **wildlife tree**. Where a hazard tree must be removed, the work should be as non-intrusive as possible. Felled trees should be left on the ground to provide habitat for wildlife,



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including a wide variety of amphibians and invertebrates. Note that a hazard tree assessor may not fully account for wildlife needs in their recommendations. For more information, see [Best Management Practices for Hazard Tree and Non-Hazard Tree Limbing, Topping or Removal](#). The [International Society of Arboriculture](#) also provides information on consulting arborists.

☑ Undertake construction only during identified **timing windows** and avoid high risk periods to minimize impacts on local wildlife. For more information on timing windows for work conducted close to Environmentally Valuable Resources, see [Table 4-2](#).

MONITOR ENVIRONMENTAL IMPACTS

☑ If Environmentally Valuable Resources (on or near the development site) could be at risk during the land clearing and construction stages, hire an appropriately qualified professional to assist in planning and monitoring. Environmental consultants and monitors should be given the authority to halt all work if they believe on-site conditions could create impacts on sensitive species or habitats. This will demonstrate due diligence should problems arise.

☑ Before land clearing and construction begin, determine who will be responsible for site monitoring after the development has been completed and for how long the monitoring needs to continue.

USE NATURAL LANDSCAPING TECHNIQUES

☑ Stockpile natural soils (with a cover to prevent incursion by invasive species) and put them back on site during landscaping.

☑ Reduce soil compaction by avoiding the use of machinery near retained vegetation wherever possible.

Give monitors the authority to halt work if it will impact sensitive habitats.

Photo: Susan Latimer





☑ Ensure that at least 20 cm of topsoil is replaced on all future lawn areas after development has been completed. This will promote deeper-rooted lawns and plants that will require less water in summer and will be able to absorb more rainwater in winter.

☑ Use locally-adapted, drought-resistant tree and shrub species and create only small lawn areas to minimize post-development watering needs.

☑ Use local native plants in landscaping; they are adapted to local climates (such as hot, dry summers), and once established, will need less maintenance and watering than non-native plants. For more information, see

- ▲ the [Naturescape](#) website;
- ▲ The [Garry Oak Gardener's Handbook](#);
- ▲ [Waterwise Gardening for Home and Small Acreage Owners of the Oliver Area](#);
- ▲ [Penticton Xeriscape Brochure](#); and the
- ▲ [Penticton Xeriscape Garden](#)

☒ Never use invasive alien species for landscaping. See “[Grow Me Instead](#)” prepared by the [Invasive Species Council of British Columbia](#).

☑ Leave fallen and topped trees on the ground in undeveloped areas and future greenspaces. Coarse woody debris provides habitat for small mammals, salamanders, and a wide variety of invertebrates. If necessary for fire-proofing, remove fine fuels (twigs and branches), but leave large logs and topped trees for habitat.

☑ When pruning trees to improve sightlines, prune selected branches rather than cutting the main tree trunk. This will allow the tree to continue to grow and its roots to hold the soil in place.

☑ Design landscaping to avoid providing cover for large predators (such as bears and cougars) near school yards and children's play areas. This will minimize wildlife conflicts.

AVOID THE INTRODUCTION OF INVASIVE PLANTS

☑ Minimize the disturbance of soil on the development site to discourage the spread of invasive plant species. Mowing before seeds develop and/or establishing a grassy ground cover can also minimize the spread of invasives. Cutting flowering heads from thistles and other invasive plants prior to seed set can significantly reduce their spread.

The estimated cost of maintaining horticultural landscapes is up to \$4 per square metre per year vs. 20¢ per square metre per year for natural landscapes (City of Surrey 2003).

Naturalized spaces are less expensive to maintain than gardens and formal open spaces. Most costs are incurred in the first three to five years of establishment, after which only periodic mowing and weeding is needed. An 80–90% saving can be achieved over a ten-year period (Geomatrix 1999 and USEPA 1998, cited in Evergreen 2001).



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☑ Remove invasive plant species (such as Purple Loosestrife, Knapweed, Cheat Grass, and Himalayan Blackberry) from the site, being careful not to damage the native vegetation. Removal of invasive species should be undertaken only with expert advice. Persistence is required when dealing with invasive plants as re-growth of perennials, and germination through seeds banked in the soil, is common until native groundcover species are re-established.

DESIGN TRAILS CAREFULLY

Trails in natural settings can provide opportunities for enjoying nature.

☑ Design trails and other accesses to avoid sensitive features, such as streams, ponds, wetlands, nesting sites, snake **hibernacula**, as well as the associated buffer areas and wildlife corridors.

☑ Ensure that trails do not cut through sensitive habitats, as well as sites with species at risk.

☑ Develop greenways with wide vegetated strips.

☑ Control recreational access to natural grassland areas—even walking in these areas can damage vegetation and result in the compaction of soils. For further information on recreational activities on grasslands, see [Best Management Practices for Recreational Activities on Grasslands](#).

☑ Keep hiking trails and walkways narrow so they do not present an impediment to wildlife movements, and use elevated boardwalks or install wildlife tunnels or other crossing sites for wildlife.

☑ Limit access to aquatic and riparian habitats. For more information, see [Access Near Aquatic Areas: A Guide to Sensitive Planning, Design and Management](#). Boardwalks can be helpful in crossing wetlands and damp areas and keeping people and pets on the trail, but these boardwalks should be kept to a minimum, as they also shade the ground beneath and prevent wetland plants from growing. An Approval under the B.C. [Water Act](#) and/or a federal [Fisheries Act](#) Authorization may be required for such structures.

☑ Discourage pet access to sensitive habitats by constructing fencing and maintaining dense shrubby vegetation.



Boardwalks are helpful in crossing wetland areas but also shade the plants beneath.

Photo: Judith Cullington



3.5 Guidelines for Climate Change

3.5.1 Greenhouse Gas Emissions

Greenhouse gases such as carbon dioxide and methane are a concern because they contribute to climate change. Developers can help reduce greenhouse gas emissions by using energy-efficient building designs as well as landscaping methods that retain or increase carbon sequestration. For more information, see the [Climate Change](#) website.

DESIGN BUILDINGS FOR MINIMAL ENERGY USE

☑ Design, construct, and retrofit buildings to minimize energy required for heating, cooling and operation.

- ▲ Take advantage of passive solar design for heating and lighting
- ▲ Construct walls, windows and roofs to minimize heat loss or gain
- ▲ Install only EnergyStar appliances

See the [Site Design Manual for B.C. Communities](#) for additional ideas.

