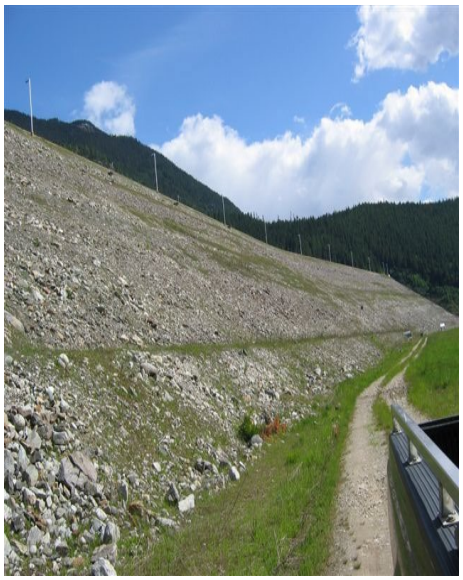
Integrated Vegetation Management Plan

For Control of Vegetation at BC Hydro Facilities

Confirmation Number: 105-985-21/26



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Confirmed: Sept. 15, 2021

Expires: Sept. 16, 2026

Version 1.1 – October, 2023

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First published March 2000.
Revised and republished August 2006, December 2010, March 2012, and May 2016.
Version Published: Oct. 31, 2023 Version 1.1 – removed word 'Draft' from previous version history
April 2021 – Version 1.0

Acknowledgements / Signing Authority:

This document is the responsibility of BC Hydro's Vegetation Management Program:

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Notice: Both federal and provincial legislation contain information required and pertinent to this BC Hydro Integrated Vegetation Management Plan for Control of Vegetation. As well, many other individuals, organizations, companies, and vegetation experts have cooperated in providing information and sources for this IVMP document.

This document is essentially a set of best practices and guidelines compiled from knowledgeable and experienced industry and government personnel. It is intended to provide the owner, operator, and contractors with advice regarding the specific topic. The recommendations set out in this IVMP are meant to allow flexibility and must be used in conjunction with competent IPM practices and judgment. It remains the responsibility of the user of the IVMP to judge its suitability for a particular application.

If there is any inconsistency or conflict between any of the recommended practices contained in the IVMP and the applicable legislation requirements, the legislative requirements shall prevail. Every effort has been made to ensure the accuracy and reliability of the data and recommendations contained in the IVMP.

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Chapter 1, Introduction to Facilities Vegetation Management

About BC Hydro

BC Hydro is a British Columbia provincial Crown corporation, and one of the largest electric utilities in Canada. The company's mandate is to generate, purchase, transmit, distribute, and sell electricity.

BC Hydro distributes electricity produced by several hydroelectric, thermal, and other generation facilities to the majority of B.C.'s population. BC Hydro also purchases power from Independent Power Producers (IPPs) or from the open market.

Hydroelectric plants consist of a dam, a reservoir, a powerhouse, and a switchyard. At each hydroelectric plant, water from a reservoir flows into the powerhouse. The flowing water turns turbines (rotating blades), which in turn drive generators. Thermal plants operate similarly, except the energy used to turn the turbines is produced by natural gas, diesel, or biofuels. Generators convert the turbine's mechanical energy into electrical energy. Transformers located within switching stations convert the generators' low-voltage electricity to a higher voltage, between 60,000–500,000 volts, to move power over long distances via transmission lines to substations.

BC Hydro has over 18,390 km of transmission lines within power line corridors that cover approximately 77,015 ha of land. In substations, the voltage is reduced for delivery to customers over distribution lines that operate at voltages below 35,000 volts. BC Hydro has over 48,500 km of overhead primary distribution lines located primarily along road allowances. Over 560 sites covering approximately 1,250 ha (substations, switchyards, communications sites and work/storage yards) are included in this integrated vegetation management plan.

About This Plan

This document is an Integrated Vegetation Management Plan (IVMP) for the management of vegetation within facilities operated by British Columbia Hydro and Power Authority (BCH). It has been prepared in accordance with Section 58 of the Ministry of Environment's *Integrated Pest Management Regulation*, or IPMR (note subsection references in major headings) and is based on **Integrated Pest Management (IPM)** principles.

It confirms BC Hydro's strategy to employ herbicides under the Integrated Pest Management Act (IPMA) and the Integrated Pest Management Regulation (IPMR). This plan is valid from August 2021 to August 2026.

In compliance with Pest Management Plan requirements outlined by the BC Ministry of Environment, this IVMP includes the following information:

- The program for controlling vegetation within facilities, using the principles of **integrated vegetation management (IVM)** (Chapter 1)
- The process for planning, selecting, using, and evaluating control methods within that program (Chapter 2)
- The methods for handling, preparing, mixing, applying, and otherwise using herbicides within that program (Chapter 3)
- The ways that environmental protection are built into the plan (Chapter 4)

This IVMP is intended to be used by BC Hydro, its agents, and its contractors to conduct vegetation control programs at all of its facilities, such as electrical substations, generation switchyards, generating sites, communication sites, storage sites, administrative buildings, or land owned or leased for future facilities.

This IVMP does **not** cover the management of vegetation on transmission or distribution power line corridors which is covered under a separate plan.

Integrated pest management (IPM) as defined by the Integrated Pest Management Act is a process for managing **pest** populations that includes the following elements:

- Planning and managing ecosystems to prevent organisms from becoming pests;
- Identifying pest problems and potential pest problems;
- Monitoring populations of pests and beneficial organisms, damage caused by pests and environmental conditions;
- Using injury thresholds in making treatment decisions;
- Supressing pest populations to acceptable levels using strategies based on considerations of:
  - Biological, physical, cultural, mechanical, behavioural and chemical controls in appropriate combinations, and
  - Environmental and health protection; and
- Evaluating the effectiveness of pest management treatments.

Integrated vegetation management (IVM) is a system of managing plant communities in which compatible and incompatible vegetation is identified, action thresholds are considered, control methods are evaluated, and selected control(s) are implemented to achieve specific objectives. Choice of control methods is based on effectiveness, environmental impact, site characteristics, safety, security, and economics.

Pest: an organism that is damaging, noxious, or a nuisance. For the purposes of this plan the focus is on vegetation that can interfere with the safe and reliable operation of the power system or damage equipment or facilities.

Person Responsible, Section 58(1)(b)(c)

58 (1) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following identifying information;

(b) the person responsible for managing pests in relation to the land described in paragraph

(c) the name and phone number of an individual who is the principal contact for information relating to the pest management plan.

The person listed below is responsible for administering the IVMP provincially and is the principal contact for information relating to the plan:

Tom Wells, Vegetation Program Manager, Integrated Planning, 604-516-8943

Geographic Boundaries, Section 58(1)(a)

58 (1) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following identifying information;

(a) a description of the geographic boundaries of the area to which the plan applies and maps or diagrams showing the proposed treatment areas within that area;

The geographic boundaries of this IVMP include the entire province of British Columbia, wherever BC Hydro manages electrical and non-electrical facilities. This includes all sites and facilities currently owned or managed by BC Hydro, as well as those developed during the term of this IVMP.

A complete list of the specific facilities to which this IVMP applies is summarized in Appendix 1 and is kept updated on the BC Hydro website along with an overview map. Sites are located in all 27 regional districts across the province, as noted in Appendix 1. Here is a link to the facilities list and map:

https://www.bchydro.com/safety-outages/stay-safe/safety-outside/trees-power-lines/managing-weeds-insects/managing-vegetation-facilities.html

Types of Facilities

BC Hydro facilities are well-defined sites owned or leased by BC Hydro, which typically are fenced and have limited or no public access. They consist of a compound that contains assets that support the generation, transmission, and distribution of electricity. Most facilities can be grouped into one of the following two categories:

- **Electrical facilities** – Sites surrounded by fences to ensure no public access. Contact with high-voltage equipment is extremely hazardous and will cause serious injury or death.

- **Non-electrical Facilities** – A wide range of sites support the BC Hydro electrical system. Some but not all are fenced, and many are located in remote places where access is difficult.

The following are common facility types to which this IVMP applies.

Access roads – Existing and proposed transportation corridors that provide access to sites and facilities for routine maintenance, daily operations, safety inspections, and emergency response. Access includes designated roadways within facilities.

Capacitor stations – Sites with equipment that controls system voltage.

Cable termination sites – Locations where overhead electrical cables enter the ground or water and are connected to underground or submarine electrical cables.

Dams / Reservoirs – Dams are concrete or earthfill barriers across a river or creek that are designed to control water flow and/or form a reservoir to store the water. Reservoirs have intakes that feed water into tunnels and penstocks.

Data collection sites – Instrumentation facilities that collect information on weather, climate, and reservoir levels. These facilities also monitor performance of dams and transmit geological information to a central control centre, using a computer application called ADAS (Automatic Data Acquisition System).

Diesel generating stations – Facilities that use diesel generators to produce electricity. BC Hydro has 16 stations.

Dikes – Banks constructed to control or confine water.

Drill sites – Small areas for extraction of geological core samples.

Gas turbine generating stations – Facilities that use natural gas or fuel oil in jet engines to produce electricity. BC Hydro has 2 stations.

Gravel Pits – Sites that are excavated and used as a source of material for an array of different projects.

Helipads – Helicopter landing pads for access to facilities in remote areas.

Hydroelectric generating stations – Facilities that generate electricity by harnessing the potential energy from water and transforming it into electric energy. BC Hydro has over 30 stations

Leased lands for generation development – land reserved for generation sites

Microwave sites – Telecommunications facilities that house a microwave repeater station, including microwave passive reflectors. These facilities receive and redirect microwave signals to distant points. This category also includes VHF/UHF repeater stations.

Office buildings and storage yards – Corporate, regional, and district administrative office sites, and visitor sites. Most of these office sites are associated with storage yards, which are facilities for storage of electrical system components and other equipment. These are usually fenced with numerous out buildings. BC Hydro has over 90 office sites.

Penstocks – Large wooden or metal pipes that carry water from a reservoir to the turbines in the hydroelectric station. Penstocks may be adjacent to surge towers, which divert and hold excess flow from reservoirs.

Pole yards – Compounds that store wooden distribution poles. These sites are usually fenced and covered with clean, crushed rock.

Potential/developing sites and facilities – lands owned or leased by BC Hydro that may be used for or affected by future facilities, including lands in the vicinity of potential dams or reservoirs.

Properties – Land that is under license of occupation or permitted, and sites with access agreements used for BC Hydro business/activities for the purpose of managing noxious/invasive species.

Repeater stations – Also known as amprodomes, and similar to microwave sites, except they receive, amplify, and redirect radio signals.

Spillways and diversion canals – Spillways are concrete or natural channels designed to pass excess water around the dam without going through the turbines. Diversion canals (or power canals) are open channels that carry water to penstocks or storage reservoirs.

Substations – Facilities that receive high-voltage electricity from transmission lines, and may reduce the voltage to an appropriate level for distribution to BC Hydro customers. They consist of a system of transformers, circuit breakers, and other high-voltage equipment. BC Hydro operates about 330 substations throughout the province.

Switchyards – Facilities that receive low-voltage electricity from a generation facility and increase the voltage to an appropriate level for long-distance transmission over transmission lines to substations.

Thermal generating stations – Facilities that generate electricity by converting heat energy (through burning of fossil fuels) into electric energy. BC Hydro has one station.

Till sites – similar to gravel extraction pits but may include clay, sand, gravel and boulders used in construction.

Importance of Vegetation Control in Facilities

BC Hydro implements vegetation management programs that will maximize public and worker safety and service reliability.Vegetation within and adjacent to our facilities is managed on a regular basis using a variety of manual, mechanical, cultural, biological, and chemical **control methods**. The method or combination of methods chosen to control vegetation on a particular site is based on the IVM decision-making process outlined in this document.

Control methods:

- *Manual and Mechanical control* in facilities are physical controls of vegetation that include activities such as brushing, girdling, gravel cleaning, hand-pulling, hedge trimming, mowing, pruning, and weed trimming.
- *Cultural control* in facilities is management of vegetation in a way that suppresses the growth of incompatible target species through the use of hard surface landscapes (e.g. clean crushed rock, asphalt, concrete, use of geotextile fabrics), low-maintenance vegetative ground-cover, or other managed landscapes.
- *Biological control* methods involve the reduction or suppression of unwanted organisms by introducing or enhancing the presence of natural enemies, such as insects, fungi, or compatible competitive plants. It is often used in noxious weed/invasive species control.
- *Chemical control* is management of incompatible vegetation through the use of herbicides.

The vegetation management program objectives are to:

- Comply with the provisions of the IPMA and all applicable government laws or regulations and BC Hydro corporate policies.
- Ensure vegetation management practices and procedures (including herbicide use) are safe; environmentally sound, practical, effective, socially responsible, and cost efficient.
- Respect agreements with the public, landowners, and other stakeholders.
- Respect Indigenous Peoples title and treaty rights.
- Communicate our vegetation management activities with clarity to the public.
- Employ innovative practices.

Vegetation within and immediately surrounding BC Hydro facilities must be effectively controlled because vegetation can cause harm in various ways. Vegetation can:

- Lead to power outages by interfering with electrical components
- Become a fire hazard or serve as a fuel source for fires
- Compromise the structural integrity of dams, dikes, and penstocks
- Spread seeds and debris into the facility from outside, damaging or contaminating the crushed rock base at electrical facilities, and leading to increased risk of electrical hazard and worker injury

- Restrict access to electrical and non-electrical components and areas for maintenance, safety inspections, and emergency response
- Interfere with surveillance and inspection abilities
- Cover or hide fences, increasing the risk of unauthorized entry and theft
- Serve as shelter for ants, termites, rodents, and other pests
- Lead to corrosion of steel equipment and structural deficiencies
- Lead to proliferation of noxious weeds
- Cause workers to slip, trip, and fall
- Degrade the appearance of the site

Areas immediately outside facility fences must also be kept clear of all vegetation. In addition, nearby trees that could act as a fuel source for fire, or hazard trees which could fall into and damage the site or drop debris onto the equipment, must be removed.

At communications facilities, trees and tall-growing vegetation can disrupt transmission of microwave and radio signals, and become energized during lightning strikes. Hazard trees that could fall onto these sites and damage equipment must be removed.

Target Vegetation: for electrical facilities, any plant species capable of contacting or growing within the limits of approach of electrical equipment or which can degrade the ground grid must be managed to ensure the safe and reliable operation of the power system. At other sites, target vegetation includes plant species which degrade the integrity of infrastructure, pose risks of spread of noxious weeds, impedes access to facilities or equipment, or pose worker safety risks.

Hazard tree: a tree that has a defect or adverse environmental condition that predisposes it to failure and which has a target that can be damaged if it falls (e.g. a power line, electrical equipment, buildings, people, etc.). Tree risk assessments are used to identify hazard trees and those with significant risk indicators are then prioritized for removal to protect public and worker safety, property and power system assets.

BC Hydro also has a program to remove vegetation that could serve as a fuel source. This helps protect sites from forest fires.

Control of Invasive Plants and Noxious Weeds

Control of noxious weeds and their seeds is regulated by the *Weed Control Act* of British Columbia. Noxious weeds are invasive plants that can displace native vegetation and reduce wildlife habitat and forage.The Act requires occupiers of land to control noxious weeds in accordance with the Regulation.

BC Hydro also strives to control invasive weeds, which are plants designated as invasive in the Invasive Plants Regulation of BC's Forest and Range Practices Act.

Herbicides are an important method used to control invasive plants and prevent their spread and are often the most economic and environmentally sound solution. Physical methods alone often cannot control invasive plants, especially when they become established. For example, mowing stimulates the production of species such as orange hawkweed, thereby increasing the weed population. Also, mechanical techniques can spread noxious weed seeds or propagules to other locations.

Vegetation management personnel and contractors are trained to identify the species of noxious weeds on the Provincial list through education programs. Workers are also familiar with ways to reduce the spread of noxious weeds, such as inspecting vehicles. Finally, BC Hydro supports research into new control methods, such as the use of insects for biological control.

Noxious weeds are plants that are injurious to public, health, crops, livestock, land, or other property and which must be controlled under the *BC Weed Control Act*. For the purposes of the IPMR, a weed or invasive plant is defined to include the entire plant in all its growth stages, including roots, seeds, rhizomes, runners, suckers, shoots, seedlings and mature plants.

An **invasive plant** is an alien plant species that has the potential to rapidly spread and pose undesirable or detrimental impacts on humans, animals, or ecosystems.

Worker Safety Issues

Vegetation control at electrical facilities is critical for safety reasons. If an electrical fault or lightning strike occurs, current flows through the structure and into the ground, creating voltage potentials that can cause injury or death to workers from electrocution. These current flows can also be transferred outside the station into water, sewer, electrical, and rail lines, thereby putting the public at risk.

For these reasons, buried underneath each electrical facility is a grid of bare wires. This provides a common grounding system for electrical and metallic structures. The purpose of the grounding system is to protect staff and the public from electrocution in case of a system fault, equipment failure, or lightning strike, by limiting electrical potentials to safe levels. It also supports the proper operation of the electrical system by providing a low impedance path for fault currents.

A surface of clean, crushed rock (similar to gravel) is laid over the electrical ground grid to provide an insulating layer between the grid and the surface of the ground. Crushed rock has many features that contribute to electrical and engineering safety. In particular, it has a high level of electrical resistivity, which means it does not conduct electricity, thereby reducing the risk of electrocution over the ground grid. If vegetation becomes established in the crushed rock, its function as an insulating layer is reduced. Vegetation in the crushed rock interferes with the ground grid, seriously compromising the safety functions of the grid and posing an electrical hazard to workers.

Regulation and Safety of Herbicides

The safety of the public, BC Hydro staff, and its contractors is paramount. The herbicides used by BC Hydro are approved by Health Canada's Pest Management Regulatory Agency (PMRA). All registered herbicides have undergone stringent evaluation by the PMRA to ensure they pose no unacceptable risks to people and the environment when used according to the label.

All herbicide use must abide by applicable federal and provincial legislation and regulations, including BC's IPMA and IPMR, and the federal Pest Control Products Act. It is illegal to treat pests with products not governed by this legislation or to use a herbicide in a manner inconsistent with its product label. Applications are planned carefully, using registered herbicides formulated for specific application methods.

Extra caution is exercised when herbicides are applied around environmentally sensitive areas and areas in the vicinity where food for human or livestock consumption is grown or located.

