

# **Pest Management Plan**

**For Management of Vegetation at  
BC Hydro Facilities**



Pest Management Plan No.: 105-Facility-2006/2011

**BC Hydro** 

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**BC Hydro**

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# Table of Contents

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<b>Chapter 1 — Introduction to Facilities Pest Management Plan.....</b>	<b>1</b>
1.1, About BC Hydro.....	1
1.2, About This PMP.....	1
Legal Authority.....	2
Purpose of PMP.....	2
PMP Term.....	2
Person Responsible, Section 58(1)(b)(c).....	2
Definitions.....	3
1.3, About Vegetation Management.....	3
Worker Safety Issues.....	4
Pest Management Objectives.....	5
1.4, Geographic Boundaries, Section 58(1)(a).....	5
Types of Facilities.....	5
 <b>Chapter 2 — IPM Program for Vegetation Management.....</b>	 <b>8</b>
2.1, Prevention (Planning), Section 58(2)(a).....	8
Crushed Rock.....	8
Crushed Rock Over Geotextile.....	9
Asphalt and Concrete.....	9
Other Surfacing Materials.....	10
Restricting Organic Matter and Seeds.....	10
2.2, Pest Identification, Section 58(2)(ii).....	10
2.3, Monitoring Pest Populations, Section 58(2)(c).....	11
Incidental Monitoring.....	11
Annual Monitoring.....	11
Site Management Plans.....	11
2.4, Injury Thresholds, Section 58(2)(d).....	12
Injury Thresholds for Electrical Facilities.....	12
Injury Thresholds for Communication Facilities.....	16
Injury Thresholds for Transportation Facilities.....	17
2.5, Method Selection, Section 58(2)(e).....	17
General Selection Criteria.....	18
Herbicide Selection Criteria.....	18
2.6, Herbicide Types and Equipment, Section 58(3)(c).....	21
Approved Herbicides.....	21
Application Equipment.....	24
2.7, Herbicide Application Methods, Section 58(2)(e).....	25
Cut-Surface.....	25
Capsule Injection of Stumps.....	25
Hack-and-Squirt.....	26

- Wipe-on Techniques.....26
- Basal Bark Applications .....26
- Foliar Applications .....26
- 2.8, Physical Treatment Methods, Section 58(2)(e) .....27
  - Physical Treatment Methods for Trees .....27
  - Physical Treatment Methods for Weeds .....28
- 2.9, Cultural/ Biological Treatments, Section 58(2)(e) .....29
  - Grass Seeding.....29
  - Parasitic Insects.....29
- 2.10, Post Treatment Evaluation, Section 58(2)(f) .....30
  - Information Collected.....30
  - Five-year Review .....31
  - Water Sampling Audit .....31

**Chapter 3 — Use and Handling of Herbicides ..... 32**

- 3.1, Qualifications of Personnel.....32
- 3.2, Herbicide Transportation, Section 58(3)(a)(i) .....33
- 3.3, Herbicide Storage, Section 58(3)(a)(ii) .....33
- 3.4, Mixing, Loading, and Applying Herbicides, Section 58(3)(a)(iii) .....34
- 3.5, Herbicide Disposal, Section 58(3)(a)(iv) .....35
- 3.6, Spill Response Procedures, Section 58(3)(a)(v) .....35

**Chapter 4 — Environmental Protection ..... 37**

- 4.1, Responsible Herbicide Application .....37
- 4.2, Protecting Community Watersheds, Section 58(3)(b)(i) .....38
- 4.3, Protecting Water Sources, Section 58(3)(b)(i).....39
- 4.4, Protecting Fish, Wildlife, Habitat, Section 58(3)(b)(ii).....40
- 4.5, Preventing Contamination of Food, Section 58(3)(b)(iii) .....40
- 4.6, Identifying Treatment Boundaries, Section 58(3)(b)(iv) .....41
  - Notification Signs.....41
- 4.7, Weather Monitoring, Section 58(3)(b)(vi).....41
- 4.8, Maintaining Herbicide Application, Equipment, Section 58(3)(b)(v) .....42

**Chapter 5 — Notification and Consultation ..... 43**

- 5.1, Notifications .....43
  - Agency Notification.....43
  - Annual Notification of Intent to Treat .....43
- 5.2, First Nations Engagement.....43
  - PMP Engagement.....43
  - Annual Notification.....44

<b>Glossary</b>	.....	<b>45</b>
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# Chapter 1 – Introduction to Facilities Pest Management Plan

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## 1.1, About BC Hydro

BC Hydro distributes electricity produced by several hydroelectric and other plants to the majority of BC's population. It is responsible for the safe and efficient movement of electricity from the time it leaves substations until it reaches customers through distribution lines.

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 via a tunnel or penstock. The flowing water turns turbines (rotating blades), which in turn drive generators. The generators convert the turbine's mechanical energy into electrical energy. Transformers located within switching stations convert the generators' low-voltage electricity into a higher voltage (greater than 60,000 volts), which is then transmitted over long distances via transmission lines. Transmission lines terminate at substations, which contain transformers that reduce the voltage of the electricity. The electricity is then distributed to BC Hydro customers via approximately 55,000 km of distribution lines (at less than 60,000 volts).

Administrative buildings and storage sites supporting BC Hydro's electrical distribution are located throughout the province and are also covered under this PMP.

For the purposes of this Pest Management Plan (PMP), a **facility** is a well-defined site, owned or leased by BC Hydro, which typically has limited public access.

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## 1.2, About This PMP

This Pest Management Plan allows BC Hydro to use pesticides within its operating area. A PMP is a plan that describes:

- a program for managing pest populations or reducing damage caused by pests, based on integrated pest management
- the methods of handling, preparing, mixing, applying and otherwise using pesticides within the program

**Legal Authority** BC's *Integrated Pest Management Act and Regulation* requires organizations to conduct pest management programs under a single, comprehensive Pest Management Plan (PMP). PMPs are required for pesticide use on public and some types of private land.

This PMP has been prepared to comply specifically with Section 58 of the Ministry of Environment's *Integrated Pest Management Regulation*.

The PMP ensures legal accountability with the provisions of the Act and Regulation, as well as all other applicable federal, provincial, and regional laws and regulations.

**Purpose of PMP** The primary purpose in developing this PMP is to provide a single document describing BC Hydro's IPM planning processes to ensure effective vegetation management while protecting environmental values and human health.

The PMP is required to:

- guide the responsible use of pesticides
- incorporate the principles of integrated pest management (IPM)
- allow public awareness of, and input into, the BC Hydro facilities vegetation management program
- ensure that the effective use of an IPM program takes into account environmentally sensitive areas and land uses
- ensure continuing investigations into alternative methods of vegetation management, while preventing damage to the environment

**PMP Term** PMPs remain valid for five years. This PMP is an updated replacement of one that was first approved in 2000 and extended to 2006. This version will be valid from 2006 to 2011.