☑ Use Canada Green Building Council [LEED™](#) (Leadership in Energy and Environmental Design), [BuiltGreen BC](#), or equivalent standards for construction.

☑ Use only high-efficiency residential gas furnaces and boilers.

☑ Consider renewable energy options (including [district energy](#)) for heating and cooling buildings.

☑ Orient streets and roof lines so that they are well placed for solar panels. Construct new homes such that they are solar hot water ready and solar PV (photovoltaic) ready.

☑ See [LiveSmart for Contractors](#) for best practices in building construction.

[BC Hydro](#) and [FortisBC](#) both provide support to enable developers to construct more energy efficient homes and other buildings.



Orient roofs so they are well placed for solar panels.

Photo: Judith Cullington



Encourage 'green' transportation options.

Photos: Judith Cullington

The Capital Bike and Walk Society has produced a bicycle parking best practices guide which includes design information. www.capitalbikeandwalk.org/

Many B.C. communities have put in public EV charging stations. These can be seen using the PlugShare maps. <http://www.plugshare.com/>

Some condominium buildings are providing new owners with free bus passes for the first year, as well as other incentives to use public transit.

ENCOURAGE GREEN TRANSPORTATION OPTIONS

- ☑ Create mixed-use residential/commercial developments. These neighbourhoods provide jobs and homes close together, reducing the need for vehicle use and providing more affordable housing options.
- ☑ Work with the local government to reduce the number of parking stalls per dwelling unit in areas that are well served by public transit. This reduces land use, impervious surfaces, and development costs.
- ☑ Design developments to encourage alternatives to automobile use, including bicycle and walking paths. Provide secure bicycle storage facilities for employees and visitors, and employee showers and change facilities at work sites.
- ☑ Provide [charging points](#) for electric vehicles, electric bicycles and motorized scooters.
- ☑ Encourage the use of van pools or car-share cooperatives by providing special parking sites.
- ☑ Locate new developments near existing, well-served transit points. Work with local transit authorities to improve bus transportation to your development if it is not already well served.

3.5.2 Climate Change Adaptation

Ongoing climate change requires that British Columbians plan for very different weather conditions than occurred in the past. For example, heavy precipitation events of short-term duration, 100-year floods, warm winters, freeze-thaw events, and unusually hot summers are likely to occur with greater frequency and intensity. Such events may affect buildings, infrastructure, vegetation, and other elements of a development. Long-term developments, buildings and infrastructure therefore need to be sited and designed to accommodate future climate and its impacts.



CONSIDER CLIMATE CHANGE RISKS WHEN SITING AND DESIGNING BUILDINGS AND INFRASTRUCTURE

- ☑ Identify future climate conditions for your area. For information on regional climate projections see the [Pacific Climate Impacts Consortium](#) website.
- ☑ Consult the [Public Infrastructure Engineering Vulnerability Committee](#) protocol for people who own, operate or design physical infrastructure. It provides a five-step procedure to assess the vulnerability of infrastructure to climate change from an engineering perspective.
- ☑ Consider relevant guidance on buildings and climate change adaptation from other jurisdictions, for example from the [UK Green Building Council](#) or the [UK National Building Society](#).
- ☑ For developments in coastal areas, follow the [Green Shores](#) principles for planning and design. Also consult the [Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use](#) for setbacks to accommodate expected sea level rise.

3.6 Guidelines for Green Developments and Buildings

“Green” developments are designed to meet multiple sustainability objectives including:

- ◆ protection of natural ecosystems and species;
- ◆ minimal use of energy and water (in construction and for the lifecycle of the building), and encouraging the use of clean and renewable energy sources; and
- ◆ use of locally-sourced materials where possible, including re-use of building materials from deconstructions.

“Cluster development can reduce the capital cost of subdivision by 10–33%, primarily by reducing the length of infrastructure. It can also reduce the area that needs to be cleared and graded, a cost saving up to U.S.\$5000 per acre” (Schueler 1995).

DESIGN THE DEVELOPMENT TO PROTECT ECOSYSTEMS AND SPECIES

- ☑ Reduce infrastructure costs while protecting wildlife habitat, and preserving local agriculture and forestry resources by redeveloping brownfield and greyfield sites rather than expanding development into natural areas or resource lands.
- ☑ Cluster developments in areas close to existing infrastructure (e.g., water, sewer, and power lines), as this will reduce infrastructure costs and enable the remainder of the site to be protected or restored as green space. Clustering development may be facilitated through options such as a density bonus or density transfer (see [Appendix F](#)).

The City of Richmond reduced road right of way widths for one development project from the standard 17 m to 11.8 m, which considerably reduced the amount of pavement needed (B.C. Sprawl Report 2001 www.smartgrowth.bc.ca/publications/ResearchReports/tabid/155/Default.aspx).



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The City of San Francisco has prepared a guideline ("Standards for Bird-Safe Buildings") to reduce the impact of buildings on bird mortality, noting that buildings and windows are the top killer of wild birds in North America." http://www.sf-planning.org/ftp/files/publications_reports/bird_safe_bldgs/Standards_for_Bird-Safe_Buildings_8-11-11.pdf

The Government of Canada provides a list of technologies and practices that improve the energy and resource efficiency of commercial and multi-unit residential buildings. For more information, see <http://www.greenglobes.com/advancedbuildings/index.htm>.

The Canada Green Building Council supports the Living Building Challenge that is trying to create homes that meet seven criteria: Site, Water, Energy, Health, Materials, Equity, and Beauty. These buildings have an extremely low (or zero) requirement for off-site water or energy, minimal carbon footprint, and protect natural habitats.



☑ Create narrow roads with infiltration swales. These use less land, create less **impervious surface**, and make neighbourhoods safer because they tend to slow traffic.

☑ Use green walls and green roofs to provide habitat for birds and beneficial insects.

☑ Ensure that taller buildings are designed to minimize bird strikes. A significant number of birds are killed each year because they fly into buildings.

☑ See **Section 3.7.1** for ways to protect streams and wetlands by encouraging rainwater infiltration.

MINIMIZE THE USE OF WATER AND ENERGY

☑ See **Section 3.5.1** for guidelines for reducing energy use.

☑ Construct low-water-use homes by installing low-flush toilets, low-water-use appliances, and other water-saving devices.

☑ Use xeriscape (low water use) landscaping to reduce water demand. Where irrigation is required, use the [Irrigation Scheduling Calculator](#) that utilizes climate stations to develop a schedule or run time for the irrigation system, helping to ensure that water is not wasted.