BC Hydro recognizes the importance of protecting aquatic, marine, and riparian ecosystems to ensure their long-term sustainability. Pesticide-free Zones (PFZ) protect environmentally-sensitive areas, such as bodies of water, watersheds, wells (domestic and agricultural), and water intakes. A PFZ is a zone (usually 10m or as noted on a label) around an area of land that must not be treated with pesticides, and must be protected from pesticides moving onto it. Herbicide applicators do not apply herbicides within PFZs.

Herbicides are applied by Certified Pesticide Applicators, who are licensed by the Province after writing a provincial exam. They are specially trained and qualified to apply herbicides safely, following stringent legislative requirements.

BC Hydro's Work Planning Process

BC Hydro operates under a long-term strategic vegetation maintenance plan as well as annual operational plans. Planned activities are based on the growth rates of target vegetation and the need for minimal weed growth within electrical facilities as determined by inspection. This information is used to optimize the facilities vegetation management program, as well as to estimate future work and budget requirements.

This province-wide IVMP provides general guidance for the use of herbicides within an integrated vegetation management decision-making process. Before herbicides are applied, a detailed site management plan is prepared for the facility, including maps that identify all bodies of water and other environmental issues. BC Hydro's standard operating procedures are provided to contractors before work begins. Layout crews flag the work areas in the field to ensure that all PFZs have been properly identified and marked before any herbicide applications begin. Where appropriate, individuals are notified before work begins and signs are posted at all treatment sites.

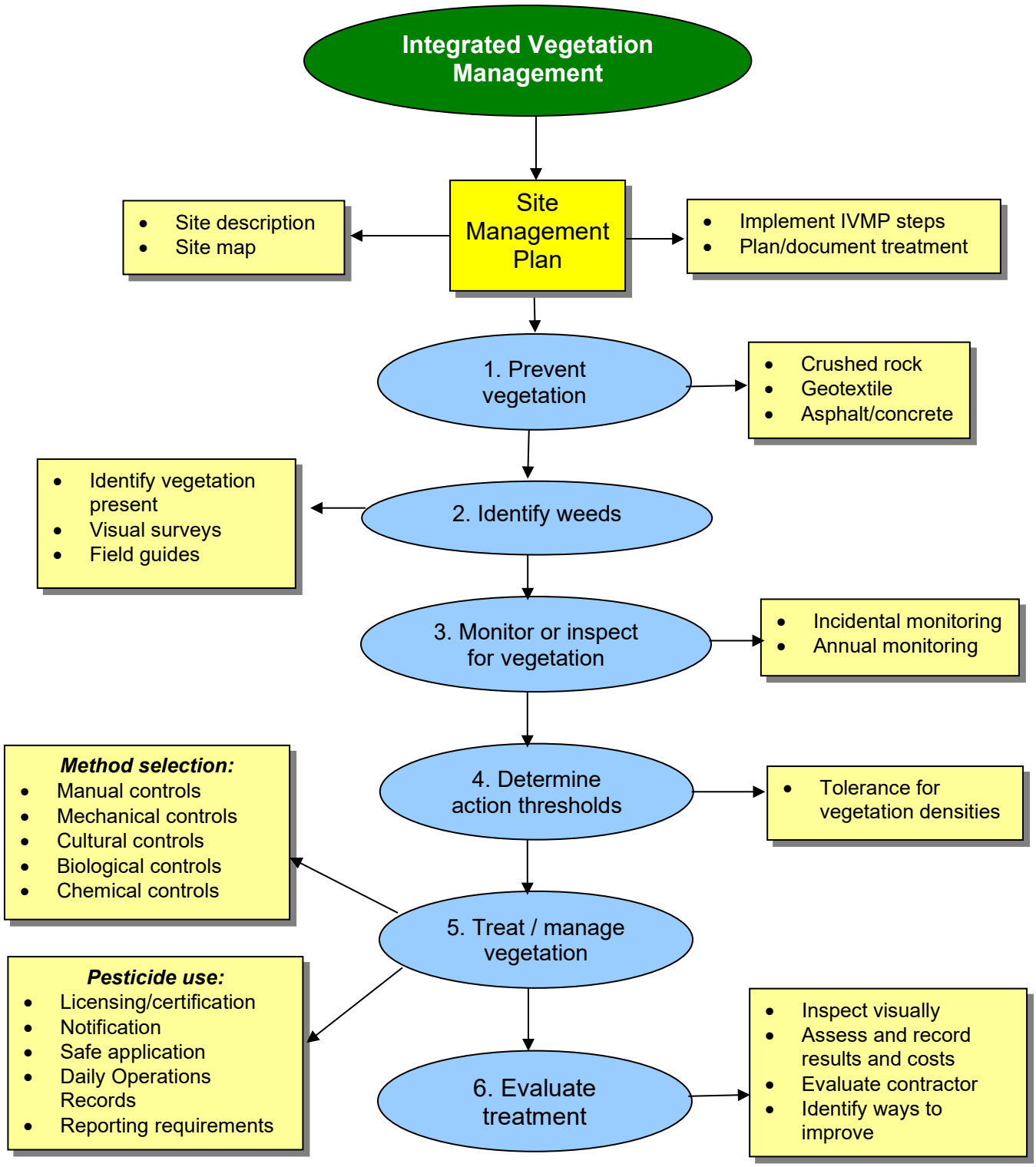
Chapter 2, Elements of Integrated Vegetation Management

This chapter describes BC Hydro's program for control of vegetation at facilities, as per Section 58 of the IPMR, which describes information required for the Integrated Vegetation Management Plan. It covers:

- Prevention – Section 58(2)(a)
- Identification of species – Section 58(2)(b))(i)(ii)
- Monitoring program – Section 58(2)(c)(i)(ii)(iii)
- Action (Injury) thresholds – Section 58(2)(d)(i)(ii)
- Treatment methods – Section 58(2)(e)(i)(ii)(iii)(iv)
- Evaluation of treatment – Section 58(2)(f)

An IVM decision making process flow diagram for facilities is located on page 11.

Integrated Vegetation Management Decision Flowchart for BC Hydro Facilities



Prevention, Section 58(2)(a)

> *58 (2) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements;*
>
> *(a) a description of the program that will be employed to prevent organisms from becoming pests;*

Prevention means stopping vegetation from becoming established, as opposed to treating existing vegetation.Vegetation management at BC Hydro facilities depends primarily on system design and preventive measures that are aimed at stopping the initial growth and spread of undesirable vegetation. These measures are considered during the design stage of facility development, during construction and during upgrades. Preventive measures may reduce the use of herbicides and other non-chemical control methods.

Preventive measures that BC Hydro may implement include improvement of drainage or the installation of crushed rock, asphalt, concrete, geotextiles, and other surfacing materials.

Crushed Rock

The most effective way to prevent the establishment of vegetation is to maintain a layer of clean, crushed rock to engineered standards, around areas that have zero tolerance for vegetation. Crushed rock surfaces may also extend 2m outside the facility fence line to minimize the drift of seeds from outside, and to maintain public safety by reducing electrical exposure adjacent to substations.

Crushed rock has many features that contribute to electrical and engineering safety. In particular, it has a high level of electrical resistivity, which means it does not conduct electricity, thereby reducing the risk of electrocution. Other functions and advantages of crushed rock include:

- Impedes vegetation from establishing
- Rapid surface drainage
- Economical and readily available
- Non-flammable and helps to prevent fires in areas around oil-filled equipment
- Reduces the spread of oil from a spill, unlike a paved surface where the oil would rapidly spread
- Provides a suitable surface for the movement of equipment and vehicles
- Helps to control dust
- Slows evaporation of moisture from the underlying soil, thus lowering the resistivity of the soil and improving its ability to conduct the fault or lightning current into the ground and away from the surface

Over time, the resistivity and effectiveness of crushed rock surfaces is reduced due to construction activity, traffic, and organic matter build-up that encourages establishment of vegetation. Therefore, for optimal safety and vegetation control, crushed rock surfaces are monitored and replenished or cleaned as required.

Crushed Rock Over Geotextile

In areas where herbicides cannot be used or where there is limited vehicle traffic and away from oil-filled transformers, the effectiveness of crushed rock for excluding vegetation can be enhanced with a geotextile layer. Geotextile is porous polypropylene fabric that is laid underneath the crushed rock, or staked to the soil surface in areas without crushed rock.

Geotextile allows drainage but effectively prevents the growth of vegetation. It works particularly well for annuals, but less so for longer-lived deep rooted perennials, such as trees or shrubs. Together with crushed rock, geotextile can be effective at preventing the growth of vegetation.

Geotextile is not normally used in drivable areas because it may become damaged, or around oil-filled equipment because it will cause the oil to spread during a spill. It is also not practical over larger tracts of land.

Asphalt and Concrete

Asphalt and concrete can also be used near electrical equipment and within electrical facilities, but are not as favourable as crushed rock. The use of asphalt and concrete is generally limited to access roads and storage areas inside facilities, or for new facilities especially designed to use asphalt or concrete.

The benefits and limitations of asphalt and concrete include:

- Asphalt and concrete are highly vegetation-resistant and both make an excellent driving surface.
- Asphalt has high resistivity, only slightly less than crushed rock.
- The use of recycled asphalt fits in well with BC Hydro's waste management strategy.
- Both concrete and asphalt cost more than crushed rock.
- They cannot be used around oil-filled equipment because they will cause oil to spread in the event of a spill.
- They provide no drainage.
- Underground work is difficult to carry out.
- Concrete conducts electricity more readily than crushed rock.
- Asphalt will burn at high temperatures.

Grass and Low Ground Cover

Grass and similar low ground covers involve the manual planting of turf or the seeding of large areas of bare soil with grass-seeding machines. This method is used to reduce the establishment of broadleaf vegetation that can have rapidly spreading airborne seeds. It can be used away from electrical equipment on large undeveloped sites or disturbed areas within the facility, or around the fence line in areas managed by BC Hydro. Required equipment may include cyclone spreaders, belly grinders, seed drills, and hydro-seeding machines.

The benefits and limitations of ground covers are:

- Grass must be mowed regularly to ensure broadleaf species do not grow through it and produce seed heads.
- They can provide good drainage, and is fairly inexpensive to install.
- Ground covers can help prevent erosion.
- They promote aesthetics.
- The seeded area may have to be irrigated to establish and maintain it.
- There may be safety concerns using mowing machines around electrical wires and equipment.
- They can increase risk of fire spread near electrical equipment.
- They cannot be used in areas which must remain free of vegetation.
- In wetter climates, there are problems with driveability.
- Ongoing maintenance of grass is required, once established
- Its ability to exclude undesirable vegetation is inferior to that of most other methods, especially crushed rock or geotextile.

Managing Surrounding Area

BC Hydro manages areas directly adjacent to facilities to help prevent vegetation from entering the facility and to protect the facility from physical damage. Therefore, this IVMP also covers the removal of hazard trees and the treatment of rapidly spreading vegetation that may become established adjacent to the facility.

Managing the surrounding area can be done in these ways:

- If the facility contains landscaped areas, use plants that don't spread rapidly, such as heather or juniper. Plants that spread by suckering or underground rhizomes or vines, and plants with airborne seeds are generally avoided.
- Maintain the 2m crushed rock strip covering the ground grid on the outside of the fence line around most electrical facilities to reduce the spread of vegetation such as blackberry, horsetail, broom, and groundsel.
- Establish physical barriers, such as solid fences to reduce windborne seeds from entering the site.
- Remove trees growing close enough to the fence line or infrastructure that they drop debris inside the site.
- Remove any hazard trees (defective trees that may fall into the site and damage electrical equipment), or storm-damaged or vandalized trees and shrubs. Herbicides may be applied to the stumps to prevent re-sprouting.
- Prune branches that overhang into the site.
- Where feasible, mow areas around the site to prevent windborne seeds from entering the site.
- Clean off any vines or climbing plants from the fence.

Identification of Species, Section 58(2)(b)(i)(ii)

58 (2) (b) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements – either:

(i) a description of the program that will be employed to identify pests targeted by the plan, or
(ii) identification of the pests targeted by the plan;

Accurate identification of vegetation present at a facility is necessary because control methods work differently on various species. For example, the most effective treatment for grass is different than that for Canada thistle. In addition, certain vegetation species require specialized herbicide mixtures, which must be planned ahead. Some vegetation types at a particular facility may be tolerable or even desirable (such as grass at a landscaped office area). In order to safely operate our facilities, BC Hydro staff and contractors are trained to be able to distinguish between desirable and undesirable plant species.

The types of vegetation that establish in facilities vary depending on the site location. Different species are found in different areas of the province, and local conditions such as seed sources determine which vegetation can be found at a particular facility.

BC Hydro has trained vegetation specialists located around the province with experience in vegetation management and plant identification. These personnel provide information and support to other staff and to contractors on types of vegetation, how they establish, their biology, growth rates, and best management practices for controlling these plant species. BC Hydro staff and contractors also use field guides to help them identify vegetation species.

Vegetation Identification Procedures

For each facility, vegetation identification procedures include:

- Identifying major vegetation species that have, or may have, an impact on the management of the site
- Identifying vegetation species by common name and/or Latin name, to the taxonomic level required for proper control method selection
- Determining the percentage of vegetation cover inside the facility/site, and the relative abundance of problem vegetation just outside the site
- Estimating the composition of broadleaf plants versus grasses (if applicable)

Noxious Weeds

Noxious weeds are typically non-native plants that have been introduced to B.C. without the insect predators and plant pathogens that help keep them in check in their native habitats. For this reason and because of their aggressive growth, these alien plants can be highly destructive, competitive, and difficult to control.

The *Weed Control Act* requires all occupiers of land to control designated weeds. The purpose of the Act is to protect our natural resources and industry from the negative impacts of foreign weeds. BC Hydro controls noxious weeds on the provincial and regional lists that are identified in the *Weed Control Act* on property that is owned or managed by the corporation. BC Hydro also participates in programs initiated by regional weed/invasive species management committees to control invasive plant species in support of the Provincial Invasive Plant Strategy.

Monitoring Program, Section 58(2)(c)(i)(ii)(iii)

58 (2) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements:

(c) a description of the monitoring program that will be employed before or during the pesticide use for assessing pest populations, environmental conditions and damage caused by pests, which program must include a description of

(i) the monitoring methods,
(ii) the frequency of monitoring, and
(iii) the data that will be collected;

Monitoring of facilities provides a record of information about vegetation presence and abundance, and overall site conditions. Monitoring can include information on changes in vegetation species composition, distribution, and density over time including plant communities immediately adjacent to a site which can invade the facility, as well as changes in the condition of surface materials or landscaping within and around the facility.

Monitoring: is an activity in the IVM process where regular site inspections are used to determine whether treatments are necessary to meet site objectives, to identify the best timing for treatments, and post treatment to review and evaluate how the applied control methods are working.

BC Hydro maintains site integrity by routinely inspecting and monitoring facilities for potential or existing vegetation problems. This incidental monitoring is carried out by BC Hydro staff working on-site or visiting sites, such as electricians, security officers, Vegetation Management Specialists/Biologists or delegates, or facility managers.

Monitoring Procedures

All sites are assessed before treatment to make decisions about the timing of treatments and whether they are necessary. Sites are generally monitored once per year, or sometimes more frequently, depending on the specific environmental sensitivities and presence of electrical equipment on site. Vegetation control crews visit all electrical facilities in the province each year. Communications facilities are visited less frequently. In addition, sites are also visited periodically

by technical staff to conduct detailed reviews and update the Site Management Plan and maps.

Monitoring of facilities includes:

- Recording vegetation occurrence and density, and site conditions
- Ensuring that action thresholds for the safe acceptable amount of vegetation are not exceeded
- Establishing the best timing for corrective action
- Choosing the treatment techniques
- Identifying any changes in site condition
- Identifying species requiring special treatment
- Describing current surrounding land use, such as agriculture, and the proximity to residences, schools, public areas, and all other sensitive areas
- Presence and risk assessment of hazard trees around facilities
- Wildfire risk assessment

Monitoring is done visually and may be documented. For electrical sites such as substations, vegetation control crews are provided with a map of the facility and required to sketch or note on the map:

- Areas where vegetation is present
- A visual estimate of the total percentage cover for the site
- Major species present
- Any species that require special treatment such as horsetail
- Areas where the crushed rock is becoming too thin or contaminated with organic matter
- Hazard trees that pose a threat or large limbs overhanging the fence line
- Any recommended changes to pesticide-free zones or residual-free zones
- Changes to the layout of the facility due to construction
- Provincially or regionally-designated noxious weeds or other invasive plant species present in or around the facility

Vegetation control crews also recommend updates to the Site Management Plan as appropriate.

Site Management Plans

A **Site Management Plan (SMP)** is a document that contains detailed information on a particular site, such as its history, vegetation coverage, and environmental concerns. The SMP also describes how integrated vegetation management activities are carried out on the site, and may include a detailed map of the facility.

SMPs have been developed for facilities requiring integrated vegetation management, primarily substations, switchyards and other electrical sites. They are prepared by BC Hydro Vegetation Management Specialists/Biologists or qualified consultants in each region.

The purpose of a SMP is to identify:

- Environmentally-sensitive areas in and around the site, such as bodies of water and wells, along with pesticide-free zones
- Current conditions, including surfacing materials and list of vegetation species inside and outside the facilities
- Preventive measures that can be taken
- Recommended treatment methods, procedures, and timing
- First Nation and public concerns

SMPs are prepared in advance for major sites, including all substations, and any other critical or large facility. SMPs are developed for smaller and lower priority sites on an as needed basis. Sites for which an SMP is not developed have a treatment evaluation and work prescription prepared prior to treatment. SMPs are updated as a result of evaluations.

Action (Injury) Thresholds, Section 58(2)(d)(i)(ii)

58 (2) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements:

(d) a description of the injury thresholds that will be applied in deciding whether a pesticide treatment is necessary and on explanation of

(i) how the thresholds were chosen, and
(ii) how the thresholds will be applied;

An **action threshold** (also called an injury threshold or hazard level) is used to determine when vegetation control becomes necessary, in order to ensure safety and minimize the risk of outages.

The **Action Threshold** is the point at which vegetation control at the facility becomes necessary to maintain public and worker safety, minimize the risk of outages and damage to facilities. Treatment of vegetation within BC Hydro facilities is required when the surface vegetation cover reaches or exceeds a predetermined level of tolerance, the action threshold. **Limits of approach** to energized equipment are also used for setting action thresholds, but incompatible plant species growth, height, density, location, condition and control costs are also considered in determining the timing and selection of control methods.