**Person Responsible, Section 58(1)(b)(c)** Within BC Hydro, the person responsible for managing pests under this PMP is: Rene Roddick, Vegetation/Pest Biologist: 604-543-1533.

**Definitions** The following words and phrases are key to this PMP. A more complete Glossary is included at the end of this PMP in Appendix 1.

**Pest** — any undesirable organism that should be controlled to ensure the safety and integrity of operating systems. For BC Hydro facilities, this means **Weeds**, defined under this PMP as any undesirable plant, including grass, brush, trees, noxious weeds, or other vegetation.

**Integrated pest management (IPM)** — a decision-making process that uses a combination of techniques to suppress pests and that must include, but is not limited to, the following elements:

- planning and managing ecosystems to prevent organisms from becoming pests
- identifying potential pest problems
- monitoring populations of pests and beneficial organisms, pest damage, and environmental conditions
- using injury thresholds in making treatment decisions
- reducing pest populations to acceptable levels using strategies that may include a combination of biological, physical, mechanical, behavioral, and chemical controls
- evaluating the effectiveness of treatments

**Integrated vegetation management** — the IPM process specifically for the control of weeds at BC Hydro facilities. The primary objectives are to ensure worker and public safety and system reliability.

### **1.3, About Vegetation Management**

Weeds within and immediately surrounding BC Hydro facilities must be effectively controlled because weeds can cause harm in various ways. Weeds 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 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 components 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 structural insect pests, especially rodents
- lead to corrosion of steel equipment and structural deficiencies
- lead to proliferation of noxious weeds (introduced weeds that must be controlled under the BC *Weed Act*)
- degrade the appearance of the site

***Worker Safety Issues***

Vegetation management at substations is critical for safety reasons. If an electrical fault or lightning strike occurs, current flows through the structure and into the ground. Weeds can conduct electricity, putting workers at risk of electrocution through “step and touch” potential. These current flows can also be transferred outside the facility, thereby putting the public at risk.

For the above reasons, buried underneath each of these sites 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
- support the proper operation of the electrical system by providing a low impedance path for fault currents

Any weeds growing over or into this grid can seriously compromise the safety functions of the grid and pose an electrical hazard to workers. Therefore, a surface of clean, crushed rock (similar to gravel) is laid over the grid to prevent weeds from establishing.

Many facilities have high voltage equipment located outdoors. Areas around electrical equipment must be kept clear of all vegetation, including nearby trees that might drop debris onto the equipment.

In addition, weeds within facilities can increase the risk of tripping and slipping.

Worker safety around electrical sites is covered under the *Occupation Health and Safety Regulation* of the Worker's Compensation Board of BC.

***Pest Management Objectives***

Pest management objectives at BC Hydro facilities are based on system design and prevention measures that are aimed at stopping the initial growth and spread of weeds. Therefore, BC Hydro will:

- manage vegetation in and around facilities in a professional manner
- maintain a reliable supply of electricity
- ensure safe working conditions and public safety
- protect environmental resources
- reduce long-term program costs
- maintain site security

**1.4,  
Geographic  
Boundaries,  
Section 58(1)(a)**

The BC Hydro service area encompasses most of British Columbia except the City of New Westminster, and those areas of the Kootenays and Boundary between Creston and Rock Creek, the Similkameen Valley, and the Okanagan Valley from the Canada/U.S. Border north to and including the City of Kelowna.

***Types of Facilities***

The types of facilities covered by this PMP include:

- substations
- capacitor stations
- microwave sites
- repeater stations
- data collection sites
- helipads
- office buildings and storage yards
- pole yards
- switchyards
- dams
- reservoirs
- dikes
- spillways and diversion channels
- penstocks
- hydroelectric generating stations
- thermal generating stations
- diesel generating stations
- gas turbine stations
- cable termination sites
- access roads to facilities

**Substations** — facilities that receive high voltage electricity from transmission lines and reduce the voltage to an appropriate level for delivery

via distribution lines to residential, commercial, and industrial customers. They consist of a system of transformers, circuit breakers, and other high voltage equipment installed outdoors. BC Hydro has more than 330 substations throughout the province.

**Capacitor stations** — sites with equipment that controls system voltage.

**Microwave sites** — telecommunications facilities that house a microwave repeater station. They receive and redirect microwave signals to distant points.

**Repeater stations** — also known as amprodomes, and similar to microwave sites, except they receive, amplify, and redirect radio signals.

**Data collection sites** — instrumentation facilities that collect information on weather 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).

**Helipads** — helicopter landing pads for access to facilities in remote areas.

**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.

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

**Switchyards** — facilities that receive low-voltage electricity from a hydroelectric powerhouse and increase the voltage to an appropriate level for long distance transmission over transmission lines to substations.

**Dams / Reservoirs** — dams are concrete or earthfill barriers across a river 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.

**Dikes** — banks constructed to control or confine water.

**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.

**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.

**Hydroelectric generating stations** — facilities that generate electricity by harnessing water energy into electric energy. BC Hydro has over 30 stations.

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

**Diesel generating stations** — facilities that use diesel generators to produce electricity. BC Hydro has 12 stations.

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

**Cable termination sites** — locations where electrical cables enter the ground or water.

**Access roads to facilities** — vehicle rights-of-way that provide access to facilities for routine maintenance, daily operations, safety inspections, and emergency response.

# Chapter 2 – IPM Program for Vegetation Management

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This chapter describes BC Hydro’s integrated pest management program for control of weeds at facilities, as per Section 58 of the *Integrated Pest Management Regulation*, which describes information required for the PMP.

The steps for integrated vegetation management include:

- prevention (planning) — Section 58(2)(a)
- identification of pests — Section 58(2)(b)
- monitoring for pests — Section 58(2)(c)
- identification and use of injury threshold levels — Section 58(2)(d)
- treatment options and selection criteria — Section 58(2)(e)
- evaluation of treatment — Section 58(2)(f)

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## **2.1, Prevention (Planning), Section 58(2)(a)**

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 (weeds). These measures are considered for incorporation into facility designs prior to construction, and may be implemented during upgrades. Preventive measures may reduce the use of herbicides and other non-chemical control methods.

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

### ***Crushed Rock***

The most effective way to prevent weeds from establishing is by maintaining a 15cm layer of clean, crushed rock (similar to gravel) in and around areas that have zero tolerance for weeds. Crushed rock surfaces should 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.