☑ Consider ways to re-use greywater and to recapture and treat wastewater.

☑ Restore heritage homes rather than knocking them down and building anew. In addition to protecting local history, it takes less energy and materials to rebuild a home than for new construction. For more information see the [Heritage and Sustainability](#) website.

☑ For more information on energy- and water-efficient developments that meet the LEED™ (Leadership in Energy and Environmental Design) standards, see the [Canada Green Building Council](#) website.

USE LOCALLY-SOURCED MATERIALS

☑ Use locally-sourced materials for building where practical. Some building materials are transported long distances, creating a large amount of greenhouse gas emissions.

☑ See **Section 3.10.1** for information on re-use of building materials.

Use **xeriscaping** to reduce water needs.

Photo: Judith Cullington



3.7 Guidelines for Water Management

3.7.1 Rainwater Management

Increasing impervious surfaces can damage local watercourses and fish populations by altering hydrology and water quality. Integrated rainwater management approaches help to reduce these impacts and are frequently less expensive for the developer than a traditional ‘pave and pipe’ approach.

There are many guidelines related to rainwater management at the site level. For information on these, refer to the [Waterbucket](#) website which provides many examples of how developments have implemented good rainwater management practices. Some of the basic guidelines are provided below.

DESIGN THE SITE TO MAINTAIN THE NATURAL HYDROLOGY

The development goal should be to preserve or mimic the pre-development hydrologic water balance for both the surface and subsurface components of the hydrologic system.

☑ Whenever possible, design the site to mimic the natural water balance to protect stream health, maintaining natural hydrological cycles during and after development. The [Water Balance Model](#) provides a runoff-based tool for source control evaluation and stream health assessment.

The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Social and Environmental Benefits provides a summary of the benefits of progressive water management techniques, and ways to calculate its values. <http://www.cnt.org/repository/gi-values-guide.pdf>

The Okanagan Basin Water Board developed a guideline for home owners “Slow it. Spread it. Sink it! An Okanagan Homeowner’s Guide to Using Rain as a Resource” http://www.okwaterwise.ca/pdf/HomeDrainageGuide_Okanagan.pdf that provides techniques that homeowners can undertake to capture and control water runoff.

Advantages of progressive design standards

“Widespread use of ...[progressive design standards] can

- reduce dwelling unit costs by 25%–40%
- increase land use efficiency
- reduce per-dwelling unit cost for neighbourhood streets and utilities
- protect ecosystems during infrastructure construction & maintenance
- increase community interaction through housing clusters & mixed-use zones
- reduce energy use by building transportation infrastructure for walking, cycling, and transit
- reduce per-capita production of greenhouse gases by 30%–50%
- preserve natural habitats and ecosystems through landscape sensitive site design
- provide cost-savings to developers and consumers by relaxing parking requirements in new developments (e.g., fewer stalls in developments near public transit)
- improve local business by increasing local residential activity.”

(Smart Growth BC website <http://www.smartgrowth.bc.ca/>)



The Water Balance Model promotes a watershed-based approach that manages the natural environment and the built environment as integrated components of the same watershed (<http://bc.waterbalance.ca/water-balance-model/>).

Waterbucket.ca (Water centric planning tab) <http://waterbucket.ca/wcp/> provides many stories about communities and developments who have taken up the challenge of developing “outcome oriented plans” rather than just target numbers.

- ☑ Retain natural water flows. Changes in surface drainage and groundwater flow patterns may adversely impact aquatic and riparian ecosystems and destabilize their banks, or change the seasonality of flows.
- ☑ Avoid changes to natural drainage patterns and riparian vegetation. Changes in surface or underground flow patterns can destabilize banks and impact upland ecosystems and aquatic habitats.

PUT WATER BACK IN THE GROUND

- ☑ Use the [Water Balance Model](#) to design rainwater systems that maximize the infiltration of uncontaminated stormwater.
- ☑ Establish performance targets for rainwater that are consistent with [Stormwater Planning: A Guide for British Columbia](#).
- ☑ Minimize the amount of impervious surface by using pervious paving on parking lots, laneways, driveways, walkways, patios, etc.
- ☑ Work with the local governments to build narrower roads that create less impervious area.
- ☑ Encourage groundwater recharge by using vegetated swales, infiltration basins and absorbent vegetation, and by disconnecting downspouts from buildings (where the terrain and local government bylaws permit).

Benefits of green roofs

Green roof technology has been well-established in Germany and other northern European countries for some time, however, it is still relatively new to North America. Green roofs provide a variety of benefits to developers and communities:

- **Cost savings:** The roof lasts up to twice as long as a conventional roof and requires less maintenance.
- **Energy savings:** Studies have shown that a typical one storey building with a grass roof and 10 cm (4 inches) of growing medium reduced summer cooling needs by 25%, and a 15 cm (6 inch) extensive green roof reduced heat gains by 95% and heat losses by 26% compared to a conventional roof.
- **Sound insulation:** Sounds from airplanes and other external sources are reduced by over 40 decibels.
- **Increased rainwater retention:** The roof absorbs water and reduces the need for stormwater management infrastructure.
- **Food production:** The Fairmount Waterfront Hotel in Vancouver used to grow herbs, flowers, and vegetables on its roof, saving its kitchen an estimated \$30,000 a year in food costs.
- **Recreation and views:** Green roofs can help address the lack of green space in many urban areas. Studies show that leisure activities in natural settings such as gardens and parks are important for helping people cope with stress and other issues.

(Green Roofs for Healthy Cities website <http://www.greenroofs.org/>)



Raingardens help to filter pollutants and slow overland flow into streams and creeks.
Photo: Judith Cullington

HOLD BACK RAINWATER THROUGH RATE CONTROL OR DETENTION

- ☑ Where surface water cannot be infiltrated, use the [Water Balance Model](#) to assess rainwater volumes and identify appropriate source controls. The [Primer on the Water Balance Methodology](#) provides more detailed background on why this model is an important approach to managing rainwater. The [Water Balance Model Express for Landowners](#) is an online tool to help landowners evaluate the ability of their properties to “slow, sink and spread” rainwater.
- ☑ Create ‘raingardens’, attractive features that allow water from roofs and driveways to be directed into a vegetated pond. For most showers and rainstorms, the pond can hold the water and slowly release it into the ground. For heavy rainstorms, an overflow pipe directs water into the storm sewer. The Waterbucket website ([Showcasing Green Infrastructure](#) tab) includes many examples of innovative approaches used by B.C. communities.
- ☑ Consider green roofs for buildings. Among other benefits, green roofs help reduce rainwater runoff by storing it on the roof where it is used to support plants. Runoff is delayed and the total volume of runoff is reduced. For more information about green roofs, see the [Green Roofs for Healthy Cities](#) website.
- ☑ Create isolated detention ponds. These help reduce the amount of silt and pollutants that can then be infiltrated or slowly enter streams and groundwater.
- ☒ **DO NOT convert** natural wetlands to detention ponds, as this may contravene the Canada [Fisheries Act](#) and/or B.C. [Water Act](#).