Limits of approach – The defined distance a person, machine, or conductive material (such as a tree) can be in relation to energized conductors based on the circuit voltage and **flashover** distance. Limits of approach are a key criterion for determining action thresholds in utility vegetation management programs. They are also used to set safe working limits for qualified or unqualified workers under WorkSafe *BC Occupational Safety and Health (OSH)* regulations and BC Hydro Safety Practice Regulations (SPRs).

Within facilities, the action threshold is generally expressed as a percentage of the total vegetated area that can be tolerated while still maintaining the integrity, security, and safety of the site. Any percentage of vegetation cover above the established action threshold requires a vegetation management action.

Vegetation must not be allowed to exceed the established action thresholds to ensure safety, system security, and structural integrity. Vegetation management work is more critical for some facilities than others, so the action threshold for a particular vegetation species may vary for each facility. Action thresholds for each major type of facility are listed on the following pages.

There is no tolerance for noxious weeds, which are controlled at all sites to comply with the *Weed Control Act*.

Electrical Facilities

Electrical facilities include substations, switchyards, hydroelectric generating stations, thermal generating stations, reactor bays, diesel generating stations, capacitor stations, and cable termination sites. These facilities can be subdivided into several areas. The acceptable level of vegetation in these areas is as follows (threshold percentages are bolded):

Within Electrical Compounds

Due to serious electrical safety hazards, there is no tolerance for vegetation within fenced electrical compounds. All vegetation present at the site when treatment crews arrive is controlled, especially any tall-growing species that could grow into the electrical equipment.

The goal is to maintain a vegetation-free environment to ensure worker safety, site security, and a reliable electrical supply. Vegetation control is considered successful when the following areas are vegetation-free:

- Under switch operators and equipment control cabinets because of the higher probability of people standing at the equipment when an electrical fault occurs
- Around oil-filled transformers and equipment
- Around high-voltage equipment with ground level insulators
- Asphalt roadways

BC Hydro does not allow vegetation populations to exceed **5%** cover of the rest of the electrical compound area. Control is initiated to ensure that vegetation levels never reach this density.

Mosses, liverworts, and lichens that are present on a crushed rock surface should also be controlled because they tend to retain moisture and will reduce the effectiveness of the surface over time and pose worker safety risks from slipping on these covered surfaces. In designated roadways and undeveloped areas, mosses and liverworts may be acceptable.

Just Inside or Outside Fence Lines

For safety reasons, the ground grid often extends beyond the fence line for 2m. These areas are surfaced with crushed rock. Therefore, requirements for vegetation control are the same as those inside electrical compounds. Vegetation densities are controlled to not exceed **5%** of the 2m area inside and outside of the fence line.

Designated Roadways

Vegetation established within or alongside roadways (inside facilities) can rapidly spread to adjacent electrical compounds. Even though electrical hazards are not as high, BC Hydro cannot leave vegetation populations unchecked. Control is initiated to ensure that vegetation levels never reach **10%** density.

The exception is asphalt roadways, where no vegetation is tolerated because the resistivity and surface integrity of the asphalt would be compromised.

Undeveloped Areas and Yards

Vegetation established in undeveloped areas and yards inside the electrical facility, where there are no buildings or equipment, can rapidly spread to adjacent electrical compounds. Even though electrical hazards are not as high, BC Hydro cannot leave vegetation populations unchecked. Control is initiated to ensure that vegetation levels never reach **10%** density.

Managing Surrounding Area

Trees and other tall-growing vegetation within electrical sites must be removed to avoid growth into or damage to equipment. This is because trees can interfere with required electrical clearances and site security, and pose a risk of fires or power outages. In particular, hazard trees (defective trees that could fall into the site) must be removed. Trees or woody debris can also serve as a fuel source for fires that could endanger the facility.

It is especially important to control invasive and rapidly spreading weeds, such as horsetail, blackberries, and groundsel because they may spread inside the facility and jeopardize the integrity of the fence line.

Communications Facilities

Communications facilities managed by BC Hydro include microwave stations, data collection platforms, and repeater stations and passive reflectors. Trees and tall-growing vegetation can disrupt transmission of communication (microwave and radio) signals.

Any vegetation interfering with the proper functioning of this equipment should be controlled as soon as possible (**0% tolerance**), including:

- Trees and tall-growing vegetation, which can disrupt transmission of microwave and radio signals and become energized during lightning strikes or create a fire risk
- Trees, shrubs, and other vegetation around data collection platforms, because they can interfere with accurate measurement and transmission of data
- Vegetation that interferes with access or may cause slips, trips, or falls

Pole Yards and Storage Yards

In pole yards and storage yards, vegetation is controlled because it can:

- Increase fire hazards
- Create slipping and tripping hazards
- Interfere with equipment access, site security, and storage capabilities
- Serve as food and habitat for ants, wood pests, and rodents, which can damage critical equipment such as wood poles
- Lead to corrosion of steel equipment

Storage of wood poles is governed by the Canadian Standards Association (CSA). CAN/CSA 015, section 5.7, states that “poles shall be piled and supported in such a manner that all poles are at least one foot above the general ground level. No vegetation or decaying wood shall be permitted underneath stored poles.”

Therefore, control is initiated at **>0%** vegetation cover under pole bunks. Control is initiated at **10%** vegetation cover in the yard areas.

Hazard trees outside the fence line are removed because they may damage equipment and material (**0%**). (Hazard trees are defective trees that may fall into the site.)

Mowed grass, forbs, and shrubs are acceptable in some open areas.

Hydroelectric Facilities

Hydroelectric facilities include generating plants, earthfill or concrete dams, penstocks, spillways, and canals. Vegetation at dam sites is a safety concern and must be removed because it can:

- Damage the structural integrity of the dam by penetration of the dam core by roots, increasing the risk of water leaks and erosion
- Damage the dam by windthrow (i.e., by tree roots pulling out of dam face)
- Impede access to structures and instrumentation for safety inspections
- Block sightlines during visual inspections for monitoring seepage and sinkholes
- Block sightlines for survey pins in the ground, used as reference points to monitor surface movement of dams and other structures
- Provide cover for burrowing rodents and other pests

It is important to control trees near generation equipment and dams before extensive roots become established, since root systems can provide channels for water to move through the dam, causing structural weaknesses.

Low-growing vegetation, such as grasses, forbs, and mat-forming shrubs, is desirable for erosion control in hydroelectric facilities in some areas such as along waterway corridors as long as it does not exceed 0.5m in height. Such vegetation helps prevent the growth of weeds and spread of pests and can improve site aesthetics.

Earthfill dams

Vegetation should be controlled near the toe of the dam, and on the upstream and downstream dam faces. These areas must be kept clear to enable visual inspections for seepage, which is an indicator of dam failure. Deep-rooted trees and shrubs are controlled before they become established. Control measures are implemented once the upstream and downstream dam faces are covered in saplings. When control is implemented, all potentially tall-growing vegetation is removed.

Concrete dams and associated concrete structures

Plants can become established around the buttresses and in cracks, contributing to dam deterioration. Vegetation should be controlled close to the toe of the dam to monitor seepage. Deep-rooted trees and shrubs should be controlled before they reach 1m in height anywhere within the dam structure. Control measures are implemented when the upstream and downstream dam faces are covered in saplings. When control is implemented, all potentially tall-growing vegetation is removed. Mosses, liverworts, and algae that become established on the concrete may need to be controlled to ensure access for maintenance and inspection. Associated concrete structures should have vegetation controlled within 2m from the edge of concrete.

Penstocks

Penstocks can range from several metres to several kilometres in length. Drainage channels located alongside of penstocks prevent erosion of the concrete cradle foundations. Penstocks are generally inspected at least once a year.

Vegetation should be controlled along the penstock right-of-way up to 5m on either side, and around the cradle or saddle support, to:

- Maintain the integrity of the penstock structure
- Maintain access for safety inspections and maintenance
- Prevent trees and debris from impeding drainage in ditches and waterways, and damaging channels
- Minimize fire hazards
- Provide proper aeration for wooden penstocks to minimize decay
- Reduce shade to prevent the growth of moss, algae, and fungi on penstocks

Vegetation management is very important on wooden penstocks because plants can contribute to their deterioration. Vegetation, especially resinous species (e.g., broom) that create a fire hazard, and tall-growing trees and shrubs, must be removed. Grasses and other low-growing herbaceous species are acceptable.

Spillways, Dikes and Diversion Canals

Vegetation control is required around spillways, dikes, and diversion canals to:

- Prevent debris accumulation in the canal, especially trees that can lead to downstream log jams
- Ensure spillways can function to full capacity (if functioning improperly, water could spill over the top of the dam, resulting in dam failure)
- Prevent roots from growing under the slabs of diversion channels and damaging the concrete lining
- Maintain access for safety inspections and maintenance

Trees and shrubs alongside canals should be controlled when **10%** of the area is covered. Grasses and other low-growing herbaceous species are acceptable. Mosses, liverworts, and algae may be acceptable and may not require control.

Action Thresholds for Transportation Facilities

Transportation facilities include access roads, parking lots, and helipads that are part of a BC Hydro-owned or leased site. These sites must be kept clear of tall-growing vegetation for maintenance, access, emergency response, and safe helicopter landing.

Helipads

The BC Ministry of Transportation has stringent clearance requirements around helipad sites, where contact with trees or other vegetation could cause a fatal crash.

Helipads consist of a critical zone, secondary zone, and manoeuvering area. Vegetation management varies depending on the topography, terrain, and direction of helicopter approach. Low-growing grass, forbs, and shrubs are acceptable around helipad sites, except within the critical zone.

The following types of vegetation are controlled around helipad sites:

- All vegetation within the critical helipad area (5m radius passenger and equipment exit zone)
- Trees and tall-growing vegetation within the secondary helipad area (minimum 15m x 15m area)
- Trees and tall-growing vegetation within the maneuvering area (44m x 44m or greater, varies depending on the helicopter and surrounding terrain), as space is required to ensure rotor clearance and maneuvering room

Access Roads and Parking Lots

The following types of vegetation are controlled around roads and parking lots:

- Trees and shrubs within 1m on either side of access roads and roadside ditches
- All vegetation in parking lots and within 1m of the edge of parking lots

Mosses, liverworts, and algae may be acceptable and may not require control unless a slipping hazard exists in areas of pedestrian access.

Noxious Weed or Invasive Plant Control

Noxious weeds or invasive plants should be controlled at all sites as soon as they are noticed. Noxious weeds are any plants that pose a threat to people, animals, or crops as specified under the *Weed Control Act*.

Treatment Methods, Section 58(2)(e)(i)(ii)(iii)(iv)

58 (2) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements:

(e) pest treatment options including

(i) a description of the pesticide and non-pesticide treatment methods of controlling pests that may be used,
(ii) that rationale for selecting the treatment methods described under subparagraph (i),
(iii) the benefits and limitations of each treatment method described under subparagraph (i), and
(iv) a description of how a decision to use treatment methods will be made.

Method Selection

A decision-making process for choosing treatment methods ensures that the most suitable, effective, and economical method or combination of methods is selected for an area to be treated, taking into account various assessment criteria. Specific techniques are not always appropriate for use at every facility or situation.

Using criteria outlined below, BC Hydro evaluates the control methods that best suit the vegetation management for a facility based on specific objectives incorporated into its Site Management Plan (see page 17). The overall objective for a site and the prescription will guide control method choices. The best methods are those that will meet the long-term site objective. Treatments are optimally timed for maximum efficacy, with consideration given to seasonal growing conditions, weather, and requirements for riparian areas or other site specific sensitivities.

Assessment Criteria

The treatment method chosen is justified and evaluated against the following assessment criteria:

Environmental, Social and Economic Considerations

- Safety and reliability considerations based on facility type and use
- Environmental sensitivities in the facility and in surrounding areas
- Public and stakeholders
- Government requirements and considerations (federal, provincial, First Nations, and local government)
- Cost of treatment
- Labour and equipment resources
- Scope of work
- Aesthetics

Effectiveness and Timing

- Consequences of not treating or delaying treatment
- Benefits vs limitations of each method
- Efficacy
- Short vs. long term impacts
- Review of timing based on action thresholds
- The vegetation species being targeted
- Condition based site assessments including time since last treatment
- Debris management and fire risk mitigation
- Seasonal timing of treatment

Suitability for Site

- Site objectives
- Type and density of vegetation
- Physical locations of the vegetation within the facility
- Security and accessibility of the site
- Terrain (slope, aspect)
- Drinking water sources on or near facility
- Riparian areas or bodies of water in vicinity of the site
- Biogeoclimatic zone, and soil type
- Retention of compatible ground cover
- Land use within the facility

Herbicide Assessment Criteria

Where herbicide use is considered for a facility, additional assessment criteria include:

Timing

Treatment timing is especially important when herbicides are used. The effectiveness of many products depends on the growth stage of the plant. For example, residual herbicides (soil-applied) should be applied before seeds germinate. Ensuring that herbicide applications are as effective as possible will help reduce the need for future herbicide use and may reduce the amount of herbicide used.

Soil Residual Activity

The activity of any herbicide residue present in the soil and its rate of break down in the environment determine its residual ability to suppress plant growth. Residual herbicides are generally effective for up to five years post-treatment. Herbicide active ingredients are generally classified by their degree of soil residual activity – low (a few weeks or months), moderate (up to 1 year), or high (greater than 1 year). Most common herbicides used by BC Hydro have low to moderate soil residual activity and are selected to be active for one growing season only.

Mode of Action

An herbicide's mode of action refers to how it affects the plant. Uptake of herbicides is by plant roots, stems, and foliage. Herbicides used under this IVMP are translocated with the exception of chlorsulfuron, which works on contact as well as by translocation and acetic acid which only works on contact.

Selectivity

Herbicides that control all vegetation are termed non-selective, while those that are effective in controlling certain types of vegetation are termed selective.

Additional Chemical Properties

The following additional properties are considered when making an herbicide selection:

- Volatility is the tendency of a solid or liquid herbicide to vaporize; if enough vapours are released, nearby compatible plants such as landscaped areas may be damaged
- Adsorption to soil particles will impact the mobility of the herbicide in soil
- Toxicity to non-target organisms; wherever practicable, herbicides are selected based on having low environmental/health impacts to humans, fish and wildlife

Health and Safety Characteristics

Herbicide Applicators are well-trained and protected by use of personal safety equipment such as goggles, gloves, coveralls, and chemical-resistant boots based on the label recommendations. To minimize exposure, BC Hydro selects herbicides with the lowest level of toxicity to humans, fish and wildlife and uses application rates that provide site appropriate levels of vegetation control.

Selection and Use of Residual vs. Non-residual Herbicides

Residual Herbicide Use

Residual herbicides, also referred to as preventive, pre-emergent, or soil-applied herbicides, tend to be retained in the soil. They are applied to bare soil or crushed rock surfaces to prevent germination of seeds. They depend on light

rainfall to carry them into the soil and root zone, and will also be absorbed by plant roots. Residual herbicides are prescribed only for facilities that pass a site review that includes an assessment of proximity to water bodies, soil types, slope and sensitivity of adjacent features.

Non-residual Herbicide Use

Non-residual herbicides (also called foliar-applied or contact herbicides) are active only on growing plant tissue, and kill vegetation either through leaf/stem contact (desiccation) or by translocating through the plant's vascular system to the roots and growing points. The action of these herbicides can range from a few days to a few weeks. They are of limited effectiveness in preventing recolonization from seed or invasion by plants from outside the treated area. Regrowth may also occur if the plant has protected growing points or underground buds.

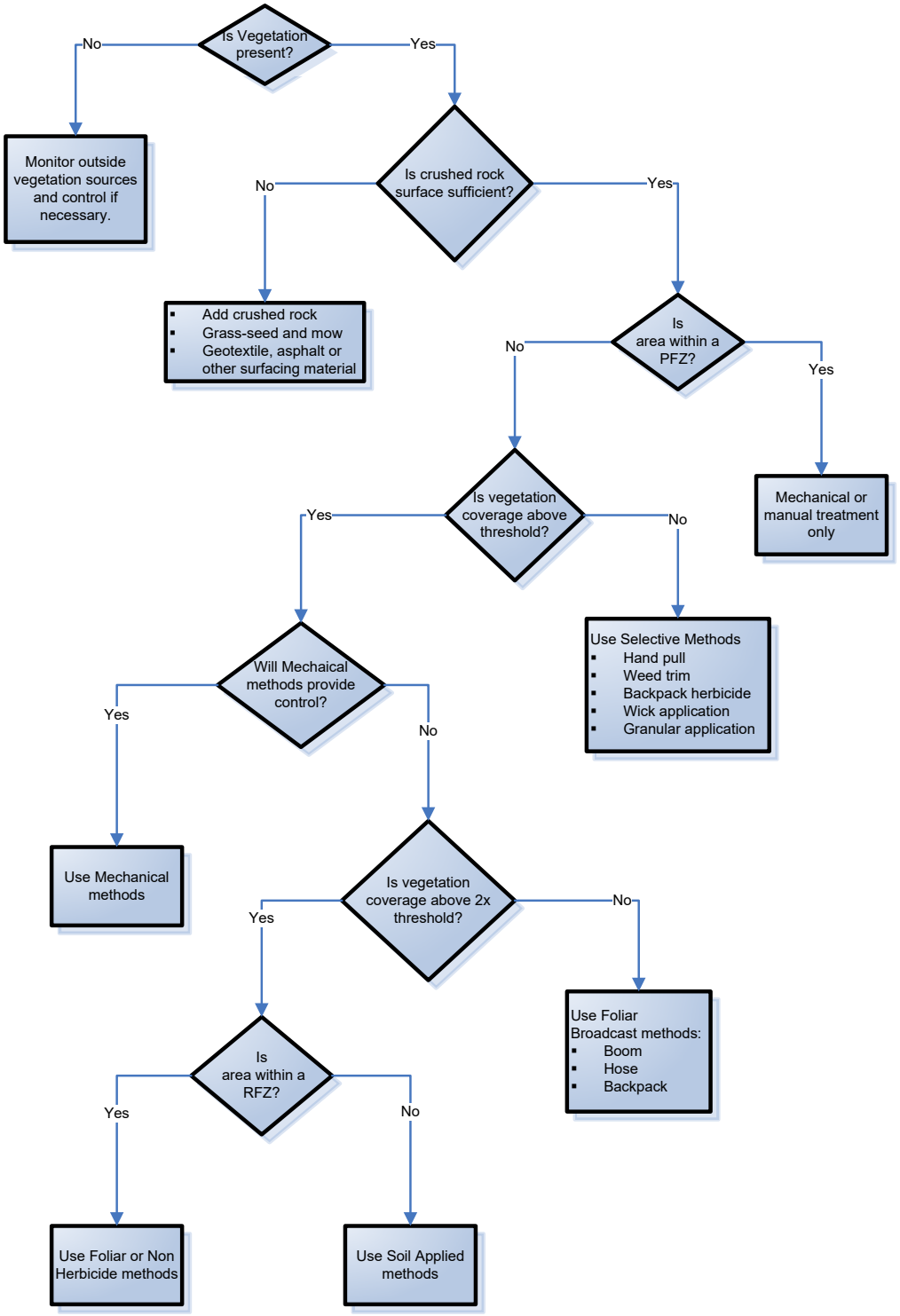
- It may be necessary to use a species-specific herbicide product for difficult to control species such as knapweed or horsetail.
- Non-residual herbicides must not be applied more than three times on the same area in a year.