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. Other functions and advantages of crushed rock are:

- It retards the 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.
- It allows rapid surface drainage.
- It is economical and readily available.
- It is non-flammable and helps to prevent fires in areas around oil-filled equipment.
- It provides a suitable surface for the movement of equipment and vehicles.
- It helps control dust.
- It provides a finished, aesthetically pleasing surface.
- It greatly impedes the establishment of weeds.

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 weeds. Therefore, for optimal safety and weed control, crushed rock surfaces are occasionally replenished.

### ***Crushed Rock Over Geotextile***

The effectiveness of crushed rock for excluding weeds can be enhanced with a geotextile layer close to fence lines, and in areas where herbicides cannot be used. Geotextile is a porous, polypropylene fabric that is laid underneath the crushed rock. It can also be staked to the soil in areas without crushed rock. Geotextile should not normally be used in driveable areas because it may become damaged, or around oil-filled equipment because it will cause the oil to spread during a spill.

### ***Asphalt and Concrete***

Asphalt and concrete can also be used near electrical equipment, but are not as favourable as crushed rock. They conduct electricity and are more expensive than crushed rock. They cannot be used around oil-filled equipment because they will cause the oil to spread in the event of a spill, and asphalt will burn at high temperatures.

The use of asphalt and concrete is generally limited to access roads and storage areas inside facilities.

***Other Surfacing Materials***

BC Hydro has tested other surfacing materials, such as limestone surfacing and crushed oyster shell surfacing, to see if they exclude weeds more effectively than crushed rock. Limestone has low resistivity, may impede drainage, is expensive, and is not readily available. Oyster shells are expensive and have limited application.

***Restricting Organic Matter and Seeds***

Organic matter and seeds should be kept from entering the facility and contaminating the crushed rock. This can be done by:

- removing trees (especially deciduous), grass, and shrubs growing close to the facility fence line to reduce debris deposition inside the facility
- maintaining a 2m crushed rock strip outside the fence line (over the ground grid) of substations to reduce the spread of invasive plants, such as blackberry, horsetail, broom, and groundsel

**2.2,  
Pest  
Identification,  
Section 58(2)(ii)**

Accurate identification of weeds present at a facility is necessary because control methods work differently on various species. For example, the herbicide treatment for grass will not control horsetail. 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 able to distinguish between desirable and undesirable species.

BC Hydro has Vegetation Management Specialists/Biologists located around the province with experience in weed management. These staff members provide information and support to other staff and to contractors on types of weeds, how they establish, their biology and growth rates, and other information.

BC Hydro staff and contractors will use field guides to help them identify weeds.

For each facility, the BC Hydro Vegetation Management Specialist/Biologist or delegate:

- identifies major vegetation species that have, or may have, an impact on the management of the site
- identifies vegetation species by common name and/or Latin name, to the taxonomic level required for proper control method selection

**2.3,  
Monitoring Pest  
Populations,  
Section 58(2)(c)**

Monitoring of facilities provides a record of information about weed occurrence, density, and site conditions. Information is recorded in Site Management Plans (SMPs — see below), including changes in weed species composition, distribution and density over time, as well as changes in surface materials and adjacent plant communities that could invade the site.

All sites are assessed before treatment to make decisions about the timing of treatments and whether they are necessary. Sites are monitored once per year, or sometimes more frequently depending on the specific environmental sensitivities and electrical concerns of the site.

***Incidental  
Monitoring***

BC Hydro maintains site integrity by routinely inspecting and monitoring facilities for potential or existing weed 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 facility managers.

Staff will notify the facility manager or regional BC Hydro Vegetation Management Specialist/Biologist of any weed problems that require immediate action.

***Annual Monitoring***

Regional BC Hydro Vegetation Management Specialists/Biologists or qualified designates annually monitor conditions at facilities to ensure that treatments are applied at the most effective times for weed control.

Monitoring is done visually and may be documented in writing. Weed percentages are estimated and compared to the threshold levels. Decisions are then made to prescribe treatment, methods, and timing.

Weed control contractors are provided with a map of the facility and asked to sketch in the areas where weeds are present, estimate the total percentage cover for the site, and note the major species present. This is done each time the site is treated, using a single map for each calendar year.

***Site Management  
Plans***

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

SMPs have been developed for sites requiring integrated vegetation management, primarily substations. They have been prepared by BC Hydro Vegetation Management Specialists/Biologists in each region, or their



qualified designates. SMPs may be developed for smaller and lower priority sites on an as needed basis. Lesser sites for which a SMP is not developed will have a prescription prepared prior to treatment.

The prescription will contain the following:

- site sensitivities (nearby water bodies, pesticide-free zones, residual-free zones)
- current conditions (surfacing materials, list of weed species within and outside the facility)
- preventive measures that can be taken
- recommended treatment methods, procedures, and timing

**2.4,  
Injury  
Thresholds,  
Section 58(2)(d)**

Treatment of weeds within BC Hydro facilities is required when the surface weed cover reaches a predetermined level, called the **injury threshold** (or action level). It is generally expressed as a percentage of the total weed area that can be tolerated while still maintaining the integrity, security, and safety of the site. Any percentage weed cover above the established injury threshold requires a vegetation management action.

Injury thresholds vary because weed control is more critical for certain areas within each facility. They can be specific and include all weed species (e.g., within a substation where there is low tolerance for weed growth), or they may be specific to one weed species (e.g., where a single, tall-growing tree or shrub species compromises site safety and security).

Injury thresholds that are deemed acceptable for weeds at BC Hydro facilities reflect the reasons for the control—safety, system security, structural integrity, economic impacts, and aesthetics.

***Injury Thresholds  
for Electrical  
Facilities***

Electrical facilities include substations, hydroelectric facilities, capacitor stations, and cable termination sites. Injury thresholds for each major type of site are listed on the following pages (threshold percentages are in bold).

Facilities can be divided into several areas with different injury thresholds, as follows.

**Within Electrical Compounds**

Due to serious electrical safety hazards, there is a very low tolerance for weeds within fenced electrical compounds.

BC Hydro does not allow weed populations to exceed **5%** of the cover of the electrical compound. When weeds reach this density, control is initiated.

In addition, the following areas are maintained weed free (**0%**):

- under or around electrical equipment
- under switch operators and equipment control cabinets because of the high risk of people standing at the equipment during an electrical fault
- around oil-filled transformers and equipment
- around high voltage equipment with ground level insulators

### **Just Inside or Outside Fence Lines**

For safety reasons the ground grid often extends beyond the fence line for 2m. Therefore, requirements for weed control are the same as those inside electrical compounds. Weeds are controlled when densities exceed **5%** of the 2m area inside and outside the fence line.