Reining in the Rain is a case study of the City of Bellingham’s use of rain gardens to manage stormwater in parking lots. For more information, see http://www.psparchives.com/publications/our_work/stormwater/stormwater_resource/bioretenction/Rain_Garden_book.pdf.



3.7.2 Water Quality and Quantity

Sediment from erosion and other sources of contaminants can seriously impair water quality for fish, wildlife and human health. Drinking water for many British Columbians comes from surface sources (such as rivers, lakes, and reservoirs) so protection of these sources is essential. The B.C. [Drinking Water Protection Act](#) protects public health from potential drinking water health hazards.

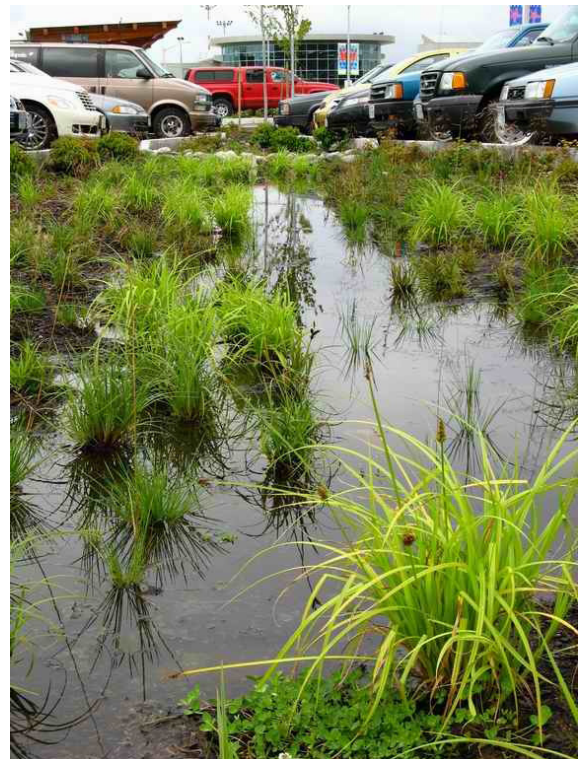
The B.C. water quality guidelines are found at http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html.

PROTECT SURFACE WATER QUALITY

- ☑ Monitor water quality before and after development to ensure that provincial water quality guidelines (and local water quality objectives if applicable) are being met (see also [Section 2.7.2](#)). Use water quality information to adapt practices to ensure continual improvement.
- ☑ Maintain healthy wetlands, aquatic ecosystems, and riparian vegetation which can help to protect water quality in the event of a release of sediment or other pollutants.
- ☑ Control erosion and sediment generation at the source rather than attempting to treat sediment-laden water (see **Section 3.7.3**).
- ☑ Establish vegetated swales or other features to prevent the transport of oils and other contaminants into sensitive habitats.

The Wetland Trust has prepared a guide on how to design and establish naturally-appearing and functioning wetlands for wildlife and fish habitat (Biebighauser, 2011). <http://www.thewetlandtrust.org/wetlandrestorationbook.html>

Use engineered wetlands to manage runoff.
Photo: Scott Murdoch





Protect groundwater quality and quantity.
Photo: Judith Cullington

- ☑ Reduce the width of roads and area of impervious parking lots to reduce the amount of surface water flow that will need to be treated.
- ☑ Consider using engineered wetlands to treat rainwater from parking and roadside surfaces prior to discharge to local streams (note that this may require approval under the [Water Act](#)). Constructed wetlands are also well suited for treating nutrients such as runoff from heavily landscaped areas and nursery areas.
- ☑ Maintain equipment so that it does not leak contaminants on the development site and to ensure that stormwater control facilities perform at the design level. This helps to prevent problems such as clogging of facilities, and washout of sediments and trash from sumps. Ongoing and proper maintenance requires: a maintenance plan and schedule; identification of responsible parties; documentation of maintenance activities; and periodic review of maintenance activities.

PROTECT GROUNDWATER QUALITY AND QUANTITY

Groundwater serves as a potable water source for a large number of British Columbians and their businesses. It is an integral part of the hydrologic cycle and is essential to the maintenance of the ecological health of many ecosystems and the species they support, as well as the year-round flow of water in many streams and rivers.

- ☑ Ensure groundwater supply and lot sizes are sufficient to avoid well interference. Use the [Design Guidelines for Rural Residential Community Water Systems](#).



The Groundwater Bylaws Toolkit was developed by the Okanagan Basin Water Board and partners as an appendix to the Green Bylaws Toolkit. This document is an excellent resource for developers aiming to protect the quality and quantity of groundwater. It includes sections on the basic principles of hydrogeology, groundwater data management, and jurisdiction for managing groundwater. http://www.obwb.ca/groundwater_bylaws_toolkit/

- ☑ Identify existing active and abandoned (i.e., not closed) wells prior to development.
- ☑ Close abandoned wells to prevent contamination and to address safety concerns. Unused and improperly closed wells can provide a conduit for surface contamination to enter aquifers and impact groundwater resources. Well operation and closure is governed by the [Ground Water Protection Regulation](#). In most cases, closing a well properly and safely requires hiring a Qualified Well Driller, Qualified Well Pump Installer or Qualified Professional (as defined in the [Water Act s.71](#)).
- ☑ Ensure that wells are properly constructed and follow groundwater regulations (e.g., standards for well construction, maintenance, and closure; protection of well heads, and flood-proofing).
- ☑ Protect groundwater systems from contamination by providing and using impervious sumps for concrete wash water and other potential construction contaminants.
- ☑ Protect groundwater systems from contamination by restricting the use of underground infiltration systems for stormwater disposal (e.g. dry wells, underground leaching systems) in aquifers that are currently or potentially groundwater supply aquifers, or aquifers that are susceptible to contamination because of their hydrogeologic characteristics or the presence of high-risk sources of contamination from existing or proposed development.
- ☒ Do not intercept shallow groundwater systems with ditches, drain tiles, or other similar structures.