IVM Decision-making Flowchart

The following flowchart shows the decision-making process that personnel follow when choosing a vegetation management technique.

Specific conditions may exist on the site that lend themselves to a particular method. Using the flowchart helps ensure that where a herbicide is used, the product will provide effective vegetation control.

Vegetation Management Technique Selection for BC Hydro Facilities Vegetation Management



The IVM control methods proposed for use on target vegetation on or adjacent to BC Hydro facilities include:

- Manual and mechanical (physical)
- Cultural (natural)
- Biological
- Chemical (herbicide) methods
- A combination of any of the above

Methods may differ depending on the type of weeds to be controlled. Treatment options used for larger, established trees are different from those used for herbaceous weeds, grasses and tree seedlings.

The sections below describe the various vegetation management controls that BC Hydro uses within and adjacent to its facilities. It covers the:

- Description of the technique
- Selection criteria for control methods
- Benefits and limitations of each control technique

Manual and Mechanical Controls

Herbaceous plants, grasses, tree seedlings, and mosses or liverworts, as well as woody vegetation both inside and outside facilities are controlled using the following physical or mechanical methods:

- Brushing
- Girdling
- Hand-pulling
- Hazard tree removal
- Hedge trimming
- Mowing
- Pruning
- Weed trimming

Vegetation just outside the facility must be controlled to prevent it from spreading into the site, and to protect the ground grid if it extends outside the fence line. Trees along the perimeter must also be removed or pruned to prevent overhanging the fence for security reasons and hazard trees must be removed if they pose a risk of breaching the fence or damaging equipment if they fall.

Brushing

Brushing is the removal by hand tools of individual woody stems that will eventually grow into equipment Stems are cut down as close to the ground as safely possible.

Brushing is a limited technique inside facilities, particularly electrical compounds that must be kept free of tall growing vegetation at all times and are not allowed to establish on site. However, brushing is used along the perimeter of fenced

compounds and in areas adjacent to facilities to reduce wildfire risk as well as around dam sites, penstocks and diversion canals at hydroelectric facilities. Brushing is sometimes combined with the herbicide cut-surface method to reduce sprouting of new shoots from the root system of broadleaf plants. Conifers when cut below the lowest green branch whorl will not regrow. Tools used in brushing include chainsaws or circular brush saws.

Generally, brushing is most effective when the target vegetation is more likely to die after being cut, for example in late summer dry periods after seasonal growth. Brushing can be highly selective and is usually directed only to target stems. In addition, a tall brush/girdle method may be used, which involves cutting taller trees at a higher height, then girdling the stem to prevent re-sprouting. This technique is often employed in riparian areas or ditches around facilities.

Selection Criteria for Brushing

Brushing is the preferred method in the following situations:

- In areas with a well-established low-growing plant community
- In combination with mowing
- In difficult terrain with limited machine access, steep slopes, and riparian areas
- When environmental concerns have a high priority

Brushing is **not** preferred in the following circumstances:

- For high densities of target trees
- Areas where mowing is a suitable alternative
- Areas with high aesthetic concerns and unsightly debris
- Areas with a high fire risk if slash debris is left on site or where trees are of a size (generally >15 cm diameter) that when cut will leave debris levels that violate BC Hydro's fuel management standard or the Wildfire Act

Benefits of Brushing

- Brushing allows the immediate removal of target vegetation, with complete retention of low-growing compatible species.
- Conifer trees cut below the lowest branch are permanently controlled.
- Brushing allows spot treatment with herbicides to prevent deciduous or broadleaf species from re-sprouting from the stump or roots.
- Brushing protects areas close to fish-bearing streams and other environmentally-sensitive areas, since it can be done without causing excessive erosion or damage to the streambed.
- Brushing is beneficial in areas where target vegetation is widely scattered.

Limitations of Brushing

- Brushing is labour-intensive and can be dangerous to workers in steep terrain.
- Brushing is more difficult to carry out in dense vegetation.
- It can increase the fire risk if there is a buildup of debris (leaves, stems, etc).

- In the absence of follow-up herbicide treatment, deciduous stumps can re-sprout repeatedly (into coppices) each time they are cut, resulting in dense thickets, increased growth rates, clearing costs, and shortened treatment cycles in subsequent years.
- Aesthetics of brushing may be a public concern due to the buildup of slash debris.
- Brushing leaves stumps, which can be hazardous to the public workers and grazing animals.

Girdling

Girdling (also called frilling) is a manual technique that involves cutting one or more strips of bark from around the entire tree trunk with a special cutting tool, saw, or chain. The bark strips are removed along with other tissue down to the sapwood. This procedure is usually limited to single-stemmed, deciduous trees but can also be carried out on selected conifer trees when required.

After the bark has been severed, the tree is left to die. The above-ground parts continue to grow, but the roots starve and the tree slowly dies.

Only girdling and herbicide applications will kill deciduous species. They will re-sprout if mowed or brushed.

Selection Criteria for Girdling

Girdling is a preferred method in the following situations:

- Girdling is most often used in riparian areas or other environmentally-sensitive sites.
- Control of scattered individuals of alder, birch, and willow species.

In general, girdling should **not** be used:

- On trees of small diameter, since they may break at the girdle, causing the tree to re-sprout.
- On black cottonwood, balsam poplar and small-diameter aspen because of prolific re-sprouting.
- In areas where the target vegetation will reach limits of approach to electrical equipment within two growing seasons, unless the tall brushing and girdling technique is used.
- For stem densities of over 15,000 stems per hectare because it is not practical or effective and is prohibitively expensive. Also, the amount of standing dead stems may create a fire hazard and when they fall impede access to people or wildlife, or damage facility fence lines and equipment.
- In situations where tree failure could lead to worker or public injury or property damage. In these cases, girdling may only be done via the tall slashing and girdling method.
- On conifers unless they are part of a riparian prescription or if the tree is retained as a wildlife tree.
- On maple species with coppices of more than five stems, or where the root collar is over half a metre in size. Maples this size are not killed using girdling,

as each stem would have to be cut and the tree may still re-sprout from the stump or roots.

Benefits of Girdling

- Girdling promotes retention of vegetation cover and increased site stability due to root structure retention. For this reason, it is useful in riparian areas or where slope stability may be an issue.
- Girdling is not limited by difficult terrain.
- Girdling is flexible, because individual stems and species can be removed or left on a tree-by-tree basis.
- Girdling increases low-growing forage vegetation for wildlife and habitat for small mammals and birds. There is no danger to wildlife.
- Deciduous over story is removed naturally over several years, giving coniferous and other low-growing understory time to adjust to new environmental conditions.

Limitations of Girdling

- Girdling cannot be used effectively over large areas or in dense brush, because it becomes too laborious and costly.
- Close inspection and careful work are required to ensure adequate depth and width of the girdles is maintained.
- Tools are not effective on large stems with thick bark.
- If stems have many live branches below breast height (1.3m above ground), additional work with hand tools is required to remove the branches.
- The dead trees remain standing for 2–3 years, which may be objectionable in highly visible areas.
- The use of hand tools may be hazardous to workers.
- Blowdown of dead trees may pose a safety problem alongside well-travelled areas, or to workers re-entering the area.
- Workers must be experienced girdlers, since poor girdling results in re-sprouts or premature blowdown with regrowth.

Hand Pulling

Hand-pulling of vegetation inside facilities is not a preferred method because it degrades the crushed rock surface. Excessive hand-pulling increases organic matter in the crushed rock, which encourages subsequent vegetation establishment. Hand-pulling is not viable as a control measure for many species, because roots are difficult to remove, and if left in the soil, the vegetation will regrow. Root extraction cultivates the soil, stimulating dormant seeds to germinate, and introducing mineral and organic soils to the surface.

There are also serious safety hazards connected with hand-pulling of vegetation within electrical facilities. If roots are in contact with the ground grid, workers pulling vegetation risk electrocution.

However, hand-pulling is an important treatment option for areas within facilities where herbicides cannot or should not be used. Vegetation is hand-pulled as soon as it establishes, at any time of the year using gloves and weed wrenches.

Selection Criteria for Hand Pulling

This method is only recommended for established and scattered vegetation that can be easily uprooted, such as tree seedlings and broom or some large weeds. Weed seedlings and grass species are too small and numerous to hand-remove.

Benefits of Hand Pulling

- In certain areas, hand pulling is effective at reducing bulk vegetation to a manageable level, allowing use of other control methods to complete the work.
- It is effective for larger, established species that can be easily uprooted.
- It is effective if there are only a few plants on the site (e.g., 100 or less).

Limitations of Hand Pulling

- Roots regenerate because many species snap off at ground line.
- It degrades the crushed rock surface and increases organic matter.
- It exposes soil and seeds.
- There are safety risks to staff pulling vegetation where roots are in contact with the ground grid.
- It is labour-intensive and costly.
- It may expose laborers to unsafe equipment, especially in electrical facilities.
- It may lead to acute and chronic back problems for workers if done frequently and repetitively.

Hazard Tree Removal

Hazard trees that are adjacent to a facility are removed when they are deemed a risk of falling into and damaging the fence, electrical equipment or other infrastructure within a site.

The equipment used for hazard tree removals includes bucket trucks or climbing equipment and chain saws. In some situations, machines such as a Rolly chipper or feller buncher may be used to cut down hazard trees around the outside of a facility.

Selection Criteria for Hazard Tree Removal

- Used around electrical facilities where site safety and electrical system security and reliability are important.

Benefits of Hazard Tree Removal

- Minimizes safety and reliability risks to facilities from falling trees.
- Reduces the risk of wildfire spread in areas surrounding a facility.

Limitations of Hazard Tree Removal

- Specially qualified contractors are needed for safe performance of the work.
- Removal of trees can make a facility more visible to adjacent landowners affecting site aesthetics. Trees are removed when they are assessed as having an unacceptable risk of falling into a site.

Hedge Trimming

Hedge trimming is the shearing of trees and shrubs to maintain an established form. BC Hydro utilizes hedging at some sites to maintain a safe buffer from electrical facilities and to maintain site aesthetics. Overall, it is a limited use technique.

The equipment used for hedging includes hedge trimmers and circular saws operated out of bucket trucks.

Selection Criteria for Hedge Trimming

- Used in landscaping around electrical facilities in urban or community environments where site aesthetics are important and where a source of water is present on site to maintain healthy landscaping.

Benefits of Hedge Trimming

- It is a relatively inexpensive and natural form of screening.

Limitations of Hedge Trimming

- Well-established contracts with qualified contractors are needed for safe performance of the work.
- Trimming ideally needs to be repeated annually or hedges may become overgrown.
- As hedges age, their spread may become unmanageable, requiring removal.
- May pose concerns if the hedging screens a site completely and interferes with security inspections.
- If the hedge is too close to the fenceline, debris from the hedge may lead to the buildup of organic debris inside a facility and promote establishment of weeds.

Mowing

Mowing is the cutting of target vegetation with wheel or track-mounted machines equipped with a cutting head and driven over a site. Mowing is not commonly used inside facilities but may be used around the perimeter of a site to reduce wildfire safety risks. Grass cutting is recommended in undeveloped areas such as fields and areas reserved for future site expansion. Mowing helps control plants before

they go to seed, thus reducing spread into areas where there is a low vegetation tolerance.

Commercial lawnmowers, garden tractors, or industrial tractors with rotary, reel or flail cutters are most commonly used around facilities.

Selection Criteria for Mowing

Mowing is the preferred method where the terrain allows, and in areas:

- With high densities of target vegetation
- With trees of a size that when cut will leave debris levels that violate BC Hydro's fuel management standard or the *Wildfire Act*
- To manage grassy areas or fields surrounding the facility
- Mowing generally can not be used inside electrical facilities due to possible damage to equipement and many areas are not accessable to large machines

In general, mowing should **not** be used:

- On target trees of large diameter (mowing larger stems is impractical)
- Where low-growing compatible species are well-established and there are low stem densities of target vegetation
- In areas with rocks that can cause excessive damage to cutting heads
- In areas that are developed or have high public use because of the risk of flying debris
- In areas where mowing debris can fly into the facility and pose risks to fencing or electrical equipment.
- In areas with stumps that create accessibility problems
- In boggy or wet areas where excessive rutting and soil compaction and damage could occur
- On slopes that create a worker safety hazard
- In riparian areas

Benefits of Mowing

- Mowing mulches the vegetation into smaller pieces that readily biodegrade, which reduces fuel loading and fire risks.
- Mowing is seasonally effective, inhibiting growth from spring through late summer. This is important in areas where herbicide follow-up treatment is not possible.
- In areas where fast-regenerating ground covers are plentiful, re-sprouting of unwanted vegetation is suppressed.
- In non-selective mowing and where little compatible vegetation exists, all vegetation is cut to ground, which may release compatible vegetation to grow and may facilitate future herbicide applications that use manual or mechanical delivery systems.
- In mowing directed only towards target vegetation, the site retains biodiversity and existing low ground cover.

- Target vegetation can be removed faster and more economically than other methods.
- Work progress and workmanship are clearly visible.
- Using machines is generally less hazardous to the operator than using hand-held equipment.

Limitations of Mowing

- Mowing is not generally suitable in riparian areas, and should not be used there unless a site-specific riparian prescription has been produced and approved.
- Mowing can promote heavier regrowth of deciduous vegetation.
- Mowing is often limited by terrain, such as large rocks, stumps, and bodies of water.
- In wet terrain, machines cannot operate effectively and could damage the environment by causing soil compaction and rutting.
- Mowing mulches the brush using a high-speed rotary or flailing action. This can leave ragged stumps that may be unsightly, hazardous, and subject to public complaints.
- Mowing may result in rutting, track marks, or degradation of the ground surface.
- Mowing should not be used in areas where archaeological or cultural heritage sites are present, to avoid disturbance.
- Mowing generally should not be used on slopes greater than 30%, because most machines are unsafe to operate on steeper grades unless they are specially designed for such work.

Pruning

Pruning is the removal of branches or limbs in order to direct and control tree growth away from power lines, electrical equipment or facility fence lines. The term pruning generally implies the use of proper arboricultural practices. It is not trimming, which refers to the cutting back of vegetation to a uniform distance; and it is not topping, which refers to cutting tree limbs back to a stub, bud, or a lateral branch. BC Hydro strongly promotes the concept of planting “the right tree in the right place” to have safe and compatible vegetation near power lines and facilities.

Pruning is the approved vegetation management method for areas where tree removal is not an acceptable option. It is the most common control method to maintain trees growing in proximity to BC Hydro facilities particularly in urban or built-up areas or where landscaping is present.

Selection Criteria for Pruning

Pruning may be the best management technique when:

- It is cost-effective compared to tree removal.
- The main stem is well outside a facility perimeter, but branches from the side are growing toward the fence line or electrical equipment.
- Trees are required for wildlife habitat or to protect riparian areas.

- A stable, healthy treed edge is adjacent to a facility and only needs side pruning to maintain clearances.

Pruning should **not** be used when:

- The tree trunk is too close to the facility to safely leave it in place and the tree needs to be topped or severely cut to maintain clearance.
- The tree is in declining health and should be removed or replaced with more suitable vegetation.
- The cost to maintain the tree exceeds the cost of removal.

Benefits of Pruning

- Trees are not removed and still provide aesthetic benefits, wildlife habitat, and other functions.
- Pruning influences the direction of branch growth so that trees can be directed away from the facility perimeter and infrastructure
- Trees are maintained in landscaped areas arroud a facility to improve the aethestics of the site
- Pruning can minimize adverse effects on tree health, and over time, reduce tree removal workload and risk from unhealthy trees.

Limitations of Pruning

- Pruning is usually costlier than removal because trees need to be pruned repeatedly.
- Pruning must be performed by Certified Utility Arborists where vegetation is in proximity to electrical equipment in facilities. CUAs are skilled experienced operators who are specially trained to work safely near energized equipment and have specialized tools to perform their work safely.
- Improper pruning techniques can seriously damage trees and result in unhealthy, unsightly, or hazardous trees that may require off-cycle remedial work.
- Pruned trees remain in proximity to facility fence lines and have hazard potential, while removed trees do not.

Weed Trimming

Weed trimming removes plants using power tools such as commercial weed trimmers. Trimming removes seed heads and is a useful method when immediate action is needed. It works best on annuals.

As part of weed trimming, organic matter including dead weeds, leaves, and shoots that could degrade the crushed rock layer should be raked up and removed from the facility to reduce accumulation.

Selection Criteria for Weed Trimming

Weed trimming may be the best vegetation management technique when:

- Cutting weeds at ground surface is recommended along fence lines and outside perimeters of facilities
- The area is within a pesticide free zone (PFZ) or no treatment zone (NTZ) and weeds must be removed without the use of herbicides

In general, weed trimming should **not** be used when:

- Where weed densities are high and debris clean-up is a concern
- Where the work is labour intensive and time consuming and alternative methods are more efficient and effective

Benefits of Weed Trimming

- It removes seed heads.
- It is convenient and economical in some circumstances.
- Uses readily available hand held equipment.

Limitations of Weed Trimming

- It is not useful on species that propagate from stem pieces and it does not remove roots.
- Flying rocks and debris propelled by the spinning thread or blade may damage windows and equipment.
- It can be a safety hazard to the operator and other staff.

Cultural/ Natural Control

Cultural control is where vegetation is managed in a way that precludes the growth of incompatible target species through the use of crops, pastures, parks, or other managed landscapes.

In facilities a number of physical barriers to weed growth (hardscaping elements) are utilized including the use of crushed rock, geotextile, asphalt and concrete surfaces.

Other areas within a facility reserved for future use may be managed as low maintenance grass so that the growth of tall, target vegetation or rapidly spreading weeds dispersed by airborne seeds is eliminated or suppressed. Outside of some facilities, the perimeter may be landscaped with low maintenance ground cover especially where site aesthetics are important. At more remote sites, where appropriate, BC Hydro actively encourages the establishment of suitable low-growing native vegetation to replace tall-growing species. This is sometimes called natural control and is used to reduce wildfire risks around the facility.