### **Pole Yards and Storage Yards**

In pole yards and storage yards, weeds are controlled because they can:

- increase fire hazards
- create slipping and tripping hazards
- degrade the appearance of the site
- interfere with equipment access, site security, and storage capabilities
- serve as food and habitat for ants and wood pests
- lead to corrosion of steel equipment

Storage of woodpoles 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%** weed cover under pole bunks. Control is initiated at **10%** weed 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. Weeds at dam sites are a safety concern and must be removed because they 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 weeds before extensive roots become established, since root systems can provide channels for water to move through the dam.

Low-growing vegetation, such as grasses, forbs, and mat-forming shrubs, is desirable at dam sites and 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. It also improves aesthetics and controls erosion.

**Earthfill Dams** — All vegetation will be controlled within 6m from the toe of the dam, and on the upstream and downstream dam faces (**0%**). These areas must be kept clear to monitor for seepage, which is an indicator of dam failure. Deep-rooted trees and shrubs will be controlled once they reach 1m in height. Control measures will be implemented once **5%** of the upstream and downstream dam faces are covered in saplings. When control is implemented, all potentially tall-growing vegetation will be removed.

**Concrete Dams** — Plants can become established around the buttresses and in cracks, contributing to dam deterioration. All vegetation must be controlled within 6m from the toe of the dam to monitor seepage (**0%**). Deep-rooted trees and shrubs should be controlled before they reach 1m in height (**0%**). Control measures will be implemented once **5%** of the upstream and downstream dam faces are covered in saplings. When control is implemented, all potentially tall-growing vegetation will be removed. Mosses, liverworts, and algae that become established on the concrete may need to be controlled to ensure access for maintenance and inspection.

**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.

Weeds must be controlled (**10%**) 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. Weeds, 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** — Weed 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 will be controlled when **10%** of the area is covered. Grasses and other low-growing herbaceous species are acceptable.

### **Designated Roadways**

Weeds established within or alongside roadways around electrical facilities can rapidly spread. Even though electrical hazards are not as high, BC Hydro cannot leave weed populations unchecked. When weed levels reach **10%** of the area, control is initiated.

The exception is asphalt roadways, where no weeds are tolerated because the resistivity and surface integrity of the asphalt would be compromised (**0%**).

Mosses, liverworts, and algae may be acceptable and may not require control.

#### **Undeveloped Areas (no buildings or equipment)**

Weeds established in undeveloped areas inside the electrical facility (either crushed rock-covered or grass-seeded) can rapidly spread to adjacent electrical compounds. When weed levels reach **10%** of the area, control is initiated.

Mosses, liverworts, and algae may be acceptable and may not require control.

#### **Other Weed Control**

There is no tolerance for noxious weeds, which will be controlled at all sites as soon as they are noticed, to comply with the *Weed Control Act* (**0%**). Noxious weeds are any plants that pose a threat to people, animals, or crops as specified under the Act.

Trees and other tall-growing or deep-rooted vegetation must be removed regardless of the hazard level for the location (**0%**). This is because trees can interfere with required electrical clearances and site security, and pose a risk of fires or power outages.

In particular, damaged and dying trees (hazard trees) that could fall into the site must be removed (**0%**).

In areas where pedestrian or vehicular access is required and a slipping hazard exists, control of liverworts, lichens, and algae may be required.

#### ***Injury Thresholds for Communication Facilities***

Communication facilities include data collection platforms, microwave stations, and repeater stations. Weeds at these facilities can interfere with reception of communication signals.

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

- trees and tall-growing vegetation, which can disrupt transmission of microwave and radio signals and become energized during lightning strikes
- trees, shrubs, and weeds around data collection platforms, because they can interfere with accurate measurement and transmission of data

***Injury 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 manoeuvring area. Vegetation management will vary 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 weeds are controlled around helipad sites (**0%**):

- all vegetation within the critical helipad area (5m radius passenger and equipment exit zone)
- trees and tall-growing vegetation within the secondary helipad area (15m x 15m area)
- trees and tall-growing vegetation within the manoeuvring area (generally 44m x 44m, but may vary depending on the terrain), if space is required to ensure rotor clearance and manoeuvring room

**Access Roads and Parking Lots**

The following types of weeds are to be controlled around roads and parking lots (**10%**):

- 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

**2.5,  
Method  
Selection,  
Section 58(2)(e)**

IPM involves the use of different techniques (options) to control weeds within BC Hydro facilities. 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 IPM techniques proposed for the control of weeds in or adjacent to BC Hydro facilities include:

- chemical methods (herbicides)
- physical methods
- cultural/biological methods

**General Selection  
Criteria**

Selection of a particular option depends on:

- the weed species being targeted
- safety, security, economic impacts, and site accessibility
- treatment timing
- effectiveness
- land use within the facility
- environmental sensitivities in surrounding areas (fish, wildlife, surrounding land use)
- site characteristics, including land use, proximity to water sources, bodies of water, biogeoclimatic zones, and soil type
- the consequences of not treating

**Herbicide Selection  
Criteria**

Chemical control involves the use of herbicides to inhibit growth of weeds within or adjacent to BC Hydro facilities. Selection of the herbicide is determined by:

- soil residual activity
- mode of action
- selectivity
- environmental characteristics
- health and safety characteristics

**Soil Residual Activity**

A herbicide with residual properties tends to be retained in the soil for a certain period of time. Herbicide active ingredients are generally classified by their degree of soil residual activity—low, moderate, or high. The most common herbicides used by BC Hydro have low to moderate soil residual activity.

**Mode of Action**

A herbicide's mode of action refers to how it affects the plant. Uptake of herbicides is by plant roots, stems, and foliage. All herbicides used under this PMP are translocated with the exception of chlorsulfuron, which also works on contact, as well as translocation.

**Selectivity**

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

**Environmental Characteristics**

The following properties are considered when making a herbicide selection:

- volatility
- adsorption to soil particles
- toxicity to non-target organisms
- selectivity
- residual activity

**Health and Safety Characteristics**

All herbicides used by BC Hydro have low to moderate toxicity. Applicators are well-trained and protected by 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 and rates that proved acceptable levels of weed control.

**Table 1: Properties of Approved Herbicides**

The herbicide active ingredients proposed for use under this PMP, their soil residual activity, mode of action, selectivity, and application mode are shown in the table below.

Active Ingredient	Soil Residual Activity*	Mode of Action	Selectivity	Where and How Applied
2,4-D	Low	translocation	selective	foliage; post-emergent
aminopyralid	Low	translocation	selective	foliage; post-emergent
amitrole	High	translocation	non-selective	foliage; post-emergent
chlorsulfuron	moderate	contact/ translocation	selective	foliage; post-emergent
clopyralid	moderate	translocation	selective	foliage; post-emergent
dicamba	Low	translocation	selective	foliage; post-emergent
diuron	moderate	translocation	non-selective	soil; pre-emergent
glyphosate	Low	translocation	non-selective	foliage; post-emergent



Active Ingredient	Soil Residual Activity*	Mode of Action	Selectivity	Where and How Applied
imazapyr	moderate	translocation	non-selective	soil & foliage; pre-and post emergent
picloram	High	translocation	selective	foliage; post-emergent
simazine	moderate	translocation	non-selective	soil; pre-emergent
triclopyr	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.