3.7.3 Erosion and Sediment Control

Erosion and sediment control can be a significant issue on construction sites. Runoff from exposed soils can enter drainage systems and watercourses and can result in charges under the [Fisheries Act](#).

Effective erosion and sediment control requires the use of a variety of techniques. For more information, consult the [Land Development Guidelines for the Protection of Aquatic Habitat](#) and the [Water Quality Municipal Best Management Practices for Construction Design](#) website.



DEVELOP AN EROSION AND SEDIMENT CONTROL PLAN

☑ Develop a plan for erosion and sediment control with the assistance of an appropriately qualified professional before construction begins. The plan should include:

- ▲ methods to minimize the extent of area cleared at any one time and to promptly revegetate disturbed areas (with native plants);
- ▲ guidelines for source control and removal of contaminants from site runoff;
- ▲ detailed directions to contractors to ensure that no erosion or sediment movement occurs and no silt is released to watercourses during the construction and post-construction phases; and
- ▲ plantings of appropriate native plant species that will quickly re-establish vegetation cover, especially in riparian areas.

☑ Check for and adhere to any local government bylaws regarding erosion and sediment control.

☑ In the construction and post-construction sediment and erosion control plan, recommend that an appropriately qualified professional:

- ▲ provides monitoring to ensure that the plan is properly implemented during the course of clearing and construction;
- ▲ ensures that construction does not harm habitat; and
- ▲ provides long-term monitoring of disturbed sites until green-up is established and soils at the site are stable.

Develop an erosion and sediment control plan.

*Photos: Marlene Caskey
and Dave Polster*



3.8 Guidelines for Air Quality

Air quality is a concern for human health and the natural environment. Land-clearing, construction, and demolition activities can temporarily degrade local air quality, as a result of fine particles, dust, vehicle emissions, and hydrocarbons released from architectural surface coatings, paving, and roofing. By considering the location of new developments relative to existing air pollution sources and by instituting best practices during site development, potential air quality issues can be avoided or minimized.

A variety of contaminants can lead to respiratory and cardiovascular health impacts particularly in susceptible portions of the population such as pregnant women, infants, children, seniors, and those with pre-existing cardiac or respiratory issues such as asthma, chronic obstructive lung disease and congestive heart failure. Fine particles (often referred to as $PM_{2.5}$) from sources such as wood smoke and vehicle/marine traffic emissions can be a concern. Diesel $PM_{2.5}$ is a probable human carcinogen and likely the most harmful traffic-related air pollutant.

LOCATE BUILDINGS TO AVOID AIR QUALITY CONCERNS

- ☑ Consult with air quality authorities before planning or seeking rezoning for residential or institutional development near industrial facilities, busy traffic corridors, and other large air emission sources.
- ☑ Do not place building air intake systems near loading docks or areas where delivery vehicles may be idling. This is particularly important because many medium- and heavy-duty delivery vehicles have diesel engines. Similarly, building intakes should not be located on a side of a building near a busy traffic corridor. This will help avoid indoor air quality problems due to traffic-related air pollution.
- ☑ Where proximity to traffic is unavoidable, use high-efficiency particulate air (HEPA) room cleaners or preferably centralized filtration units to reduce exposure to air pollution from fine particles. However, HEPA filters do not reduce exposure to gaseous air pollutants such as carbon monoxide or nitrogen oxides, of which motor vehicles are a large source.

For more information, see the B.C. [Air Quality](#) website.



Use HEPA filters where proximity to traffic is unavoidable.
Photo: Judith Cullington



PROTECT AIR QUALITY DURING DEVELOPMENT

- ☑ Control construction dust.
- ☑ When clearing land, encourage or require alternatives to open burning, such as leaving downed wood in buffer areas, chipping or composting.
- ☑ If wood waste from land clearing is to be burned, ensure that it is in compliance with municipal bylaws regarding open burning and the [Open Burning Smoke Control Regulation](#).
- ☑ Ban engine idling. Remind construction workers to turn off their vehicles while stopped at the site. This will reduce their fuel costs and protect air quality.
- ☑ Require contractors to adopt practices that will reduce emissions from their vehicles and equipment such as diesel generators.
- ☑ For major construction and demolition activities, implement the design considerations and emission reduction actions identified in [Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities](#).

Metro Vancouver has adopted Sustainable Procurement and Green Procurement Procedures which outline requirements for hired diesel-powered vehicles & equipment.

Local governments are required to include emissions from their contractors as part of their carbon neutral local government commitments starting in 2012. For information see <http://www.toolkit.bc.ca/resource/becoming-carbon-neutral-workbook-and-guidebook>.



Control construction dust.
Photo: Judith Cullington



3.9 Guidelines for Hazard Management

3.9.1 Terrain and Flood Hazards

- ☑ See the [Floodplain Mapping Program](#) for maps of areas that are highly susceptible to flooding, as well as the information in [Section 2.8.1](#) and [Section 4.2.4](#) on flooding and sea level rise.
- ☑ For information on landslides and other terrain hazards, see the B.C. [terrain stability maps](#) and [Section 2.8.2](#).



Be Bear Aware.

Photo: Ministry of Environment

3.9.2 Wildlife Conflicts

As native plants and trees are replaced by roads, buildings, and lawns, many wildlife species are displaced. Some species, such as rats and starlings, benefit from human activities and may cause conflicts. Other species, such as bears, cougars, and rattlesnakes, may pose safety concerns. Every year, hundreds of bears are destroyed as a result of conflicts with humans. Identifying potential wildlife conflicts and designing developments to minimize them can help both people and wildlife.

SITE DEVELOPMENTS TO AVOID WILDLIFE CONFLICTS

- ☑ Avoid building on or near wildlife corridors and other frequently used wildlife habitats (especially those used by large predators, such as bears and cougars, and other potentially dangerous species such as rattlesnakes).
- ☑ Choose vegetation for landscaping with wildlife in mind. For example, planting with species that attract deer could increase vehicle collision risks and attract cougars to populated areas. Instead, choose local native plants that deer do not find palatable.

Be Bear Aware

Residential dumpsters can be used to replace individual household garbage cans. Residents take their household garbage to their nearest bear-proof container (located throughout residential areas at one per 20–35 homes). To reduce odours, containers are emptied regularly and taken to a bear-proof landfill. There are significant savings in using this system over curb-side pick-up, even after factoring in the capital costs of purchasing and implementing new containers. Replacing curb-side collection with dumpsters that are emptied with a self-loading truck (a one-operator system) is the main cost saving in switching to a bear-proof container system. This system eliminates the problem of residents storing garbage on their property.