Required equipment may include cyclone spreaders, belly grinders, seed drills, and hydro-seeding machines to establish low-maintenance grassy areas, the use

of gravel cleaning and spreading equipment often driven by small tractors, and other tools needed to maintain landscaping (e.g. rakes, shovels, forks, etc.).

Selection Criteria for Cultural/Natural Control

Where plant competition is feasible inside or adjacent to a facility, manual, mechanical, and chemical control techniques that enhance compatible vegetation are carefully selected to prepare the site for conversion to culturally managed sites.

Cultural/natural control may be a favoured management method in the following circumstances:

- Replanting with appropriate, low-growing vegetation can be an effective vegetation management technique, particularly in undeveloped sections of a facility reserved for future growth, areas with high public exposure, or facilities located near riparian habitats or shelterbelts.
- Where the facility is situated in an area with surrounding lands suitable to compatible use such as cropping, rangeland, nurseries, or parkland.
- Where the compatible land use is actively managed by others, usually privately owned lands or lands managed actively by a government agency – provincial, local, First Nations, etc.

Cultural control may **not** be feasible in the following situations:

- Where it would be difficult to maintain plantings
- Where suitable nursery or seed stock may be hard to source or be prohibitively expensive
- Where a water source is not available on site to maintain landscaped areas in a healthy condition

Benefits of Cultural/Natural Control

- The facility is managed in a way that is compatible with its intended use and its safe and reliable operation.
- When the landscaping is effectively converted to compatible cultivated or natural cover, it effectively suppresses the growth of tall, incompatible vegetation and weeds or reduces their volume, making the site easier to maintain with reduced frequency or magnitude of disturbance.
- It may be used to manage complex riparian sites or areas with unstable slopes, using bioengineering techniques with living plants or a combination of plants and structural materials that help prevent erosion (e.g., hydro-seeding, grass seeding, live staking, or wattles).
- It may have initial higher costs to convert an area but may have lower long-term costs through reduced ongoing maintenance.

Limitations of Cultural/Natural Control

- High cost to maintain landscaping or inability to have others manage adjacent sites over the long-term, resulting in abandonment of the initiative

- Difficulty in establishing and maintaining suitable cover and the risk of increasing undesirable vegetation (tall-growing targets or noxious/invasive weeds) through site disturbance
- Low vegetation cover can only be used within non-electrical sections of a facility
- Ongoing maintenance of grass or landscaping is required once established and benefits must outweigh costs

Biological Control

Biological control is the reduction or suppression of unwanted organisms by introducing or enhancing the presence of natural enemies. Biocontrols are rigorously tested and must be registered prior to use in Canada. They are often used in noxious weed or invasive plant control by introducing parasitic insects that selectively control specific weeds but do not damage other vegetation. The insect species attack the target weed plants either by slowly killing it, or by reducing seed production and plant vigour.

With respect to tall-growing vegetation, there is currently a fungus that has been used as a biological control agent for some woody broadleaf species. There are no insects currently available which control woody target species. The fungus, *Chondrostereum purpureum*, (Chontrol) is a registered biological agent used to control target deciduous trees and shrubs. This fungus is a primary invader of wounded deciduous trees. It works over a period of one to two years by slowly killing the tree and shrub. Under the right conditions, it can effectively control deciduous trees that are prone to re-sprouting. It is applied to cut stumps in a paste formulation.

Biological control may be used in utility vegetation management:

- On noxious weed species known to have an effective biocontrol agent.
- Registered biocontrol agents are non-toxic to humans and animals and can be used near bodies of water or other environmentally sensitive sites.

Biological control may **not** be feasible in the following situations:

- Where conditions are not favourable to the introduction or survival of the biocontrol agent, which limits its ability to effectively control the target vegetation.
- Where no suitable biocontrol agent exists for the vegetation species being managed. Currently, limited biocontrol agents are available for utility vegetation management.

Benefits of Biological Control

- May provide very selective control of problem vegetation, especially some species of noxious weeds
- Low impact to the environment as it creates less site disturbance unlike any other manual, mechanical, or cultural control method and some herbicide application techniques
- It helps to reduce the spread of undesirable vegetation

- It may reduce vegetation densities to a manageable level

Limitations of Biological Control

- The very specific nature and limited availability of the organisms that are registered for use
- The limited amount of species and areas that can be controlled using this method
- Labour-intensive technique that requires very specific site conditions for effective application (timing, weather, temperature, etc.)
- Use restrictions in some cases where economic crops (e.g. orchards) are present in proximity to the area requiring control
- It is not usually effective in eliminating vegetation populations

The introduction of insect biocontrol agents for noxious weed control may limit options for the control of tall-growing vegetation targets, so sites must be carefully chosen and recorded. This method is only used at larger sites with a high density of noxious weeds or invasive plants, such as fields or areas with adjacent properties where there is a cooperative effort to control vegetation. The size of the vegetation stand must be large enough to support the insect population, and the site itself must be suitable habitat for the insect species. This type of program is generally employed with the cooperation and guidance of an expert from Agriculture Canada.

Biological control may become move viable as an increased number of biological agents become available. However, research of new biocontrol agents is very time consuming and expensive and it takes years to determine if a potential agent is promising or effective and has no impacts on non-target species. The registration and regulation of biocontrol agents is an involved process to get a new product to market. BC Hydro will monitor any products that become available and add them to the list of vegetation management techniques, where appropriate and operationally feasible.

Chemical (Herbicide) Control

Herbicide use is an integral and necessary integrated vegetation management method required to maintain facilities to BC Hydro's high safety standards. Although physical methods are used in conjunction with herbicides whenever feasible, they are not effective by themselves in obtaining a vegetation-free condition. For example, extensive hand-pulling of weeds disturbs the soil and allows organic matter to increase. Continuous cultivation is not practical inside of fenced compounds with a crushed rock surface near electrified equipment.

Herbicides have been used widely in the electrical utility industry as well as many other industries, including manufacturing/refining sites, railways, roadways, and pipelines for over half a century. Many alternatives have been explored, developed, and tried, and the search continues for alternative technologies. However, herbicide use continues to be an integral part of a facilities maintenance program with no other practical alternatives available at this time.

The herbicides that BC Hydro uses are chosen on the basis of highest effectiveness and selectivity, the lowest hazard to health and the environment, and the lowest impact on non-target species. Benefits and limitations of herbicide use are listed under the various herbicide application methods below.

With a broad variety of products from which to select, BC Hydro can optimize herbicide application, resulting in:

- Reduction of “repeat” applications to solve a specific problem. For example, use of a soil-active product can obtain season-long control of a weed problem with one application, while use of a product that effectively controls only actively-growing plants will result in new growth from the seed bank, requiring multiple applications each year to get the job done.

- BC Hydro is committed to using the lowest possible rate per hectare of herbicide to control a weed problem. By having a broader range of types of products to choose from, each with their own control characteristics, BC Hydro can pick the herbicide that can do the specific job with the least amount of herbicide.

- Some weed species, particularly annuals that produce many seeds in their life cycle, can become resistant to certain herbicides by overcoming the herbicide’s action. Weed resistance to herbicides can be reduced by avoiding repeated applications of the same herbicide types by rotating products that have different modes of action to control weeds.

- Some herbicide products work more efficiently and at lower rates to control certain weeds when tank mixed together and applied. This synergistic effect may be because one product may translocate (move) in plant tissue more readily, and the second product may be more efficient at interrupting cell division. Each chemical may work more efficiently when mixed together than if applied alone.

Herbaceous plants, grasses, tree seedlings, and mosses or liverworts and woody vegetation both inside and outside facilities are controlled using soil-applied and foliar-applied herbicide methods.

This section describes the various herbicide techniques that BC Hydro uses at its facilities to control vegetation. It covers:

- Cut surface
- Basal bark
- Injection techniques
- Foliar
- Mechanized foliar
- Soil-applied techniques

Techniques used to control trees

Both coniferous and deciduous trees must also be removed from around electrical facilities. Identified hazard trees are removed that could fall into the facility damaging equipment and presenting a safety risk. In addition, trees along the perimeter of fenced compounds and in areas adjacent to facilities are controlled to to reduce wildfire risk. Finally trees around dam sites, penstocks and diversion canals at hydroelectric facilities are controlled to maintain the integrity of the dam structures and allow for inspections.

Cut Surface

This control method (also called cut-and-treat) is used in conjunction with brushing or tree removal of deciduous target trees. The tree is cut as low as possible to the ground, and herbicide is applied to the cut surface of the stump to limit re-sprouting. Cut surface is a directed technique, which reduces the impact on non-target species. It also minimizes herbicide use and optimizes natural control.

The current herbicide of choice for cut surface treatments is triclopyr. Glyphosate is preferred in environmentally-sensitive areas, and imazapyr on dense clumps of hard-to-control species such as big leaf maple.

Selection Criteria for Cut Surface Treatment

- Cut surface treatment is used in areas where basal bark treatment is not optimal, such as where standing dead trees are an aesthetic concern (e.g., around facilities in urban areas)
- Cut surface treatment is highly effective on most species that do not sucker from their roots.

Benefits of Cut Surface

- Cut surface treatment can be used in any terrain.
- No standing dead foliage remains, making this technique desirable in highly visible areas.
- Effectively eliminates growth risks into electrical equipment.
- There is minimal risk of herbicide exposure to workers or the public due to the directed nature of the treatment.
- Herbicide is limited to the stump surface, resulting in minimal impact on fish, wildlife, or the environment.

Limitations of Cut Surface

- Poor application technique can result in unsuccessful treatment, and may require re-application of the herbicide.
- Cutting of vegetation can only be performed around de-energized electrical equipment so that applicators can do the work safely.
- Taking equipment out of service is not always feasible and often must be scheduled well ahead of time.

- It is a labour-intensive method and not cost-effective for dense stands.

Basal Bark

Basal bark treatment involves applying herbicide onto the bark of the target tree. The herbicide penetrates the bark into the cambium layer and diffuses throughout the tree and the roots, to prevent re-sprouting. It is applied with a low-volume backpack or hand-held sprayers with a positive shut-off system.

Selection Criteria for Basal Bark Treatment

- The method is best used on small deciduous trees under about 4m in height.
- At very high stem densities, basal treatment may not be practical, effective, or cost-effective. Also, the amount of standing dead stems may create a fire hazard.

Benefits of Basal Bark

- It is less labour-intensive than manual brushing and girdling.
- It is suitable for remote or difficult-to-access areas.
- It treats only targeted individual stems and so is appropriate for areas with low densities of target trees.
- It removes the canopy over a three-year period, allowing a low-growing plant community to establish.
- The potential for spray drift is reduced.
- There is minimal risk of herbicide exposure to workers or the public due to the targeted nature of the treatment.
- A small amount of product is applied per hectare.

Limitations of Basal Bark

- Dead foliage may be objectionable.
- In areas of low clearance, surviving treated stems may continue to grow.

Injection/Hack and Squirt

Mechanical injection of herbicides into stems using a syringe or capsules or cutting into bark and application of herbicide (hack-and-squirt) are sometimes suitable application methods where permitted according to the herbicide label. In mechanical injection, a small capsule or syringe containing herbicide is inserted into the stem of the target vegetation. Capsules may be injected by means of a battery-powered drill or automatic loading lance. The herbicide is slowly released into the sapwood. Hack-and-squirt uses a small axe, machete, or hatchet to cut through the thick bark and into the sapwood. The herbicides is then squirted into the cut with a squeeze bottle. These can be effective and highly selective application techniques when the problem vegetation is surrounded by other high value vegetation or in environmentally sensitive areas.

Selection Criteria for Injection or Hack-and-Squirt Techniques

- An injection technique can be used when the cut surface method cannot be done.
- It should not be used when there is a risk to electrical equipment because the trees do not die immediately.
- It is effective on re-sprouting stumps, provided the capsules are applied to live tissue.
- It can be used in areas of limited access.
- It may also be a good choice around riparian areas.
- Larger-diameter trees are not effectively controlled by injection, but can be controlled by hack and squirt
- It is not effective on bigleaf maple or aspen poplar.
- Blowdown of dead trees may pose a safety problem inside or adjacent to facilities, or to workers re-entering the area.

Benefits of Injection or Hack-and-Squirt Techniques

- Injection and hack-and-squirt techniques are highly selective and injury to surrounding vegetation is uncommon
- Both injection and hack-and-squirt are effective on certain species, such as red alder, and for larger trees that cannot be managed with basal applications. Injection has also proven to be effective on large stemmed noxious weed species
- These applications are not limited by terrain
- They are easily learned and safe for the applicator but are more labour intensive
- Herbicide use is minimal and self-contained. The potential for worker and public exposure is virtually eliminated
- These applications virtually eliminate the possibility of environmental contamination because they are so directed

Limitations of Injection Techniques

- In highly visible areas, dead foliage of standing trees may be objectionable
- Capsules are not bio-degradable
- Stems may be occasionally missed for treatment.
- Capsules are not readily available
- Both injection and hack-and-squirt methods are very labour intensive

Foliar- applied Techniques

Backpack Foliar

Backpack foliar treatment sprays herbicides onto the foliage of weeds or individual or small clusters of trees or tall growing shrubs. The technique uses a manually-operated, low-volume, pressurized backpack with a positive shut-off system. Alternatively foliar application can be done using power hose spray guns

or hand-held booms. It is often used to control vegetation within facilities using non residual herbicides.

Selection Criteria for Backpack Foliar Treatment

- The terrain must have good foot access to reduce the risk of tripping and falling by applicators.
- If target vegetation is below shoulder height (approximately 1.5m), it allows for better coverage, and reduces the potential for operators to overreach.
- It is the main treatment used for noxious and invasive weed control.

Benefits of Backpack Foliar Treatment

- Backpack foliar or power hose applications are the most efficient methods for controlling plants within facilities and controlling noxious weeds or to treat the re-sprouts of high-density target vegetation
- Use of certain herbicides allows the treatment to target specific vegetation, with adjustable application rates and dosages.

Limitations of Backpack Foliar Treatment

- Buffer zones may be required to protect pesticide-free zones (see Table 3), depending on wind direction and topography.
- The recommended treatment height is applicator shoulder height (typically around 1.5m or less) as applicators should not treat foliage above their heads
- Caution must be exercised to avoid treating areas where desirable species may be affected.

Mechanized Foliar

This treatment method uses a fixed nozzle or boom-directed nozzle or wick (wipe-on) applicator mounted on a vehicle such as a skidder or an ATV, to spray or wipe herbicides onto the foliage of vegetation.

Selection Criteria for Mechanized Foliar Treatment

- It is recommended for use when there is a high density of target cover at a uniform height. This reduces the potential for spray runoff to the ground.
- It is an excellent treatment for noxious and invasive weed control.
- It is effective for managing large areas wihin facilities that have vegetation established above the allowable threshold density.

Benefits of Mechanized Foliar

- Mechanized foliar is an efficient method for managing the re-sprouts of high-density target vegetation.
- It targets specific vegetation, with adjustable application rates and dosages.

- Nozzles can reduce the amount of herbicide used because well-defined droplets are produced, resulting in good coverage of the foliage with limited runoff.
- Wick application is ideal in areas where no spray drift can be tolerated and over even surfaces where the wick can be dragged efficiently over the foliage of the target vegetation.

Limitations of Mechanized Foliar

- It is not as selective as backpack foliar application.
- There is more potential for drift than a backpack foliar application.
- Buffer zones may be required to protect pesticide-free zones (see Table 3), depending on wind direction and topography.
- Caution must be exercised to avoid treating areas where desirable species may be affected.
- Mechanized foliar is often limited by undulating terrain or presence of steep slopes or large rocks.
- Some areas within the facilities may not be accessible for equipment.
- In wet terrain, machines cannot operate effectively.
- Mechanized foliar may result in rutting, track marks, or degradation of the gravel surface in facilities.
- It should not be used on slopes greater than 30% because most machines are unsafe to operate.

Soil-applied Techniques

All soil-applied herbicides are residual and non-selective. They are applied to crushed rock to prevent germination of seeds.

Residual herbicides are usually applied in areas that have no tolerance for vegetation, i.e., in and around electrical equipment. Equipment used includes, using a power hose, backpack spray equipment and wand, or a fixed boom sprayer mounted on ATV-type equipment.

Selection Criteria for Soil-applied Techniques

- Where there is the presence of weeds that produce multiple generations of growth a year and are difficult to control using non-residual methods.
- Often used in secure facilities where total-control of vegetation is required.

Soil-applied techniques may **not** be suitable for:

- Non-secure sites with public access given the residual nature of the chemicals used.
- Where water bodies or potable water sources are nearby.
- Pesticide free zones and buffers need to be applied that may not be practical at some sites.

Benefits of Soil-applied Techniques

- highly effective for preventive control of certain species
- reduces treatment interventions required to control prolific seeding species
- more labour and cost efficient in larger scale operations

Limitations of Soil-applied Techniques

- risk of spray drift and increased volatilization due to higher volume of mixture being applied
- buffer zones may be required to protect pesticide-free zones
- specialized equipment may be required

Evaluation, Section 58(2)(f)

A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following integrated pest management elements:

58 (2) (f) a description of the monitoring program that will be employed for evaluating the effectiveness of the pesticide use on pest populations and the environment, including effects on organisms other than targeted pests, by comparison with the information collected under the program described in paragraph (c), which program must include a description of

(i) the monitoring methods,
(ii) the frequency of monitoring, and
(iii) the data that will be collected.

BC Hydro carries out comprehensive evaluations of its facilities to ensure effectiveness of its vegetation management program. It includes:

- **Contract inspections** – As work projects are carried out, site inspections are performed to ensure proper procedures and work specifications are followed.
- **Post-treatment evaluations** – These include quality assurance assessments and audits to ensure program objectives are met.
- **Continuous improvement** – New techniques and products are identified and incorporated where appropriate.

After vegetation management work has been completed at a site, information is collected to evaluate and measure the treatment results against the planned site objectives.

The purpose of evaluating vegetation management work is to:

- Achieve site objectives
- Assess program effectiveness and adjust work plans accordingly
- Determine the success/efficacy of treatment techniques

- Ensure no negative environmental impacts occurred
- Take corrective action where necessary as a result of ineffective control

The treatment method used is deemed effective if it meets the vegetation control objectives set out in the facility SMP.