**Selection and Use of Residual vs. Non-Residual Herbicides**

**Residual** — Residual herbicides are prescribed only for sites that pass soil and site sensitivity assessments. In the Lower Mainland and coastal areas of BC, assessment of weed densities and a recommendation to apply residual herbicides to the soil will generally be made in the fall.

Residual herbicides are only applied a maximum of once per year. The residual herbicides simazine, diuron, or imazapyr may be used alternatively each year in the spring so that the same active ingredient is not applied more than once every two years.

In the interior regions of BC, assessment of weed densities is also made in the fall. However, simazine and diuron are generally applied in the fall, rather than the spring. This is because the herbicides will be protected in the soil by the winter snow pack, and will begin working immediately in the spring to prevent rapid weed growth. Imazapyr is generally applied in the spring.

**Non-Residual** — If weed density by surface area is less than two times the injury threshold, a combination of hand-pulling and spot treatment with a low residual herbicide such as glyphosate or dicamba is generally used. If broadleaf weeds such as groundsel or fireweed are predominant at the facility, dicamba may be used instead of glyphosate. Weeds can also build up a resistance to glyphosate, so if a weed species seems to persist after glyphosate application, dicamba is generally substituted.

Low residual herbicides are not applied more than three times per year in the same facility.

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## **2.6, Herbicide Types and Equipment, Section 58(3)(c)**

### ***Approved Herbicides***

BC Hydro only uses the herbicides listed and described below for weed control at facilities. These herbicides are all of low toxicity to mammals, and except for picloram, have either low or moderate soil residual activity.

#### **2,4-D**

This herbicide is generally used in combination with other herbicides, particularly picloram (Tordon 101) to control a wide range of weeds, however, it can also be used on its own. It is applied as a foliar treatment to control rangeland vegetation and woody vegetation. 2,4-D depletes the plant's stored energy, causing plant death.

#### **Aminopyralid**

Aminopyralid controls a number of noxious and invasive weeds, such as Canada thistle, dandelion, and knapweeds. When tank-mixed with 2,4-D amine, the control spectrum broadens significantly to include such hard to control species as buttercup, curled dock, perennial sow thistle, and hawkweed.

Aminopyralid is absorbed through leaves and roots, and translocates throughout the plant. It interrupts cell division causing the plants to die.

#### **Amitrole**

Although it controls a wide variety of weeds and grasses, BC Hydro generally uses amitrole to spot-treat horsetail. It is not used as a soil-applied herbicide. Amitrole hinders or inhibits the production of chlorophyll, thereby killing the plant.

#### **Chlorsulfuron**

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

#### **Clopyralid**

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 weeds, clopyralid will control the

initial top growth and inhibit regrowth during the season of application. Clopyralid is not used as a soil-applied residual herbicide, and will not be used in areas of high rainfall.

### **Dicamba**

This herbicide is used for the spot treatment of actively-growing broadleaf weeds 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.

### **Diuron**

This herbicide is used to control many annual and perennial grasses and herbaceous weeds such as dandelion, goldenrod, thistles, and milkweed. It is 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 BC. Because it requires moisture to activate, effects on weeds are slow and will not become apparent until the diuron has been absorbed into the plant and leaves.

### **Glyphosate**

This herbicide is the most commonly used herbicide at BC Hydro facilities and is used to control a wide variety of weeds. It works best on annual and perennial weeds that have emerged above the soil and are actively growing. Glyphosate is useful in areas in close proximity to wells, water bodies, and other environmentally sensitive features due to its high soil adsorption properties.

Glyphosate can also be used to control resprouting from tree stumps (cut-surface method) or as a foliar spray application to control small patches of weeds. It may be used following manual and mechanical control methods to prevent re-sprouting of deciduous trees.

### **Imazapyr**

This herbicide is used to control broadleaf weeds, annual and perennial grass species, and woody vegetation. It is particularly useful in controlling weeds that have not been effectively managed using a combination of physical controls and glyphosate application. BC Hydro uses imazapyr both as a soil-applied residual herbicide and to control established weeds by spot treatment.

Imazapyr works by preventing germination of weed seeds. It is readily absorbed through foliage and roots and moves rapidly throughout the plant where it breaks down tissue.

### **Picloram**

Although picloram is effective in controlling a variety of broadleaf weeds, its use under this PMP (as formulated in the product Tordon 22K) will be restricted to the control of broadleaf noxious weed species, including diffuse and Russian knapweed, Dalmatian toadflax, and hound's tongue. Picloram does not control established grasses and will not be used as a soil-applied residual herbicide. Picloram will not be used in areas of high rainfall such as the Fraser Valley and Vancouver Island.

Picloram may occasionally be used in combination with the active ingredient 2,4-D (Tordon 101) for the control of patches of rangeland weeds and woody vegetation.

### **Simazine**

This herbicide is used as a soil-applied residual herbicide to prevent the germination of a wide range of annual and perennial grasses and broadleaf weed seedlings. It is particularly useful where combinations of physical controls and post emergent spot herbicide treatments have not been effective.

Simazine is absorbed mainly through roots and has very little foliar activity. It has little lateral movement in the soil but can be washed along with soil particles to adjacent areas.

### **Triclopyr**

Although it is effective in controlling established perennial weed and brush species, triclopyr will generally be used to selectively control trees that are encroaching on the fences of electrical facilities or alongside access roads. As a basal bark treatment, it is particularly effective in controlling trees that commonly re-sprout following cutting. It is more effective than glyphosate for control of birch and aspen.

Triclopyr is absorbed by both leaves and roots and readily moves throughout the plant.

**Application  
Equipment**

Depending on the herbicide being applied, the following types of equipment may be used.

**Backpack Sprayer**

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. It is particularly useful for spraying small areas or individual plants and trees. Backpack sprayers may be used for selective herbicide applications or for spraying individual trees or plants. Within this PMP, backpack sprayers may be used for applying all of the herbicides proposed for use by foliar or soil application.

**Powerhose Spraygun**

A hand-held spraygun and hose attached to a portable tank 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. They can be used for the application of all herbicide liquid mixtures.