There are also additional benefits to bear-proofing waste management within a community. Bear-proof waste management systems often reduce human-bear conflicts, and they also make garbage unavailable to other animals. For example, Norman Wells, NWT, has been bear-proof since 1991. Because bear-proof dumpsters have been used since that time, birds and dogs no longer scatter garbage around. As a result, the entire community is cleaner.

For more information: Get Bear Aware www.bearaware.bc.ca



- ☑ Consider possible wildlife conflicts when siting trails around or near developments.
- ☑ Ensure adequate fencing where necessary.
- ☑ Discourage use of human use areas by installing noise and other deterrents (e.g., birds of prey).
- ☑ Install adequate lighting in areas that are near natural wildlife corridors or man-made green spaces.
- ☑ Follow the [Bear Smart guidelines](#). This program is working to address the root causes of human-bear conflicts, thereby reducing the risks to human safety and private property, and the number of bears that have to be destroyed each year.
- ☑ Provide new residents with education about improperly stored barbecues, pet food, bird feeders, and domestic animals that bring wildlife close to people. (See box for additional ideas on education.)

REMOVE OR REDUCE WILDLIFE ATTRACTANTS

- ☑ Implement an animal-proof solid waste management system to reduce potential conflicts with wildlife. Covered garbage storage areas can be designed to keep out common conflict species such as bears, skunks, and rats. Spilled garbage attracts crows and raccoons, which prey on sensitive wildlife such as reptiles, amphibians, and songbirds. Under the B.C. [Wildlife Act](#) it is an offence to improperly manage attractants, such as garbage, leaving them accessible to dangerous wildlife (coyotes, wolves, cougars, and bears).

Provide Safety Information

Provide adequate signage about wildlife in and around the area and suggestions to reduce potential encounters:

- keep dogs on leash
- proper food storage
- look for wildlife tracks and scat
- avoid travelling at dawn and dusk
- avoid travelling alone or with headphones along trails and travel corridor
- never approach wildlife or encourage wildlife to get close to people

Provide adequate signage of appropriate behaviours to have when wildlife are encountered:

- make attempts to immediately scare off non-threatening wildlife
- create space, go back the way you came
- pick up small children, leash up pets, form a group
- deploy noise deterrents such as whistles, air horns, bangers/cracker shells
- look big, pick up a stick, wave arms over head
- report all wildlife sightings to authorities



Eliminate entry points into buildings.
Raccoons.

Photo: Grant Bracher



- ☑ Provide adequate bear-proof storage containers for refuge and recycling that prevent all wildlife from getting access to human related food sources. If bears succeed in getting food once, they will come back for more and end up being killed as a nuisance bear. Most wildlife will move out of an area with little or no food for them.
- ☑ Minimize attractants for large carnivores and nuisance wildlife. Avoid planting fruit trees and other species palatable to deer or bears, or ensure fruit trees are harvested promptly. Clear dense vegetation and berry-producing shrubs from areas around houses and children's play areas. For more information on ways that communities have dealt with problem bears, see [Get Bear Aware](#).
- ☑ Eliminate access to artificial denning sites for raccoons, squirrels and skunks by ensuring that entry points into buildings (such as chimneys, attics, vents, spaces under houses, porches, and sheds) are animal-proof. Prevent access to rooftops by keeping tree and shrub branches at least three metres away from the sides and tops of buildings.
- ☑ Put in fences that keep wildlife such as deer away from attractive food sources. This can also protect pets and property from wildlife damage. However, fences can also disrupt wildlife travel, so choose fence styles carefully.



3.9.3 Contaminated Sites

In British Columbia, a contaminated site is defined as an area of land in which the soil or underlying groundwater or sediment contains a hazardous waste or substance in an amount or concentration that exceeds provincial environmental quality standards.

Where commercial and industrial activities take place, releases of toxic substances such as hydrocarbons (e.g., fuels, oils, PCBs) and metals (e.g., lead, cadmium, chromium) can occur into the soil, surface water and groundwater. Sites are considered contaminated if these toxins reach levels that pose a threat to the environment, human health or the safety of underground services (such as short circuits in street lighting), and which make these sites unsuitable for specific land or water uses.

For land developers, the legal and financial implications of site contamination can be significant. Soil removal/replacement can be costly, and there may be restrictions on the types of land use permitted following cleanup. Groundwater impacts may restrict land use unless they are dealt with appropriately during remediation, and the costs of remediating groundwater contamination may be even higher than for soil cleanup. For sites where risk assessment has been used to meet remediation requirements, restrictions on land use may continue and future excavation and disposal of soil from the site may also be restricted.

Redevelopment of brownfield sites is environment-friendly because it encourages site clean-up and allows for development that does not destroy natural habitats. However, it is important to ensure that the site has been properly cleaned up so that human and environmental health is protected. Prevention of future contamination is also important.

For general information on contaminated sites see the Contaminated Sites 101 overview at <http://www.env.gov.bc.ca/epd/remediation/cs101.htm>.



Identify and clean up contaminated sites.
Photo: Judith Cullington

Dealing with contaminated sites

Contaminated sites projects typically follow a five-part management process for dealing with contaminated sites:

- Identification
- Investigation
- Remediation planning
- Remediation
- Evaluation/monitoring

For land developers, the legal and financial implications of historic site contamination can be significant. Soil removal/replacement can be costly, and there may be restrictions on the types of permitted land use following cleanup. Groundwater impacts may restrict land use unless they are dealt with appropriately during remediation, and the costs of remediating groundwater contamination may be even higher than for soil cleanup. Note that at sites where risk assessment has been used to meet remediation requirements, restrictions on land use may continue, and excavation and disposal of soil from the site may also be restricted.

For more information, see the Contaminated Sites Fact Sheets available from http://www.env.gov.bc.ca/epd/remediation/fact_sheets/index.htm#4



A listing of Society of Contaminated Sites Approved Professionals (formerly the Licensed Environmental Professional) is available from <http://www.csapsociety.bc.ca>.

IDENTIFY POTENTIALLY CONTAMINATED SITES

- ☑ Check the status of a site prior to acquisition. In order to determine if a site is contaminated, it must be assessed and investigated following a process as described in the [Contaminated Sites Regulations](#). These regulations provide a method of screening potentially contaminated sites. Developers should review the fact sheet [Highlights for Developers](#).
- ☑ Identify the potential for contamination on neighbouring sites. Information on known and potential contaminated sites may be available in the provincial [Site Registry](#) and may be accessed via [site specific information requests](#).
- ☑ Should a site have a potential to be contaminated due to past activities, review and follow the Province's requirements for site profiles and site investigations (see below).
- ☑ Practice due diligence when preparing property transactions, including providing/requesting a site profile, where required. For more information, see the [Highlights for Realtors, Property Vendors and Purchasers](#) fact sheet.