Evaluation of the site also adheres to Section 35(2) of the IPMR, which requires that records of treatment results, effectiveness, and impacts be kept. Evaluation results are used to revise site prescriptions and to provide the basis for improvements and changes to the vegetation management process.

Evaluation Methods

Results of vegetation management must be evaluated to determine the success of vegetation control and to ensure there were no negative environmental impacts. Treatment program evaluations are based on visual estimates of the percentage of vegetation cover.

To evaluate the results of the vegetation control, all relevant information is collected, such as previous monitoring data and current site conditions. Both formal and informal assessments may be completed. The information collected from the evaluation is measured against vegetation management objectives for the site. Notes on the yearly evaluation are included in the SMP as needed (most facilities have a current site management plan but some remote or infrequently visited sites may not), and results are used to improve future IVM programs.

When evaluating the results of vegetation work on a site, BC Hydro considers and gathers information on the following:

- Amount of organic matter content in the crushed rock
- Effectiveness of the treatment technique/program in controlling the undesirable species
- Percentage of vegetation still present and percentage estimate of mortality
- Need for follow-up or touch-up treatments,
- Amount of herbicide used to determine if increases or decreases are necessary
- Cost-effectiveness of the treatment program and of any follow-up treatments
- Any impact of the treatment method/program on adjacent landscaped grounds and surrounding areas
- Recommendations for enhanced preventive measures
- Recommendations for future treatment programs
- Whether the technique was the most appropriate one for the job
- Any recommended changes to pesticide-free zones or residual-free zones

Where low plant growth is acceptable, bare-ground conditions are noted and corrective action, such as seeding and planting, are incorporated in a future management program.

Where all plant growth is unacceptable, plans for resurfacing with vegetation-inhibiting materials will be considered for future action.

Data Collected and Frequency of Evaluation

During contract and maintenance inspections, which occur annually, facilities are reviewed for effectiveness of vegetation control. Remote sites that are infrequently treated for vegetation growth may only be inspected following contract work and are not necessarily visited annually.

With respect to herbicide applications, the following data is collected:

- Cut surface – Look for marker dye on stumps.
- Basal – Look at the stem to ensure a proper wrap was made.
- Foliar – Check for droplet coverage on leaves and for foliar decline (wilting, browning).
- Soil-applied – look for effective control of multiple-generation weeds such as groundsel, willow-herbs, etc.
- Injection – Check the number and placement of cuts, capsules, drills, and plugs.
- Incidental treatment of non-target species is identified by looking for signs of spray on vegetation compatible with power lines. In addition, buffer zones and PFZs are checked for signs of spray drift.

Other site criteria examined and updated in an SMP include:

- Landscaping remains healthy and is easy to maintain and meets site objectives for screening or aesthetics.
- Gravel or other hard surfaces are effective at remaining relatively weed free and are of suitable depth and cleanliness that vegetation growth is not promoted.
- Grassy areas are effective at keeping target vegetation suppressed and are easy to maintain with little or no intervention.
- Tall vegetation surrounding a facility do not pose security risks or are growing-into or overhanging fences or acting as a source of organic debris inside the facility fence line.
- Hazard trees adjacent to a facility are regularly monitored and are removed as necessary to avoid their falling-into the fence or electrical equipment.
- Vegetation growth is kept within tolerance levels at storage facilities, especially under equipment or wood-pole bunks.
- Dam faces are effectively maintained to prevent vegetation from degrading the works.
- Site access is kept safe and unimpeded from vegetation growth.

Research

To ensure the most up to date research, tools, and techniques for vegetation management are considered and incorporated into both operational and strategic vegetation plans, BC Hydro works in conjunction with many organizations, including, but not limited to:

- Integrated Vegetation Management Association of BC (IVMA)
- Invasive Species Council of BC (ISCBC)
- International Society of Arboriculture (ISA)

- Utility Arborists Association (UAA)

Research into Alternative Methods

BC Hydro's Vegetation Management Program is continually looking for and testing new and innovative ways to prevent the growth and spread of vegetation. The cost-benefits, efficiency, and safety of various preventive and control methods have been researched, including:

- Burning vegetation with a torch – Does not kill roots, and risk of fire too high for use around electrical equipment and oil-filled equipment.
- Steaming vegetation or spraying hot water over vegetation – Only controls shallow-rooted annuals, not deep-rooted perennials; requires a lot of water, which many facilities do not have; hot water machines have also proven unreliable and expensive.
- Mycoherbicides – a biological control method using a naturally occurring fungus. To date it has limited effect on alder species and some aspen.
- Infrared light to control seeds and vegetation – Does not control roots; very expensive.
- Spreader grader (a mechanical tiller pulled through crushed rock areas to remove large clumps of vegetation) – May spread seed through site causing a larger problem.

Chapter 3, Herbicide Use and Handling

This section covers the responsible use and handling of herbicides, as per Section 58 of the IPMR (information required for Integrated Vegetation Management Plans). It includes:

- Transportation — Section 58(3)(a)(i)
- Storage — Section 58(3)(a)(ii)
- Mixing, Loading and Applying Herbicides — Section 58(3)(a)(iii)
- Disposal — Section 58(3)(a)(iv)
- Spill response plan — Section 58(3)(a)(v)
- Pre-treatment inspection procedures – Section 58(3)(b)(iv)
- Equipment maintenance and Calibration – Section 58(3)(b)(v)
- Weather monitoring – Section 58(3)(b)(vi)
- Herbicides Used and Application Methods — Section 58(3)(c)

Responsible Use of Herbicides

The careful, limited use of herbicides is an important and necessary part of vegetation management at facilities. For safety reasons, many electrical facilities cannot tolerate any vegetation growth. Herbicides are often the most effective way to achieve this zero tolerance level.

When herbicides must be used, BC Hydro takes all reasonable precautions to ensure they are used safely and responsibly. There are many ways in which BC Hydro reduces the impact of herbicides, for example, by using the least amount possible to achieve expected outcomes, and ensuring that applications are conducted properly by qualified personnel. By including herbicides in an integrated pest management program, vegetation densities can be reduced to a level that allows for a longer period of time between herbicide treatments by employing non-chemical techniques efficiently in the cycle.

Requirements for Certified Applicator

Any individual or company (i.e., a Contractor) that provides a service to BC Hydro to apply commercial or industrial herbicide must have a valid B.C. Pesticide User Service License.

Herbicide applications are to be performed or supervised by a Certified Pesticide Applicator with a Certificate in the Industrial Vegetation and Noxious Weed Control or Forestry General or Forestry Non-Broadcast categories. The name and certificate numbers of the applicator(s) who will supervise the work must be recorded on the Daily Operations Record (DOR).

The Certified Pesticide Applicator must, as per the IPMR:

- Be in continuous attendance at the work site while herbicides are being applied
- Supervise no more than four certified assistant applictors at one time
- Maintain continuous contact, auditory and/or visual, with each assistant certified applicator being supervised
- Be within 500m of persons being supervised
- Have proof of certification at or near the treatment location so it is readily available for inspection during herbicide use (if possible, the certificate should be kept at the mix site, in the vehicle used by an application crew during a treatment, or on the applicator's person at all times, such as in a wallet or pocket; the certificate can be a copy to avoid loss or damage of the original)
- Comply with requirements set out in Division 7 of the IPMR, Records and Reporting Requirements

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Herbicide Transportation, Section 58(3)(a)(i)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

A description of the methods of handling, preparing, mixing, applying and otherwise using pesticides that will be employed under the plan including a description of the following procedures:

(i) procedures for safely transporting pesticides;

Personnel must adhere to the following legal requirements for the transportation of herbicides, as per the IPMR:

- Ensure that the herbicide is properly secured during transport to prevent accidental discharge or unauthorized removal, and to prevent contamination of food or drink intended for animal or human consumption, household furnishings, toiletries, clothing, bedding, or similar items transported with the herbicide.
- Keep herbicides in their original containers and with original packaging and labelling affixed, or in appropriate containers with trade name, name of active ingredient, concentration of active ingredient, and pesticide registration number affixed.

In addition to the IPMR, BC Hydro requires personnel to:

- Follow all applicable provincial transport requirements set out in the *Transportation of Dangerous Goods* Act, including requirements for documentation, labels, markings, and placards. Spray equipment containing more than 5,000 liters cannot be taken onto public roads.

- Persons transporting dangerous goods must hold a valid TDG Certificate of Training or be under the direct supervision of someone who is trained and certified.
- Read and understand the product label and Safety Data Sheet outlining the transportation requirements for each regulated product used by BC Hydro.
- Keep in the vehicle a first aid kit, fire extinguisher, spill contingency plan, and spill contingency kit (with WorkSafe BC regulated contents). Vehicle operators must be trained to handle spills.
- Inspect containers for defects prior to transport. Transfer any defective packages to empty pesticide containers of the same type, or secure any defective containers into secondary containment vessels for transportation.

Herbicide Storage, Section 58(3)(a)(ii)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(a) a description of the methods of handling, preparing, mixing, applying and otherwise using pesticides that will be employed under the plan including a description of the following procedures:

(ii) procedures for safely storing pesticides;

Storage facilities may be permanent, temporary, or mobile. Building materials must be fire-resistant wherever possible and facilities must be kept clean and well-marked.

Personnel follow these instructions to store herbicides as per the IPMR requirements:

- Keep herbicides in their original containers and with original packaging, or in appropriate containers with trade name, name of active ingredient, concentration of active ingredient, and pesticide registration number affixed.
- Store herbicides separately from food intended for human consumption.
- Keep herbicides in storage facilities that are locked when unattended, not used for storage of food intended for human or animal consumption, ventilated to the outside, and accessible only to authorized persons.
- Mark storage facility in block letters: "WARNING: CHEMICAL STORAGE – AUTHORIZED PERSONS ONLY" so signs are visible to persons approaching each door providing access to the facility.
- Store fumigants and other pesticides that release vapours or bear a poison symbol on the label in a storage facility that is not attached to or within a building used for living accommodations
- Within 60 days after starting to store an herbicide at a location, provide notice of the storage location to the fire department closest to that location.

In addition to the IPMR, BC Hydro requires personnel to:

- Keep storage facilities separate from work and living areas, and away from flammable materials, and bodies of water.
- Keep a herbicide inventory log book, current product labels, Safety Data Sheets, and a copy of WorkSafe BC's Occupational Health & Safety Regulation at the storage facility.
- Keep at the storage facility a first aid kit, fire extinguisher, Spill Response Contingency Plan, and a spill kit with WorkSafe BC regulated contents. Persons storing herbicides must be trained to handle spills.

Mixing/Loading & Applying Herbicides, Section 58(3)(a)(iii)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(a) A description of the methods of handling, preparing, mixing, applying and otherwise using pesticides that will be employed under the plan including a description of the following procedures:

(iii) procedures for safely mixing, loading and applying pesticides;

Mixing and Loading Herbicides

Personnel follow these instructions to mix and load herbicides as per the IPMR requirements:

- Do not wash or submerge in a body of water any container used to prepare, mix, or apply herbicides.
- When drawing water from a body of water or an irrigation system into a container for herbicide use, maintain a gap between the herbicide and the equipment to prevent herbicide from entering the body of water or irrigation system.

In addition to the IPMR, BC Hydro requires personnel to:

- Before mixing, read the product label and Safety Data Sheet, and follow all safety precautions.
- Ensure that persons mixing or loading herbicides are Certified Pesticide Applicators, and use proper protective equipment and clothing as recommended on the label.
- Ensure that emergency wash facilities, first aid equipment, spill kits spill response plans, and emergency phone numbers are close at hand.
- Use clean water free of any suspended particles. Use appropriate procedures to prevent backflow of herbicides into the water source.
- Conduct mixing and loading in areas selected to prevent any spilled herbicides from entering the PFZs for bodies of water, wells, and water intakes.

- Mix herbicides in well-ventilated areas outdoors, under low wind conditions. Ensure there is adequate light and stand upwind to avoid contaminating yourself.
- Keep containers well below eye level to prevent splashing or spilling herbicides in the face or eyes.

Applying Herbicides

As required by the IPMR during work, personnel must:

- Not exceed the area of treatment areas specified on the Notice of Intent to Treat.
- Take precautions to ensure that domestic water sources, agricultural water sources, and soil used for agricultural crop production are protected for their intended use.
- Take precautions to prevent unprotected human exposure to herbicides.
- Take precautions to avoid applying herbicides over vertebrate wildlife or domestic animals that are visible to the user.

In addition to the IPMR, BC Hydro requires personnel to:

- Follow directions and restrictions on product labels and Safety Data Sheets.
- Record and/or map any changes to the original treatment plan.
- Use the most practical, suitable, target-specific application techniques, such as low-volume, low-pressure backpack or hand-held sprayers and wick applicators.
- Whenever possible, apply herbicides when target species are at their most susceptible stage.
- Have in their possession the site management plan and map showing proposed treatment areas and pesticide free zones
- Refer complaints to the BC Hydro representative

Herbicide Disposal, Section 58(3)(a)(iv)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(a) A description of the methods of handling, preparing, mixing, applying and otherwise using pesticides that will be employed under the plan including a description of the following procedures:

(iv) procedures for the safe disposal of empty pesticide containers and unused pesticides;

The disposal of herbicide waste is governed in British Columbia by the *Environmental Management Act and Hazardous Waste Regulation*.

Personnel follow these instructions to dispose of herbicides:

- Plan all applications carefully to minimize excess and waste. Any leftover herbicide mix should be saved for future use or disposed of in an appropriate manner.
- Triple-rinse empty metal, glass, or plastic containers before disposal. Rinse sprayers and containers well away from any body of water or well.
- Puncture or break any non-recyclable containers so that they cannot be reused, then discard at an approved sanitary landfill.

Spill Response Plan, Section 58(3)(a)(v)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(a) A description of the methods of handling, preparing, mixing, applying and otherwise using pesticides that will be employed under the plan including a description of the following procedures:

(v) procedures for responding to pesticide spills;

Personnel must ensure that an appropriate spill containment kit and spill contingency plan is at the application site. If an herbicide spill occurs, personnel follow these instructions:

- Ensure the safety of workers and public by limiting access to the area, protecting people from exposure, and ensuring wash facilities are nearby.
- Put on protective equipment before cleaning up the spill, including protective clothing, respirators, and eye protection.
- Contain the spill.
- Report spills to the Provincial Emergency Program (PEP) as per the *Spill Reporting Regulation*. Also follow reporting protocols to BC Hydro.
- Clean up the site.

Pre-treatment Inspection Procedures, Section 58(3)(b)(iv)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(iv) pre-treatment inspection procedures for identifying treatment area boundaries;

Before vegetation management is conducted at a specific site, a pre-treatment inspection is completed to ensure that environmentally-sensitive areas are protected. At this stage, the work method is confirmed to ensure it is appropriate for the site, and specific environmental concerns are identified. Before work

begins, environmentally-sensitive areas are marked in the field and incorporated into the facility SMP.

Before Work Starts

When treating areas with herbicide, BC Hydro seeks input from parties who may be significantly impacted, notably facilities situated within or adjacent to First Nations treaty lands or reserves. Most BC Hydro facilities are located on land fee-owned by the utility and are fenced off to ensure site security.

Personnel must ensure that the work area is properly defined and inspected before work begins as required by the IPMR:

- Check the Notice of Intent to Treat to ensure that the proposed treatment locations, the proposed treatment (including the herbicide and its method of application), and the total area of the treatment areas are correct.
- Ensure that the herbicide used is registered for the intended use as described on the herbicide label.
- Keep onsite the detailed map showing the proposed treatment areas and PFZs in the work area.
- If work is being conducted in an area where biological control agents have been released to control noxious weeds, make reasonable efforts to identify these sites and prevent harm to these organisms.

Before herbicide applications begin, personnel must ensure that each individual who will be using the herbicide is informed of:

- Boundaries of the treatment area
- Requirements for personal protection, including Safety Data Sheets
- Herbicide use procedures required to protect human health and the environment
- Target species to be controlled, the desirable species to be protected during treatments, and how to identify these plants/trees

Signs

The IPMR requires that notification signs be posted on land being treated with herbicides. Signs must be clearly visible and legible from each approach to the treatment area used by the public. Signs are typically posted on the fence at entrances to a facility and they may not be removed for at least 14 days after the herbicides have been applied. Records are kept on how public notification was given and where notices were posted.

The signs must include information on the trade name or active ingredient of the herbicide used, date and time of application, precautions to be taken to prevent harm to people entering the treatment area, the IVMP confirmation number, and contact information.

Equipment Maintenance & Calibration, Section 58(3)(b)(v)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(v) procedures for maintaining and calibrating pesticide application equipment;

Equipment Maintenance

The IPMR requires applicators to ensure that all equipment is in good working order and if required is calibrated to conform to the application rates on the herbicide label.

In addition to the IPMR, BC Hydro requires that:

- Equipment must meet all regulatory requirements.
- Equipment must be safe, clean, in good repair, and compatible and appropriate for the herbicide being used.
- Nozzles must be working properly or be replaced, and hose connections must not be leaking.
- Tools and equipment must be in good working order and properly cared for and stored.
- Tools that are prone to failure must be replaced, and spares must be available onsite.
- A regular maintenance schedule must be implemented for each piece of equipment.

Equipment Calibration

Application equipment must be properly calibrated to conform with the application rates on the herbicide label.

As a minimum, all sprayers should be calibrated once per year prior to use, and at regular intervals throughout the season when changing pesticide products and when nozzle output begins to vary. The frequency of calibration is dictated by factors such as the formulation of herbicides used. For example, abrasive formulations result in greater nozzle wear and require more frequent calibrations.

In general, equipment should be calibrated:

- For each individual applicator using hand-held or backpack equipment
- At the beginning of each season
- At the start of each treatment job
- More frequently with abrasive formulations (such as wettable powders)
- If application rates are questionable

- Any time the application equipment type is changed, such as a change in size or type of nozzle
- Any time the pesticide or formulation of a pesticide is changed

It is not necessary to calibrate every back pack, provided each back pack has the same set up with nozzles etc.

Calibration Records

As per the IPMR requirements, personnel must keep a record for each piece of application equipment that requires calibration, when the equipment was calibrated, and the data upon which the calibration was based.

Weather Monitoring, Section 58(3)(b)(vi)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(vi) procedures for monitoring weather conditions and strategies for modifying pesticide application methods for different weather conditions;

Personnel monitor weather and weather forecasts at the beginning and on a daily basis wherever herbicides are applied. Information is collected from Environment Canada and other official sources.

The prevailing meteorological conditions including temperature, precipitation, and velocity and direction of wind, are recorded for each treatment location and each day of use on the Daily Operations Record (DOR).