Broadcast treatments applied from the ground can be done with powerhose sprayguns, although terrain conditions may require the use of backpacks. Operating pressures may range from 200–350 kPa at the nozzle of a powerhose spraygun. The volume ranges between 300–2000L per hectare. The hand guns can be fitted with various size nozzles to modify the delivery rate required and to alter the production of fine particles (fog vs. large droplets) in the application pattern.

**Boom Sprayer**

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.

Flat fan or hollow cone nozzles are typically used on ATV boom sprayers, and deliver volumes no less than 55 litres per hectare in order to minimize drift. Sprayer manufacturers and dealers should be consulted to assure that proper nozzles and systems are used. Typically, ATV boom sprayers used on BC Hydro sites would range from 2-4m in total spray width.

**Wick/Wipe-on Applicator**

This tool is 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 various materials and 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.

**Injection Tools**

This tool is used to inject a small capsule containing glyphosate into the stem of a target tree or stump. It is a battery-powered drill or automatic loading lance.

The EZ-Ject® product uses a recycled 0.22 caliber shell casing containing gelled glyphosate. A lance with a multiple capsule magazine is used to drive the casings into the tree stem. The magazine holds up to 400 capsules.

**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.

**2.7,  
Herbicide  
Application  
Methods,  
Section 58(2)(e)**

BC Hydro uses the following herbicide techniques at facilities:

- cut surface
- capsule injection of stumps
- hack-and-squirt
- wipe-on
- basal bark applications
- foliar applications

***Cut-Surface***

This method (also called cut-and-treat) will be used in conjunction with manual tree cutting (slashing) in deciduous stands. The tree is cut low to the ground, then a herbicide is applied to the cut surface of the stump to limit resprouting. Herbicide products containing glyphosate, 2,4-D, picloram, or triclopyr may be applied to the stump with a squirt bottle or backpack sprayer. Cut-surface is a selective technique, in that only the unwanted trees are removed and other species are left.

***Capsule Injection of Stumps***

In this technique, a small capsule containing glyphosate is injected into the stem of a target tree or stump with an injection tool. The herbicide is slowly released into the sapwood. Capsule injection is best employed when cut-surface cannot be done immediately after slashing. This technique is also effective on resprouting stumps, provided the capsules are applied to live tissue.

One capsule of 1 ml of glyphosate per 5cm of stem diameter is recommended for control. Trees greater than 20cm diameter are not effectively controlled by capsule injection. The cutting edge of the capsules must penetrate to the sapwood to ensure translocation of the herbicides throughout the tree.

***Hack-and-Squirt***

Hack-and-squirt is a type of injection technique that involves making one or more incisions into the tree trunk, down to the sapwood, and placing small amounts of the active ingredient glyphosate into the cuts with a squirt bottle. This technique may be used where tree removal is not mandatory for fire hazard or aesthetic purposes. The cuts should be spaced evenly around the trunk, with at least one cut for each 2.5cm of stem diameter at breast height. The glyphosate is normally applied as a carbopaste, generally with a squirt bottle, within minutes after making the incisions.

***Wipe-on Techniques***

In this technique, a wick soaked with the active ingredient glyphosate is wiped or dragged over the foliage of the target species. This application technique virtually eliminates drift. Wick application is ideal for vegetation management in areas where no spray drift can be tolerated, or when individually treating the stumps of deciduous trees immediately following manual cutting.

The wipe-on technique is best employed where cut stumps have resprouted to a height that raises the tree over the desirable vegetation so that it may be treated safely and effectively.

***Basal Bark Applications***

This procedure involves treating the bark of a tree from the root collar to a point above the ground with a hand-operated backpack sprayer, with products containing the active ingredient triclopyr. The herbicide penetrates the bark into the cambium layer of target stems and diffuses itself throughout the tree. It also travels to the roots and prevents resprouting.

Although most effective in the late summer, basal bark applications can be made throughout the year, except in wet weather. Although this technique is used primarily for controlling individual trees, it can also be applied to cut stumps to prevent resprouting and root suckering.

***Foliar Applications***

With this technique, a backpack, powerhose with spraygun, or boom sprayer is used to apply post-emergent herbicides. This method is generally used for individual trees or small clusters of trees where the vegetation is between 50cm and 1.5m high. It may also be used as a touch-up for cut-surface treatments and to treat areas where there are many resprouts on stumps

after mowing or slashing. It is most effective when done in the late summer or early fall, prior to leaf fall, when the resprouts are less than 50cm high.

**2.8,  
Physical  
Treatment  
Methods,  
Section 58(2)(e)**

The physical IPM techniques to control hazard trees and weeds in or adjacent to BC Hydro facilities include:

- tree cutting
- girdling
- mowing
- weed-trimming
- hand-pulling

***Physical Treatment  
Methods for Trees***

Trees must be removed from around electrical facilities, helipads, access roads, parking lots, pole yards, and storage yards for the reasons described earlier. Trees are either slashed or girdled.

**Tree Cutting (Slashing)**

The required equipment for manual tree cutting include chain saws, circular brush saws, and axes.

The benefits and limitations of tree cutting include:

- selective (only cuts desirable species)
- assures electrical safety requirements
- expensive and labour-intensive
- deciduous stumps must be removed, ground down, covered, or treated with a herbicide to prevent resprouting
- chain saws, hand tools, and falling trees pose safety hazards
- negative aesthetics unless costly clean-up is completed

**Girdling**

Girdling involves cutting a strip of bark from around the entire tree trunk with a specialized girdling tool, an axe, or other hand tool. The bark strip is removed along with other tissue down to the sapwood. The above-ground parts of the tree will continue to grow, but the roots starve and the tree slowly dies.

The benefits and limitations of girdling are:

- effective on any tree more than 4cm in diameter
- tools are inexpensive, durable, relatively safe, easy to use, and quiet



- flexible because individual stems and species can be removed or left on a tree-by-tree basis
- close inspection required to ensure adequate depth and width of girdle is maintained
- possible safety issue if girdled trees snap and fall over
- not all tree species are susceptible to girdling, such as maple species

***Physical Treatment Methods for Weeds***

Herbaceous plants, grasses, tree seedlings, mosses, liverworts, and woody weeds both inside and outside facilities are controlled through mowing, weed trimming, or hand-pulling.

**Mowing**

Grass cutting is recommended in undeveloped areas such as fields and low priority sites. Mowing helps control weeds before they go to seed, thus reducing spread into areas where there is low weed tolerance. Mowing promotes aesthetics and is economical, but requires repeated treatments. Commercial lawnmowers, garden tractors, or industrial tractors with rotary or flail cutters will be used. There are some safety risks due to flying debris.

**Weed Trimming**

Cutting weeds at ground surface is recommended along fence lines and at low priority sites. Commercial type weed trimmers are available. Weed trimming helps to remove seed heads and is convenient and economical. 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 and can be a safety hazard to the operator and other staff.