PREPARE A SITE PROFILE AND SITE INVESTIGATION

The site profile system is a mandatory process under the [Environmental Management Act](#). It is used to bring potentially contaminated sites to the attention of the Ministry of Environment and to determine if and when site investigation is required. Site profile submissions are triggered by applications for zoning of land, subdivision, development and development variance permits, and soil removal and demolition permits for sites having a specified commercial or industrial use in the past. Site profiles must also be submitted for these kinds of sites upon decommissioning and/or foreclosure. This process ensures that properties having a potential to be contaminated due to past or present site activities are assessed and, where necessary, cleaned up prior to re-use.

Where a site profile is required, approving authorities (including local governments) are prohibited from approving specified applications (for example, in relation to zoning, development permits or subdivision) unless at least one of seven statutory conditions is met, several of which involve receiving notifications or determinations under the *Environmental Management Act*.

- ☑ If required, prepare a site profile for sites with a commercial or industrial history. A site profile is a screening form for identifying



potentially contaminated sites and is created from readily available information about a site, including a basic description and its past and present uses. The form is typically filled out by a site owner or a qualified consultant acting for the site owner. Based on the information provided, a site profile could trigger a site investigation requirement imposed by a ministry Director of Waste Management.

☒ Hire a qualified consultant to prepare a site investigation, if required. Site investigations are a more in-depth study to determine if a site is contaminated. A preliminary site investigation involves searching existing records for information about a site, interviewing people who are or have been involved with the site, and determining the general location and degree of any contamination. If more information is needed, then a detailed site investigation is undertaken. In this case, investigators conduct more detailed work to determine the location, extent, and impact of contamination. The information gathered is usually sufficient to develop a remediation plan, or a human health or environmental risk assessment. A ministry Director of Waste Management has the authority to require or order site investigations.

☒ Follow the [prescribed approaches](#) for site remediation and monitoring.

Further information on contaminated sites, site investigations and the site profile system is found in a series of [fact sheets](#) for local governments, developers and others.

PREVENT SITE CONTAMINATION

☒ Implement pollution prevention strategies, which are far more cost effective than site remediation.

☒ Whenever contamination is suspected, avoid activities that would allow the escape or spread of the contaminated materials. This includes protecting the site from rainwater and erosion. Remediate early.

☒ Assess flooding and erosion risks to aquatic habitats and downstream water users from stormwater runoff from these sites. Proposed developments that would increase existing levels of risk (or create new high risk effects) to aquatic habitats, downstream water users, or downstream floodplains should either not be permitted to proceed or should be required to mitigate those impacts.

☒ Do not approve new businesses that store or use hazardous materials in flood-prone areas. Where current such businesses are located in flood-prone areas, encourage them to have plans to secure or remove those materials if there is a threat of flood events. For information on



BC Timber Sales has prepared a Fuel Handling Environmental Field Procedure for BCTS clients (Licensee, Permittee and Contractor workers) who are responsible for fuel handling. http://www.for.gov.bc.ca/ftp/TST/external/!publish/EMS2/EFP/EFP_06_Fuel_Handling.pdf

Potential spill contaminants include fuels, special wastes, dangerous goods, and other hazardous substances, or sediments, drilling salts/mud, construction materials, sewage, and other polluting substances.

The Oiled Wildlife Society of British Columbia is a not-for-profit organization dedicated to maintaining preparedness for oiled wildlife response in British Columbia. They maintain preparedness for oiled wildlife response in British Columbia, including equipment, contingency plans, and training for key personnel. <http://www.oiledwildlifesociety.com/>

**Report spills to the Provincial Emergency Program:
1-800-663-3456**

the handling of fuel in the field, see [A Field Guide to Fuel Handling, Transportation & Storage](#). This document provides guidance on acceptable industry practice for managing fuel handling, transportation and storage in rural and remote areas of British Columbia, and summarizes requirements of applicable statutes, industry codes of practice and recommendations relating to environmental protection, health and safety, and fire protection. It is the responsibility of each commercial or industrial operator to implement the statutory requirements for which they are responsible.

- ☑ Contact Provincial staff or an appropriately qualified professional for additional information on preventing and cleaning up contaminated sites.
- ☑ See the Emergency Planning BC [Personal Flood Preparedness and Prevention](#) website for information that can be provided to residents.

3.9.4 Spill Containment and Reporting

The accidental release of contaminants can have serious public safety, environmental and financial consequences for communities and the person or company responsible for the spill.

PRACTICE SPILL PREVENTION

- ☑ Develop a plan that identifies potential spills and ways to mitigate or avoid them.
- ☑ Become familiar with local government bylaws regarding spill containment.

BE PREPARED FOR SPILLS

- ☑ Develop a spill response plan and make prior arrangements with qualified contractors to handle spills.
- ☑ Train workers in spill prevention and emergency response.
- ☑ Respond quickly when a spill occurs. Immediately contain or control a spilled material to reduce any threats it may pose, such as contamination of surface or groundwater. Ensure the safety and protection of all personnel on the site.
- ☑ Report all spills to the Provincial Emergency Program immediately as required under the *Environmental Management Act* [Spill Reporting Regulation](#).
- ☑ Provide (or make arrangements) for suitable disposal of spill materials and contaminated soils, water, and other materials and as required under the *Environmental Management Act* [Hazardous Waste Regulation](#).



☑ Refer to the Ministry of Environment's [Environmental Emergency Program](#) website for further information and updates on spill prevention, preparedness, response, and recovery requirements.

3.9.5 Pesticides

USE INTEGRATED PEST MANAGEMENT APPROACHES

Pesticides should only be used when necessary and only as part of an **Integrated Pest Management** (IPM) program. IPM is a decision-making process for managing pests which incorporates a suite of strategies and tools in an effort to suppress pest damage to acceptable levels. Practicing IPM can reduce the need to control pests in the future, resulting in considerable savings and reducing impacts to human health and the environment.