Stop Work Conditions

Herbicide applications must be stopped when any of the following conditions exist in the contract area. When herbicide label restrictions are more limiting, they take precedence over the conditions below:

- Temperatures exceeding label requirements
- Raining steadily (water running consistently down the lateral stems)
- Ground wind speed exceeds 8km an hour (for foliar applications), i.e., gentle breeze, leaves, and twigs in constant motion
- Foliage is covered by ice or frost, or water is flowing on the foliage
- Overall conditions that favor herbicide drift

Residual pesticides must not be used on water-saturated soil, during heavy rainfall, or if heavy rainfall is imminent.

Herbicides must be applied only between 30 minutes before sunrise and 30 minutes after sunset.

Drift Monitoring Procedures

Three factors contribute to drift: application techniques, weather conditions, and applicator error. The possibility of drift is reduced through appropriate training and certification of workers, and by not conducting foliar applications in ground winds over 8km/h. Also, thickeners can be added to the herbicide to increase droplet size.

Spray drift is monitored during foliar applications of herbicide to help ensure the accuracy of buffer zone establishment, and the integrity of PFZs.

Herbicides Used and Application Methods, Section 58(3)(c)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

> *(c) identification of each pesticide that will be used under the plan, the manner of its application and the type of equipment required for each manner of application.*

Chemical control involves the use of herbicides to inhibit growth of vegetation on or adjacent to BC Hydro facilities. Herbicides are an important tool in integrated vegetation management.

As per the definitions in the IPMR:

Pesticide – means a micro-organism or material that is represented, sold, used or intended to be used to prevent, destroy, repel or mitigate a pest, and includes:

- A plant growth regulator, plant defoliator, or plant desiccant
- A control product as defined in the *Pest Control Products Act* (Canada)
- A substance that is classified as a pesticide by regulation, but does not include micro-organisms, materials, substances, or control products excluded from this definition by regulation

The herbicides listed below may be utilized under this Facilities IVMP and have some of their key properties outlined in Table 1. They are used according to the methods and application equipment summarized in Table 2. Some of the herbicides or commercial mixtures are described in more detail below and application methods are described further in the next section and in Chapter 2.

- acetic acid
- aminocyclopyrachlor
- aminopyralid
- chlorsulfuron

- *Chondrostereum purpureum*
- clopyralid
- dicamba
- diclorprop-P
- diflufenzopyr
- diuron
- flazasulfuron
- flumioxazin
- fluroxypyr
- glyphosate
- imazapyr
- indaziflam
- metsulfuron-methyl
- picloram
- pyroxasulfone
- saflufenacil
- triclopyr
- trifluralin
- 2,4-D

Some herbicide products may have the identical active ingredient but a different trade name and a different PCP (pesticide control product) number by the federal Pest Management Regulatory Agency (PMRA). These herbicides are considered equivalent and can be used under this IVMP.

Table 1 – Properties of Approved Herbicides

The herbicide active ingredients that can be used under this IVMP are listed below with the following information provided for each: soil residual activity, mode of action, selectivity, and application technique.

Active Ingredient	Soil Residual Activity*	Mode of Action	Selectivity (toxicity to non-target organisms)	Where and How Applied
acetic acid	Low	Contact	Non-selective	Foliage; post-emergent
aminocyclo-pyrachlor	Moderate	Translocation	Non-selective	Soil & foliage; pre-and post-emergent
aminopyralid	Low	Translocation	Selective	Foliage; post-emergent
chlorsulfuron	Moderate	Contact/ translocation	Selective	Foliage; post-emergent
Chondrostereum purpureum	Not applicable	Translocation	Selective	Cut stump; post-emergent
clopyralid	Moderate	Translocation	Selective	Foliage; post-emergent
dicamba	Low	Translocation	Selective	Foliage; post-emergent
dichlorprop-p	Low	Translocation	Selective	Foliage; post-emergent
diflufenzopyr	Low	Translocation	Non-selective	Foliage; post-emergent

Active Ingredient	Soil Residual Activity*	Mode of Action	Selectivity (toxicity to non-target organisms)	Where and How Applied
diuron	Moderate	Translocation	Non-selective	Soil; pre-emergent
flazasulfuron	Moderate	Translocation	Selective	Soil and foliage: pre- and post-emergent
flumioxazin	Low	Translocation	Non-selective	Foliage; post-emergent
fluroxypyr	Low	Translocation	Selective	Foliage; post-emergent
glyphosate	Low	Translocation	Non-selective	Foliage; post-emergent; syringe injection
imazapyr	Moderate	Translocation	Non-selective	Soil & foliage; pre-and post-emergent
indaziflam	Low	Translocation	Selective	Soil & foliage: pre- and post-emergent
metsufuron-methyl	High	Translocation	Selective	Soil & foliage; post-emergent
picloram	High	Translocation	Selective	Soil & foliage; post-emergent
pyroxasulfone	Moderate	Translocation	Selective	Soil; pre-emergent
saflufenacil	Moderate	Translocation	Selective	Soil and foliage: pre- and post-emergent
triclopyr	Low	Translocation	Selective	Foliage, stem, or stump; post-emergent
trifluralin	High (when using bio-barrier)	Translocation	Non-selective as bio-barrier	Sheets with infused beads; soil; pre-emergent
2,4-D	Low	Translocation	Selective	Foliage; post-emergent

* LOW generally refers to residual soil activity of up to 40 days, MODERATE for residual soil activity of up to one year and HIGH for residual soil activity of greater than one year

Types of herbicide application equipment that may be used include:

Backpack – A backpack is a portable, manually operated, pressurized container with a nozzle for spraying herbicides. It operates under low pressure, thus minimizing the possibility of drift. Backpack sprayers may be used for selective herbicide applications or for spraying individual trees or plants. Backpack sprayers are not effective for large, continuous areas requiring vegetation control due to problems with effective patterns and overspray or underspray. Directed spray from a backpack unit will selectively control targeted weeds. Backpack spray is effective on established, low-density species, tree seedlings, and noxious weeds. Within this PMP, backpack sprayers may be used for applying all of the herbicides proposed for use by foliar or soil application

Mechanized foliar – Boom sprayers are widely available commercially for ATV and agricultural tractor equipment. They use a solution tank and spray apparatus similar to a powerhose sprayer, except that solution is delivered to nozzles mounted at designated intervals along the boom length.

Powerhose – A hand-held spraygun and hose attached to a portable tank with a motorized pump system filled with herbicide will selectively control a variety of vegetation with directed spray. Its use, effectiveness, and disadvantages are similar to the backpack, except that a spraygun is not as mobile or as convenient to use. However, sprayguns are efficient for larger scale applications. Many of the larger facilities with larger patches of weeds will be treated by powerhose spraygun or boom systems unless restricted by terrain. This equipment can be used for the application of all herbicide liquid mixtures.

Wick – Wick applicators are used to selectively apply herbicide by wiping it directly onto plants. Wicks are made of rope or absorbent pads. The wick applicators are available in many sizes, from hand-operated to vehicle mounted. Only small amounts of herbicide are applied, so the need for pumps, control devices, and spray tanks is eliminated. Applications using this technique are very labour-intensive. Wipe-on wick application is ideal for areas where no spray drift can be tolerated.

Squirt bottle – A squirt bottle refers to a hand-held, non-pressurized container, usually plastic. It may have a trigger pump sprayer. It is used to spray a solution of low-toxicity herbicides directly onto foliage or tree stumps

Injection tools – Battery-powered drill or automatic lance used to inject capsules of herbicide into stems or stump of a target tree. This can also include a syringe type applicator where allowed under a herbicide product label.

Brush bar with herbicide – A brush saw or chainsaw with an attachment that deposits the herbicide on the spinning blade or chain, and automatically applies the herbicide onto the stump when cutting the stem

Granular applicator – Granular applicators are used to apply dry (granular) formulations of herbicide to the targeted area in a uniform and controlled manner. Types range from “shaker containers” sold with or as part of the product container, to small hand-held broadcast granular spreaders (commonly used for spreading lawn fertilizer), to larger tractor-mounted broadcasters.

Table 2: Herbicide Method and Equipment

Manner of Application	Active Ingredient	Equipment Required
Foliar/bareground application	Acetic acid	• Backpack sprayer • Boom sprayer • Power hose • Wick
	Aminocyclopyrachlor	
	Aminopyralid	
	Clopyralid	

Manner of Application	Active Ingredient	Equipment Required
	Dicamba	
	Diflufenzopyr	
	Flazasulfuron	
	Fluroxypyr	
	Glyphosate	
	Imazapyr	
	Indaziflam	
	Metsulfuron-methyl	
	Picloram	
	Pyroxasulfone	
	Saflufenacil	
	Triclopyr	
	2,4-D	
Cut stump	*Chondrostereum purpureum*	• Backpack sprayer • Spray bottle • Squirt bottle • Modified brush saw
	Glyphosate	
	Picloram	
	Triclopyr	
	2,4-D	
Basal bark	Glyphosate	• Backpack sprayer • Spray bottle
	Triclopyr	
Injection	Glyphosate	• Injection lance • Syringe
	Triclopyr	
	Imazapyr	
Hack and squirt	Glyphosate	• Backpack sprayer • Spray bottle • Squirt bottle
Bareground	Trifluralin	• Landscape fabric

Acetic Acid – Ecoclear, Munger's Hort Vinegar or Equivalent

Acetic acid is used as a non-selective herbicide that kills on contact. It is effective when the plants are in a stage of active growth and is applied as a foliar application to the leaves of herbaceous plants. The main difference between household vinegar (5-7%) and acetic acid used as a herbicide (25%) is the concentration of the active ingredient. The product Ecoclear uses a synergistic combination of acetic acid and citric acid; however, it only lists acetic acid as the

active ingredient. Safe handling procedures must be followed as this concentration of acetic acid can cause burns.

Aminocyclopyrachlor and Chlorsulfuron – Truvist or Equivalent

The combination of active ingredients in Truvist® is effective for management of the broadleaf foundation to bareground control. It can handle pre- and post-emergent control of tough broadleaf species at low use rates. It also maximizes productivity with less tank mixing and batching, and fewer return trips. Its dual modes of action can help achieve a wider spectrum of vegetation control, including ALS-resistant broadleaf species.

Aminocyclopyrachlor and Metsulfuron–methyl – Navius or Equivalent

This is a selective, low-toxicity herbicide that provides pre- and post-emergent control of broadleaved species, woody species, vines, and grasses on several non-food use sites, such as rights-of-way, wildlife management areas, recreational areas, turf/lawns, golf courses, and sod farms. The chemical is a systemic herbicide and acts by disrupting gene expression. This causes undifferentiated cell division and elongation. The herbicide can cause damage to specific conifer species such as spruce and pines.

Aminopyralid – Milestone or Equivalent

This herbicide is a selective, post-emergent herbicide that controls a wide spectrum of broadleaf species, including Canada thistle, knapweeds, oxeye daisy, scentless chamomile, and many others. This herbicide is mildly residual, and uses reduced application rates to minimize herbicide load on the environment.

Aminopyralid and Metsulfuron-methyl – ClearView or Equivalent

ClearView combines two active ingredients (aminopyralid and metsulfuron methyl) to produce a selective, post-emergent herbicide that controls a broad spectrum of broadleaf annual and perennial species, including Canada thistle, knapweeds, oxeye daisy, scentless chamomile, and many others. This herbicide can be applied for 12-24 months of good control, and uses reduced application rates.

Aminopyralid, Metsulfuron-methyl and Fluroxypyr – Sightline or Equivalent

The combination of three active ingredients allow this herbicide to effectively control broadleaf species, invasive plants, and shrubs on rangeland, pasture, non-crop areas, industrial sites and rights-of-way. Difficult to control invasive species such as Kochia, including glyphosate-resistant biotypes, are successfully managed with this combination of active ingredients.

Aminopyralid, Metsulfuron-methyl and Triclopyr – ClearView Brush or Equivalent

ClearView Brush combines the above listed active ingredients (from Clearview) with triclopyr (from Garlon), which results in broad-spectrum control of hard to control woody species, shrubs, and broadleaf and invasive species. This product is relatively new and represents the move to reduced risk chemistries that offer a safe profile for environment, wildlife, and adjacent vegetation when used as per the label.

Chlorsulfuron – Telar or Equivalent

This herbicide is useful for the control of hard to manage annual and perennial broadleaf species. It is generally used by BC Hydro to spot-treat horsetail. Chlorsulfuron is not used as a soil-applied residual herbicide.

Chondrostereum purpureum – Chontrol or Equivalent

This product is a fungal organism that slows or stops the re-growth or suckering of targeted plants. It is best applied during September/October and provides best results in areas with a high concentration of alder and other deciduous woody species that it is labelled for.

Clopyralid – Lontrel, Transline, or Equivalent

This herbicide is useful for spot-treatment control of broadleaf noxious weed species. It is preferred over picloram for the control of noxious weeds such as Canada thistle, perennial sow-thistle, and scentless chamomile. It is effective only on actively growing plants in areas where high-residual herbicides should not be used. For perennial species, clopyralid controls the initial top growth and inhibit regrowth during the season of application. Clopyralid is not used as a soil-applied residual herbicide, or in areas of high rainfall.

Dicamba – Vanquish, Banvel, or Equivalent

This herbicide is used for the spot treatment of actively growing broadleaf and brush species. Dicamba can be safely mixed with other herbicides to broaden the number of target species controlled. Because it is a selective herbicide, it is useful in areas where grasses will be retained.

Dichlorprop-P and 2,4-D – Estaprop XT or Equivalent

Estaprop XT is a post-emergent herbicide used for controlling hard-to-kill broadleaf species, such as Russian thistle, Canada thistle and Kochia, especially when they are located within a wheat or barley crop, or on industrial or non-crop lands.

Dichlorporp-P is a chlorophenoxy herbicide similar in structure to 2,4-D that is used to kill annual and perennial broadleaf species. It causes an abnormal increase in cell wall plasticity and natural protein production that results in

abnormal and excessive cell division and growth, damaging vascular tissue. The most susceptible tissues are those undergoing active cell division and growth.

Diflufenzopyr and Dicamba – Distinct, Overdrive, or Equivalent

This herbicide is the first active ingredient from a chemical class called semicarbazones. Based on available data, diflufenzopyr is low toxicity to humans, birds, aquatic organisms, mammals, and bees. It has low residual properties. Diflufenzopyr causes hormones in plants to become concentrated in the growth regions. These products generally target broadleaved species.

Diuron – Karmex, Diurex 80 WDG, or Equivalent

This herbicide is used to control many annual and perennial grasses and herbaceous species such as dandelion, goldenrod, thistles, and milkweed. It is mostly used by BC Hydro as a soil-applied residual herbicide to prevent germination and growth of weed seedlings.

As diuron requires moisture (minimum 12mm) to move it into the root zone, application timing is important in the drier interior areas of B.C. Because it requires moisture to activate, effects on vegetation are slow and will not become apparent until the diuron has been absorbed into the plant and leaves.

Flazasulfuron – LongRun 25WG or Equivalent

This is a selective, broad spectrum, pre- and post-emergent herbicide with a wide application window. It controls a variety of broadleaf weeds and grasses. It is absorbed through roots and foliage and is non-persistent. It has low toxicity to birds, mammals, fish, bees, amphibians and beneficial arthropods (insects and spiders).

Flumioxazin – Payload or Equivalent

This herbicide can be used for non-crop selective vegetation control to maintain bareground areas that must be kept vegetation-free. Its water-dispersible granule provides broad spectrum control and can provide season long control on industrial sites.

Flumioxazin provides residual control of vegetation such as ragweed, dandelion, green foxtail, lamb's quarters, and various nightshade plant species. This is a low rate, pre-emergent herbicide and provides a new weed resistance alternative for vegetation managers due to its mode of action and class. Flumioxazin can be tank-mixed with glyphosate products. This active ingredient degrades rapidly in water and soil.

Flumioxazin and Pyroxasulfone – Torpedo, Fierce or Equivalent

This herbicide controls annual grasses and annual broadleaf weeds. It has some residual control and therefore acts as a pre-emergent herbicide used in areas where bare-ground weed control is needed such as in secured facilities. It has low risk of off-site movement but should not be used in proximity to water bodies

or wildlife habitat. It combines two different herbicide chemistries and action to reduce the risk of plant resistance.

Glyphosate – Vantage, Vision, or Equivalent

This herbicide is effective for controlling re-sprouts of most deciduous tree species. It is applied to the cut stump surface of the woody vegetation immediately after brushing, or injected/squirted into the cut frill of a tree as a liquid formulation. It can also be used in a broadcast application. Glyphosate is non-selective and has no or very little residual activity in the soil. It binds tightly to all types of soils independent of the levels of organic matter, silt, clay, and soil pH.

Imazapyr – Arsenal Powerline or Equivalent

This herbicide is used to control most broadleaf species, annual and perennial grasses, and many woody shrubs or trees. It is applied once the plants have had time to sprout. This herbicide is translocated throughout the plant and plant growth stops almost immediately after application. It is moderately residual and can usually provide season-long control on many perennial plants.

Indaziflam – Esplanade or Equivalent

Indaziflam is a new chemistry that is an alkylazine. It works by inhibiting crystalline cellulose deposition in the plant cell wall, severely affecting cell wall formation, cell division, and cell elongation. It is a non-selective herbicide that is best applied as a pre-emergent product. Idaziflam delivers long-term residual control of broadleaf species and hard to control grasses. Indaziflam has a favorable human health and ecological profile.

Metsulfuron-methyl – Escort or Equivalent

The active ingredient (metsulfuron-methyl) is used as a selective herbicide to control various species of broadleaf species, trees, and brush and some annual grasses. It stops cell division in the shoots and roots of the plant, causing plants to die. It is applied pre-and post-emergence (before and after growth begins). The herbicide has low to very low toxicity to humans and animals. Best results are obtained when this product is applied to actively-growing vegetation during late spring to autumn.

Picloram – Tordon 22k, Tordon 101, or Equivalent

Picloram is a selective, residual herbicide that can remain in the soil for several years providing long-term control against susceptible broadleaf invasive plants. The mode of action and soil persistence allows for a broader application window. Since picloram may persist in the soil, care is taken to avoid areas where soil may be moved or where there is shallow aquifers or domestic water intakes and wells.

Picloram and 2,4-D – Aspect or Equivalent

The combination of Picloram and 2,4-D results in the targeted control of woody plants as well as broadleaf species, while still being safe for grasses. Picloram is a selective, residual herbicide that can remain in the soil for several years providing long-term control against susceptible broadleaf invasive plants. Since picloram may persist in the soil, care is taken to avoid applying this herbicide to areas where soil may be moved or where there is shallow aquifers or domestic water intakes and wells.