**Hand Pulling**

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

Large or clumpy rhizomatous or woody vegetation is pulled from the site at the beginning of the season to reduce the amount of herbicide that needs to be sprayed. By dealing with weeds early, the potential for weeds to propagate inside the facility is reduced, and the problem can be eliminated before it becomes too large or costly.

Alternatively, when weeds have extensive root systems, an appropriate herbicide is used to spot-treat them, and the dead vegetation is removed by early fall.

The benefits and limitations of hand pulling are:

- in certain areas, weed density can be reduced to a manageable level, allowing use of other control methods to complete the work
- effective for larger, established weeds that can be easily uprooted, such as grass clumps, tree seedlings, and broom
- effective if there are only a few weeds on the site (e.g., 100 or less)
- roots can regenerate because many species snap off at ground line
- tends to degrade the crushed rock surface
- tends to expose soil and seeds
- risk of electrical safety hazard when roots are in contact with the ground grid, or where electrical equipment is close to the ground
- must dispose of debris
- labour-intensive and costly
- may expose labourers to unsafe equipment, especially in electrical facilities
- may lead to acute and chronic back problems

**2.9,  
Cultural/  
Biological  
Treatments,  
Section 58(2)(e)**

Biological and cultural control methods use other plants or organisms to help control or displace weeds. BC Hydro often uses grass seeding and may use parasitic insects where appropriate.

***Grass Seeding***

Grass seeding refers to the manual planting of turf or agricultural grasses, or to the seeding of large areas of bare soil with grass-seeding machines. This method is used to reduce the establishment of broadleaf weeds with rapidly spreading airborne seeds. It can be used on any undeveloped site or disturbed area. Required equipment may include cyclone spreaders, belly grinders, seed drills, and hydro-seeding machines.

The benefits and limitations of grass seeding are:

- prevents erosion
- inhibits the growth of weeds
- promotes aesthetics
- may require irrigation to establish and maintain
- safety concerns using equipment around electrical wires and equipment
- hydro-seeding has better chances of success than manual grass seeding

***Parasitic Insects***

The release of parasitic insect species can help control noxious weeds and invasive plants by invading the plant and slowly killing it, or by reducing seed

production and plant vigour. This method will only be used at large-area 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 weeds. The size of the weed 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.

This method is expensive and labour-intensive, is not usually effective in eliminating weed populations, but does help to reduce the spread of weeds and may reduce weed densities to a manageable level.

**2.10,  
Post Treatment  
Evaluation,  
Section 58(2)(f)**

All contract vegetation management work will be evaluated to:

- ensure compliance with this PMP and the contract
- ensure compliance with the *Integrated Pest Management Act and Regulation*
- determine the efficacy of the work done by the contractor

Results of vegetation management will be evaluated on a site to determine the success of the Site Management Plan (SMP) and techniques, and to ensure there was no negative environmental impact.

The timing and procedure for evaluating specific treatment programs will be part of the SMP, and will depend on the treatment used. In general, all sites will be evaluated within one year of the treatment. (This is in addition to an end-of-contract inspection, which focuses primarily on contractor performance.)

Treatment program evaluations will be based on visual estimates of the percentage of weed cover. Evaluations will be conducted by the regional Vegetation Management Specialist/Biologist or delegate.

***Information  
Collected***

To evaluate the results of a vegetation management program, all relevant information is collected, such as previous monitoring data and current site conditions. Both formal and informal assessments may be completed.

When evaluating the results of weed control at a facility, BC Hydro will collect the following information:

- the effectiveness of the treatment method/program in controlling the weeds

- the percentage of weeds still present and a percentage estimate of mortality
- the need for follow-up or touch-up treatments, if any
- the amount of herbicide used to determine if increases or decreases are necessary
- the 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
- whether the technique used was the most appropriate one for the job
- recommendations for enhanced preventive measures
- recommendations for future treatment methods/programs

***Five-year Review***

In addition to the above evaluations, all previously treated facilities will be subject to a review every five years by the regional BC Hydro Vegetation Management Specialist/Biologist or delegate. During these reviews, all monitoring and inspection/evaluation information collected for the facility over time will be reviewed. The results of the review will be incorporated into a revised SMP for the facility.

***Water Sampling Audit***

To ensure that the recommended treatment program is environmentally sound, some of the sites treated with residual herbicides will be selected for a water sampling program. This ensures that sites and surrounding land and water bodies are not being contaminated by residual herbicides. Sites will be selected according to the following criteria:

- proximity to water, water sources, the public, and schools
- the environmental sensitivity of the area
- whether herbicide use has increased over time (or whether herbicides are used at all at the site)
- the topography, soil type, and size of the site

Not all facilities have a location that is suitable for water sampling.

At facilities where residual herbicides were used, the water sampling location will be where the majority of surface run-off and discharge from underground drainage systems can be collected. The location of water sampling will be recorded on the SMP map. Water samples will be taken from each site prior to herbicide application to establish a baseline. After herbicide application, samples will be taken again within 24 to 30 hours after the start of the first significant rainfall.

# Chapter 3 – Use and Handling of Herbicides

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This chapter covers the responsible use and handling of herbicides at BC Hydro facilities, including:

- qualifications of personnel
- transportation — Section 58(3)(a)(i)
- storage — Section 58(3)(a)(ii)
- mixing, loading and application — Section 58(3)(a)(iii)
- disposal — Section 58(3)(a)(iv)
- spill response plan — Section 58(3)(a)(v)

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## 3.1, Qualifications of Personnel

The use and handling of herbicides is governed by federal and provincial legislation. All persons working with herbicides will follow safe handling practices, including workplace requirements for Workplace Hazardous Materials Information System (WHMIS), labeling, and worker education.

The required practices for pesticide applicators are detailed in:

- Worker's Compensation Board of British Columbia (1998) *Occupational Health and Safety Regulation* – BC Regulation 296/97 as amended by BC Regulation 185/99 – Sections 6.70 to 6.109
- B.C Ministry of Environment (2005) *Handbook for Pesticide Applicators and Dispensers*
- Worker's Compensation Board of British Columbia (1990) *Standard Practices for Pesticide Applicators*

Any individual or company (i.e., a contractor) that provides a service to BC Hydro by applying commercial or industrial pesticides must have a valid BC Pest Control Service License. Each supervising applicator must have a valid BC Pesticide Applicator Certificate in the Industrial Vegetation and Noxious Weed Control category.

Under the *BC Integrated Pest Management Act and Regulation*, a certified pesticide applicator can supervise up to four uncertified assistants, provided the assistants are within continuous auditory or visual range at all times while

**3.2,  
Herbicide  
Transportation,  
Section 58(3)(a)(i)**

applying pesticides. Individuals must carry proof of their applicator certification with them when applying pesticides.