- ☑ Develop and follow an Integrated Pest Management approach for all pest problems based on the following principles:
- ◆ Plan and manage ecosystems and structures to prevent organisms from becoming pests;
 - ◆ Identify the organism, confirm it is actually a pest and use its biology to better manage the problem;
 - ◆ Monitor populations of pests and beneficial organisms, pest damage, and environmental conditions. Know where and how large your pest population is;
 - ◆ Use defined injury thresholds in making treatment decisions. Don't waste resources - treat when necessary, not on a schedule!
 - ◆ Reduce pest populations to acceptable levels through strategies which may include a combination of biological, physical, cultural, mechanical, behavioural, and chemical controls; and
 - ◆ Evaluate the effectiveness of treatments.

For more information, see the [Integrated Pest Management Program](#) website.

START WITH PREVENTION

Poor design, construction and planning can create niches for pests to thrive and generate a reoccurring pest problem. Relying on reactive measures, such as pesticide application, often only provides a temporary solution to pest problems.

Members of the Society of Contaminated Sites Approved Professionals of British Columbia (<http://www.csapsociety.bc.ca>) provide professional site investigation and remediation services as well as recommendations to the Ministry of Environment regarding contaminated sites in the Province.



Ladybugs are used as natural pest controls.

Photo: Dave Polster



Section 3: Site Development and Management

Prevention is the first and most important element of IPM. This can save tenants, property managers and neighbours time, stress and money by reducing the opportunities for organisms to become pest problems.

- ☑ Consider pest prevention during building and landscape design by seeking advice from specialists, including factors affecting potential pest refuge, structure susceptibility, and envelope integrity (e.g., exclusion screening for rodents).
- ☑ Provide good access for inspections and treatments.

TREAT PESTICIDES WITH REPECT

- ☑ All pesticide applications must adhere to the requirements of the [*Integrated Pest Management Act*](#) and [Regulation](#). This may include posting signs and keeping records.
- ☑ Inform all parties who may be affected by pest control activities.
- ☑ Only use pesticide products registered in Canada. Homemade pesticides are not allowed and may be dangerous even if the ingredients are “natural”.
- ☑ Read and follow all directions on pesticide container labels – it’s not a suggestion, it’s the law!
- ☑ Make sure the pest can actually be controlled with the pesticide chosen.
- ☑ Hire licensed and certified pesticide applicators when legally required or if unsure how best to manage the pest or use the pesticide products. Pest identification and management can be complex and demanding, don’t try to solve problems without sufficient knowledge - “When in doubt, hire it out!” Check the IPM Program website for currently licensed companies.
- ☑ Ensure any staff conducting in-house pesticide applications have received education on the safe use, handling and storage of pesticides. All applicators should have and use proper safety equipment.
- ☑ Ensure all equipment is properly maintained and calibrated to reduce risk to staff and bystanders and reduce costs.
- ☑ Ask pest control company technicians about their IPM programs and how they intend to use prevention activities and alternatives to manage the pest.
- ☑ Request written information on what pesticide has been applied and ask about safety considerations when pesticide application is being conducted.

Pesticides are materials that are used to kill or repel pests in order to reduce the damage they cause. Pesticides include herbicides (used to kill plants), insecticides (used to kill insects), fungicides (used to kill fungal organisms [mould, rot, etc.]), and treatments used as wood preservatives and other chemicals. The storage of pesticides and disposal of pesticide containers are strictly regulated.

Restricted class pesticides may be applied only by a certified applicator. Regulatory standards and applicator certification requirements apply whenever pesticides are used as a service or applied to public land, rights-of-way, private forest land, or to manage mosquito larvae in water.



- ☑ Store pesticides responsibly and secure them from unauthorized access.
- ☑ Label containers to prevent accidental poisoning and destroy empty pesticide containers to prevent them from being reused.
- ☑ Check for and follow local bylaws respecting the use of pesticides.

3.10 Guidelines for Waste Management

3.10.1 Liquid Waste

On-site sewage disposal systems (septic fields) can pollute groundwater if not properly installed and maintained.

FOLLOW GUIDELINES FOR ON-SITE SEWAGE DISPOSAL SYSTEMS

- ☑ Site septic systems well away from riparian areas and watercourses as well as from potable water sources. Nutrient enrichment from improperly sited and improperly functioning septic systems can cause significant degradation of water quality for fish, wildlife, and humans.
- ☑ Follow the requirements of the [Municipal Wastewater Regulation](#) or [Sewerage System Regulation](#) as applicable.
- ☑ Ensure that septic systems are approved by the local public health authority. For information see <http://www.healthlinkbc.ca/healthfiles/hfile21.stm>.
- ☑ Follow the best management practices for on-site sewage systems provided in the Ministry of Environment's [Municipal Best Management Practices for Water Quality](#).
- ☑ Consult the APEGBC Professional Practice [Guidelines for Onsite Sewerage Systems](#).



3.10.2 Solid Waste

REDUCE SOLID WASTE FROM DEVELOPMENT



Re-use materials from deconstruction of buildings.
Photo: Judith Cullington

- ☑ Where possible, re-use materials from the deconstruction of former buildings. This reduces the need for landfill space and new construction materials. It also reduces greenhouse gas emissions from new construction materials. Construction, renovation and demolition (CR&D) materials are targeted to come under B.C.'s [Recycling Regulation](#) by 2017. Many CR&D materials can already be recycled, consult the [Recyclepedia](#) to find your closest recycling depot.
- ☑ Dispose of non-recyclable parts of demolition and construction waste stream to an appropriate landfill.
- ☑ If a building being deconstructed contains (or may contain) asbestos, call in an asbestos removal expert and ensure that removal follows all precautions as set out in the Workers' Compensation Board handbook "[Safe Work Practices Handling Asbestos](#)". For more information see the [Management of Waste Asbestos by Home Owners in B.C.](#) website.
- ☑ To find out how much re-using CR&D materials can help the environment use the [Environmental Impact Calculator](#).

Supporting Re-use of Building Materials

The Whistler Re-Build It Centre accepts reusable building materials for resale to reduce waste. The facility is operated by Whistler Community Services Society in partnership with the Resort Municipality of Whistler. <http://www.mywcsc.org/pages/re-build-it-centre>

The Town of Sidney has a \$1 permit price for moving a house to a new location for reuse. <http://www.sidney.ca>

The District of Squamish provides lower tipping fees for CR&D waste that is source separated. <http://squamish.ca/our-services/garbage-and-waste-diversion/landfill/>

A deconstruction pilot project undertaken by Lighthouse and Metro Vancouver showed that by separating construction materials the tipping fee was reduced to \$1508.57 compared to \$4599.31. http://www.sustainablebuildingcentre.com/wp-content/uploads/2013/07/July-2013_Construction-in-Reverse.pdf