Saflufenacil – Detail or Equivalent

This is a selective herbicide suitable to industrial site applications which is non-volatile and has low mobility. It is absorbed by root and foliar uptake and acts as both a pre- and post-emergent herbicide on a variety of annual and perennial broadleaf weeds.

Triclopyr – Garlon Products or Equivalent

The active ingredient triclopyr is effective for control of deciduous trees and brush. It provides an effective alternative to glyphosate for control of certain tree species, such as aspen poplar and trembling aspen. Triclopyr is a selective herbicide, has very little soil residual activity, and rapidly degrades in soil microorganisms and sunlight. It generally takes 10-46 days to break down in soil depending on soil type, moisture, and temperature. Although the herbicide does not bind to soil as tightly as glyphosate, once triclopyr moves into the soil, there is generally little movement. The herbicide tends to stay in the upper 30 cm of the surface soil layers following rainfall where it undergoes degradation. Garlon products can be applied as cut stump, basal, or foliar applications.

Trifluralin – BioBarriere, Treflan, or Equivalent

Trifluralin is generally applied to the soil to provide control of a variety of annual grass and broadleaf species. It inhibits root development by interrupting mitosis (cell division), and thus can control vegetation as it germinates.

Trifluralin has a moderate to high residual activity in the soil environment, depending on conditions. It is incorporated into beads and attached to a geotextile fabric for use in new construction to prevent vegetation growth for long periods of time.

2,4-D – LV 700 or Equivalent

2,4-D compounds are hormone mimic chemicals that are selective depending upon rate and species. It is formulated to rapidly penetrate the waxy covering of plants. It is of low toxicity to humans and animals; however, waterbodies should always be protected. The most common application is foliar, and for best results should be applied when plants have rapid growth, likely May/June and September. 2,4-D herbicides have a short soil persistence period.

Chapter 4, Environmental Protection

This chapter covers the following, as per Section 58 of the IPMR (information required for Pest Management Plans):

- Protecting community watersheds and water sources – Section 58(3)(b)(i)
- Protecting fish, wildlife, and habitat – Section 58(3)(b)(ii)
- Preventing contamination of food – Section 58(3)(b)(iii)

Measures to Protect the Environment

Guidelines for Facilities

Many treated facilities have a SMP that generally includes a comprehensive map. The map identifies waterbodies, including wetlands, streams, ditches, culverts, catch basins, wells, and other drinking water sources, as well as the slope of the site. The map clearly defines the management areas within the site that have different action thresholds for vegetation control. The map also shows surrounding land use, such as tree stands, adjacent vegetation sources, and landscaped areas.

Certain areas must remain free of herbicides at all times, and additional areas must exclude residual herbicides. Most herbicides categorized as residual in this IVMP are soil-applied. The SMP map shows clearly-marked PFZs and RFZs.

BC Hydro follows these guidelines to ensure that herbicides do not leave a facility site:

- Prevent herbicides from being applied in PFZs and RFZs.
- Track weather patterns prior to application.
- Refrain from applying herbicides during rain.
- Where practical, use rain fast surfactants on residual applications.
- Carry out a visual evaluation to monitor any possible movement offsite.

In addition, applicators inspect the site and plan application procedures before treatment begins. Where possible, herbicides are applied when target species are at their most susceptible stage. Herbicide products and application methods are selected to maximize the degree of selectivity for the vegetation species, and minimize the degree of toxicity to non-target organisms, herbicide drift, bystander and worker exposure, and persistence in the environment. Due consideration is given to the proximity of bystanders, workers, high foot traffic areas, and other locally sensitive features. Where possible, herbicides are applied during periods

of low public presence, in the early morning or evening, or on weekends if necessary, unless otherwise required by product labels.

Residual-free Zone Restrictions

RFZs apply to soil-applied herbicides only. See Table 1 (Chapter 3) for a listing of soil-applied and foliar-applied herbicides. Note that some products such as imazapyr and picloram can be applied using both modes of application.

- No residual herbicides are used in oil contaminant pits.
- In un-terraced facilities, if the overall slope of the facility is more than 10%, a 5m RFZ is established along the downslope side of the fence. No residual herbicides are used within 5m of a slope where the land slopes away steeply (greater than 30%) on the outside of the fence.
- No residual herbicides are used on any soils saturated with water, or when heavy rainfall is predicted or occurring.
- No residual herbicides are used if foliage is covered by ice, frost or water sufficient to cause runoff.
- Site sensitivity reviews are conducted to determine proximity to water bodies or environmentally sensitive areas, soil types, and adjacent land features.
- Foliar-applied herbicides (non-residual) may be applied up the edge of perimeter ditches, provided they are dry at the time of treatment, removal of vegetation will not increase erosion, and the ditches do not lead directly to fish-bearing water.

Residual-free zone (RFZ) – An area of land that must not be treated with residual herbicides (soil-applied), and must be protected from residual herbicides moving onto it.

Protecting Watersheds and Water Sources, Section 58(3)(b)(i)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(i) strategies to protect community watersheds and other domestic and agricultural water sources from adverse effects of pesticide use;

Pesticide free zones (PFZs) are maintained around community watershed intakes, as well as other water intakes and wells used for domestic and agricultural purposes. The location of water sources, intakes, or wells are clearly marked on the facility SMP map, both those within the facility and those within 30m of the fence line. PFZs are flagged before any herbicide treatment takes place. See Table 3, Water Protection Table (below).

Pesticide free zone (PFZ) – is an area of land that must not be treated with pesticides, and must be protected from pesticides moving onto it. PFZs usually are a strip of land adjacent to water bodies to protect riparian habitat. Required PFZ widths are specified in the herbicide product label or by provincial regulation and are usually a minimum of 10 m in width as measured by the horizontal distance from the high water mark. PFZs are marked in the field before starting any herbicide treatment.

Measures to Protect Community Watersheds

Many communities have designated watersheds where surface water is managed as the water source for the community. The location of community watersheds to be protected is verified by checking the Community Watershed website of the BC Ministry of Environment.

Community watershed – A water source from a stream where the water is used for human consumption, the stream is licensed under the provincial Water Act for a waterworks purpose or a domestic purpose controlled by a water user's community, and the drainage area is not more than 500 square kilometres.

By regulation, no herbicides are mixed, loaded, or applied within:

- 10 metres of bodies of water within community watersheds
- 30 metres of community watershed intakes

Herbicides are not stored within the boundaries of community watersheds.

These PFZs are measured and flagged in the field prior to treatment.

Measures to Protect Wells and Water Intakes

In many B.C. communities, homeowners use private groundwater or surface water sources for domestic water, instead of a watershed. BC Hydro is restricted from applying herbicides within defined PFZs and **No Treatment Zones** (NTZs), set out in Table 3, Water Protection Table (below). PFZs and NTZs are used to protect water supply intakes or wells used for domestic and agricultural purposes that are located on or adjacent to power line corridors and facilities. Locations of registered wells and intakes are verified by searching applicable government websites.

No treatment zone (NTZ) – an area of land that must not be treated with pesticides.

Attempts to identify and locate unregistered wells and water intakes are made by:

- Identifying potential water users, such as private property owners or lessees, and asking them about intake and well locations.
- Looking onsite for domestic or agricultural water use.

Protecting Fish and Wildlife, Riparian Areas, and Wildlife Habitat, Section 58(3)(b)(ii)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(ii) strategies to protect fish and wildlife, riparian areas and wildlife habitat from adverse effects of pesticide use;

Bodies of water are provided protection through the IPMA and IPMR. BC Hydro ensures that herbicides will not be applied within established NTZs, and will respect PFZs and special requirements set out in buffer zones.

Body of water – Any natural body of water, including lakes and streams, etc. It does not include a human-made, self-contained body or structure of water.

Buffer zone – A strip of land between a PFZ and the pesticide treatment area where pesticides are not applied directly in order to prevent stray drift, runoff, or leachate into the PFZ. The width of the buffer zone is variable and up to the discretion of the applicator, taking into consideration the application equipment used and site factors such as terrain, soil conditions, and weather conditions.

In addition to the PFZs specified earlier for bodies of water, BC Hydro will exercise caution when working with herbicides adjacent to and within sensitive ecosystems including riparian habitat.

Riparian habitat – The area of land adjacent to a body of water that contains vegetation that is distinctly different from the vegetation of adjacent upland areas due to the presence of water. Riparian vegetation has several important ecological functions including providing shading or cover, water temperature regulation, food for fish and wildlife (small organic debris), bank stability, or stream structure (large organic debris).

Work near riparian areas is carefully planned in advance during site monitoring and the development of the site management plan. Fish and riparian habitat is protected as follows:

- Identifying and mapping bodies of water through applicable sources of government data
- Documenting bodies of water identified during field assessments on the facility maps
- Classifying bodies of water as fish-bearing or non-fish-bearing (bodies of water that cannot be confirmed as fish-bearing are managed as fish-bearing)
- Managing fish-bearing bodies of water with appropriate PFZs and NTZs as per Table 3

Measures to Protect Fish and Riparian Areas

These general precautions are followed when working around bodies of water:

- Applicators will adhere to the PFZs and NTZs in Table 3.
- Treatment controls are directed only to target vegetation. As much vegetation as possible is retained around bodies of water in order to:
  - Prevent erosion of a stream bank
  - Prevent debris that would cause an unreasonable adverse impact from entering the stream
  - Maintain slope stability in areas where landslides have occurred
- Trees are directionally felled away from stream banks and shorelines to minimize disturbance to the riparian area.
- No deleterious substances are allowed to enter the watercourse, including fuels, debris, sawdust, herbicide products, or sediment.
- Where required, machine-free zones are established around riparian areas.
- Equipment or vehicles will not be washed at a stream or along the shores of any body of water.
- No power equipment or vehicles are serviced or refueled any closer than 15m from a body of water. (Note: This distance may need to be greater depending on site-specific conditions.)
- Watercourses will not be diverted, blocked, or restricted, except temporarily to correct hazardous situations, or in an emergency.
- Machinery should only cross streams over a bridge or culvert. If there is no bridge or culvert available, only one crossing point is selected and used, at a location where adverse effects can be minimized and mitigated.

Water Protection Table (Table 3)

The following distances for NTZs and PFZs are prescribed by the IPMR. Section numbers are listed in the first column.

In order to maintain PFZs as pesticide-free, an adequate buffer zone must be implemented around the PFZ. This zone must account for sloped topography, weather at the time of treatment, or any other site factor that could cause the spread of the pesticides.

To establish NTZs and PFZ's, BC Hydro measures the distance between the point of application of herbicide and the water source. This means the horizontal distance from the **high water mark** of the body of water, **stream**, dry stream, or classified **wetland**. If the high water mark cannot be reliably identified (as in the case of puddles or small pools or water), it is measured from the level of the water.

Stream – A watercourse that contains water on a perennial or seasonal basis, is scoured by water, or contains observable deposits of mineral alluvium, and which has a continuous channel bed that is 100m or more in length, or flows directly into a fish stream or a fish-bearing lake or wetland, or a licensed waterworks.

Wetland – A swamp, marsh, bog, or other similar area that supports natural vegetation, and which is distinct from adjacent upland areas.

High water mark – The highest area of land frequently wetted during a season of high water, i.e., the edge of the body of water at its highest wet point, usually marked by a break in terrestrial vegetation

Table 3: Water Protection Table

Section of IVMP Reg.	Permitted Application	NTZ/PFZ	Notes
All Herbicide Applications			
71(3) Reg.	Domestic and agricultural wells and water intakes, including all methods and pesticides.	30m NTZ	NTZ may be reduced if reasonably satisfied that a smaller NTZ will ensure no pesticide enters well or intake (70(4) Reg.)
Glyphosate Applications			
74(1)(a)(ii) Reg. 74(1)(a)(i) (B) Reg.	Along or around a body of water or classified wetland that: • is fish-bearing, or • that drains directly into a fish-bearing body of water, or • is along or around a dry stream that when wet is fish bearing or • drains directly into a fish bearing body of water	2m PFZ	Glyphosate must be applied using **selective application methods**.* Use within industrial sites that must be kept free of vegetation.
74(1)(c) Reg.	Along or around a body of water if the body of water is: • not fish-bearing at any time of the year • does not drain directly into a fish-bearing body of water	2m NTZ	
74(1)(b) Reg.	Along or around a body of water or a classified wetland that is: • fish-bearing, or • that drains directly into a fish-bearing body of water, or • along or around a dry stream that when wet is fish-bearing or drains directly into a fish-bearing body of water	5m PFZ	For glyphosate applications other than those applied using selective application methods or within industrial sites that must be kept free of vegetation.

Section of IVMP Reg.	Permitted Application	NTZ/PFZ	Notes
74(2) Reg.	Up to the high water mark of a temporary free-standing body of water and dry stream, that is: • not fish-bearing at any time of the year • does not drain directly into a fish-bearing body of water	0m NTZ	
75(4) Reg. 75(5),(6),(7) Reg.	No PFZ is required if the body of water is: • a temporary free standing body of water • not a classified wetland or wildlife habitat feature and • not fish bearing and does not drain into a fish bearing body of water within 100 m. glyphosate may be applied to a body of water if above three criteria met and body of water is less than 25m^2 or not a wetland, or a dry stream bed if the dry stream is not wildlife habitat and not fish bearing when wet	0m PFZ	No glyphosate applications allowed below the high water mark except as per 75 (5),(6),(7) Reg.
Non-glyphosate Applications			
73(1) Reg.	Around or along a body of water or dry stream and classified wetland using any pesticide except glyphosate, subject to label restrictions and including all application methods.	10m PFZ	Except for glyphosate applications.
Noxious Weed and Invasive Plant Management			
77(2) Reg.	Targeted application of glyphosate to noxious weeds and invasive plants if the application is used between 1m and 10m above the high water mark	1m PFZ	

*__Selective application__ – The application of a pesticide to individual plants so that the vegetation between individual plants is not treated. For the purposes of BC Hydro's Integrated Vegetation Management Plan for Facilities this includes cut surface, basal bark, directed foliar, and injection treatments.

Wildlife and Wildlife Habitat

Information is collected from the Conservation Data Centre on locations of rare and endangered species. Areas of known critical **wildlife habitat** are identified within the BC Hydro geographic information system. The provincial *Wildlife Act* and the federal *Species at Risk Act* must be adhered to. Where critical habitat has been mapped and a recovery plan is in place, BC Hydro informs its vegetation management control decisions with information from the recovery plan to ensure activities meet the strategy requirements. In cases where treatment areas potentially intersect with protected habitats, required protection measures are prescribed.

Wildlife habitat – Any natural environment in which a species or group of species lives; those of particular concern are areas managed or protected by provincial or federal legislation.

Herbicides used in the vegetation management program have no known unreasonable adverse effects on fish and wildlife when applied according to the product label.

Although there is little or no wildlife habitat within BC Hydro facilities, any intensive wildlife use outside the fence line will be noted in the SMP and appropriate precautions taken.

Wildlife and habitat are protected as follows:

- Identify and protect wildlife trees adjacent to facilities.
- Leave a diversity of low-growing shrubs and plants that can be browsed by wildlife or used for habitat, including along the edges of facilities where feasible.
- Ensure that herbicide use is directed only at target vegetation.
- Do not disturb inhabited raptor and heron nests – most electrical facilities have bird and wildlife guards to discourage use of equipment for perching or nesting and to avoid or minimize the potential for electrocution.
- Check vegetation for active nests of migratory birds prior to carrying out vegetation management work and use buffers or alter work timing to protect migratory bird nests.
- Minimize soil erosion caused by vegetation management activities to reduce impact on desirable plants or wildlife.
- Control noxious weeds (as designated under the *Weed Control Act*).

Protecting Bees

- Electrical facilities, in general are not attractive sites for foraging bees compared to their vegetated surroundings.
- In general, herbicides are NOT harmful to honeybees and other pollinating insects when applied according to label instructions. BC Hydro does not use any neonicotinoid pesticides in its pest management activities.
- Herbicides are often applied to vegetation that is not a forage source of honeybees and wild bees, and/or spraying is taking place outside the blooming period.
- Most tree species controlled by BC Hydro are wind pollinated (e.g. alder, aspen, birch, cottonwood, willow), not insect pollinated (e.g. arbutus, cherry, some maple species).
- In cases where bee forage plants are sprayed, the herbicide(s) most often have a repellency effect on foraging bees.
- Within a short time after spraying, the plants will be affected and wilting and discoloration will quickly deter foraging bees to visit.
- Most herbicides are liquid sprays that will cause rapid absorption and evaporation. Wettable Powders (WP) may pose a risk when bees are tempted to collect the powdery residue of the pesticides left on the foliage and flowers but these formulations are not commonly used by BC Hydro.

Preventing Contamination of Food, Section 58(3)(b)(iii)

58 (3) A pest management plan prepared for the purpose of section 7 (1) (a) of the Act must include the following operational information:

(b) a description of the environmental protection strategies and procedures that will be followed under the plan, including a description of the following strategies and procedures:

(iii) strategies to prevent pesticide contamination of food intended for human consumption;

BC Hydro facilities are sometimes located near environmentally-sensitive areas such as parks, schools, lawns, gardens, residences, berry-picking and bee-keeping areas, and areas containing agricultural crops and domestic animals. Within these areas, food intended for human consumption is sometimes grown or found. BC Hydro identifies surrounding vegetation in the Site Management Plan (SMP). There is no food gathering within any fenced compound.

BC Hydro attempts to identify areas outside the fence line where there is food intended for human consumption, including berries. Appropriate precautions are taken during vegetation control operations to avoid contaminating these areas, by providing increased buffer zones during herbicide applications, or using alternative, non-chemical methods of control.

Public notification of herbicide treatments is posted at the treatment area according to the IPMR, Section 64. BC Hydro will also notify landowners or users who have previously requested such notification. These measures help ensure that people can recognize an area that has recently been treated and can avoid inadvertently gathering food in the vicinity until the appropriate wait time noted on the posting has passed.

Any adjacent farm fields are noted. Herbicides are not sprayed on areas used for agricultural crop production without permission of the landowner.

In the vicinity of certified organic farms, the grower is responsible for maintaining an 8m buffer zone between their organic crops and power poles (as recommended by the Certified Organic Associations of British Columbia, CAN/CGSB-32.310-200 5.1.7). During the pre-treatment planning, identified organic farms are contacted to ensure they are aware of required buffer zone.