The transportation of herbicides will comply with all current legislation governing their transport, as well as the following requirements under this PMP.

- The quantity of herbicides carried in a vehicle will be limited and no more than what is necessary for each project, except where transportation occurs between storage facilities.
- Herbicides will be carried in a secure lockable compartment.
- Herbicides will be transported in original labeled containers.
- Herbicides will be transported separately from food and drinking water, safety gear, and people.
- Spill containment and clean up equipment will be transported separately from pesticides, but in close proximity to them, on each vehicle during transport and use.
- Appropriate documents such as Pest Control Service Operations Records, Material Safety Data Sheets (MSDS), and the PMP document will be available during transport and use of pesticides.
- All documents and placards will be carried in, or placed on, transport vehicles if required under the *Transportation of Dangerous Goods Act* or the *BC Integrated Pest Management Act*.
- All pesticide containers will be inspected for defects prior to transporting and will be secured against spillage or unauthorized removal.

**3.3,  
Herbicide  
Storage,  
Section 58(3)(a)(ii)**

Pesticides may be stored by BC Hydro or its contractors at facilities owned or operated by BC Hydro or the contractor.

Pesticide storage will adhere to requirements of the *Integrated Pest Management Act and Regulation* and the Worker's Compensation Board document *Standard Practices for Pesticide Applicators*.

The storage area must:

- be ventilated to the outside
- be locked when left unattended
- be entered only by authorized persons
- have a placard affixed on the outside of each door with clearly visible block letters saying: “WARNING – CHEMICAL STORAGE – AUTHORIZED PERSONS ONLY”

The person responsible for the storage area must notify the appropriate fire department of the presence of the herbicide on the premises.

BC Hydro has no direct control of the pesticide storage practices of its contractors while not under contract to them. These companies are still governed by the provisions of the *BC Integrated Pest Management Act and Regulations* with respect to storage by a Pest Control Service License.

Some contractors may store pesticides for extended periods of time in vehicles when performing a number of pesticide treatments for BC Hydro. The vehicle is considered a mobile storage unit. Persons responsible for the pesticide storage must ensure that all pesticides are stored in a locked canopy or similar arrangement, separate from the driver and personal protective gear.

**3.4,  
Mixing,  
Loading, and  
Applying  
Herbicides,  
Section 58(3)(a)(iii)**

All mixing, loading, and application of herbicides are carried out by certified pesticide applicators who are certified in the appropriate category, or by individuals directly supervised by a certified pesticide applicator with the appropriate category of certification.

Mixing and application of herbicides must be consistent with product label rates.

To help ensure safe mixing of herbicides, the following will be kept on site, as recommended on the respective product labels:

- safety spill kits
- spill response plans
- first aid supplies
- eye wash station(s)
- protective clothing
- product labels
- Material Safety Data Sheets (MSDS)

There will be no mixing or loading of pesticides within 15m of sensitive environmental features.

**3.5,  
Herbicide  
Disposal,  
Section 58(3)(a)(iv)**

Disposal of empty containers is done according to the manufacturer's instructions on the product label, or provincial instructions and recommendations detailed in the BC Ministry of Environment's *Handbook for Pesticide Applicators and Dispensers* (2005).

At a minimum, empty pesticide containers must be either:

- returned to the pesticide distributor as part of their recycling program  
**or**
- triple-rinsed or pressure-rinsed, then crushed, punctured, or damaged so they cannot be reused, and disposed of in a permitted sanitary landfill or other approved disposal site

**3.6,  
Spill Response  
Procedures,  
Section 58(3)(a)(v)**

Spill treatment equipment will be ready and available at storage sites (including mobile storage sites) and mixing and loading sites. It will include:

- personal protective equipment as recommended on product labels
- absorbent material, such as sawdust, sand, activated charcoal, vermiculite, dry coarse clay, kitty litter, or commercial absorbent
- neutralizing material, such as lime, chlorine bleach, or washing soda
- long handled broom, shovel, and waste-receiving container with lid
- approved spill response kit

A copy of an approved spill response plan will be available at each work site. All personnel working on a project involving herbicides must be familiar with its contents. If contractors working under this PMP have their own spill response plan, it must meet or exceed the contents of the BC Hydro plan.

Contractors will follow these procedures if a spill occurs:

- Ensure all personnel are wearing appropriate protective clothing and safety gear.
- Move persons exposed to a herbicide away from the place of the spill and keep them warm.
- Administer first aid if required.
- Stop the source of the spill, if possible.



- Create a dam or ridge to stop the spilled material from spreading.
- Stop operations until the spill is contained and the source is repaired.
- Spread absorbent material over the spill, if applicable, to absorb any liquid.
- Collect the absorbent material into garbage bags or containers with the contents clearly marked.
- Remove contaminated soil or other material from the spill site and place in garbage bags or containers.
- Contact the environmental coordinator at the BC Hydro Materials Management Business unit for shipping instructions and disposal requirements.
- If the spilled herbicide is released (or may be released) into the environment, immediately report it to the Provincial Emergency Program at 1-800-663-3456. If that is impractical, the local police or nearest RCMP detachment can be called.
- Notify an approved representative of the PMP holder as soon as possible about the details of the spill.

## Chapter 4 – Environmental Protection

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All vegetation management activities proposed for use within this PMP (both chemical and non-chemical) will incorporate measures designed to protect the environment, as described in this chapter:

- responsible herbicide application
- strategies to protect community watersheds, and other domestic and agricultural water sources
- strategies to protect fish and wildlife, riparian areas, and wildlife habitat
- strategies to prevent pesticide contamination of food intended for human consumption
- pre-treatment inspection procedures for identifying treatment area boundaries
- procedures for monitoring weather conditions and strategies for modifying pesticide application methods for different weather conditions
- procedures for maintaining and calibrating pesticide application equipment

The size of the pesticide-free zone (PFZ) and no-treatment zone (NTZ) that will be adhered to in this PMP are based on the standards contained in the *Integrated Pest Management Act and Regulation*.

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### 4.1, Responsible Herbicide Application

To protect the environment, BC Hydro ensures that the following conditions are adhered to for all application of herbicides under this PMP:

- Applicators must have current labels and Material Safety Data Sheets for the herbicide products they will be using.
- Applicators will inspect each site and plan application procedures before treatment begins.
- All herbicides are applied by or under the supervision of certified applicators using appropriate application and protective equipment.
- All herbicides are applied at the lowest possible application rate to ensure efficacy.

- 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 weed species, and minimize the degree of toxicity to non-target organisms, herbicide drift, bystander and worker exposure, and persistence in the environment.
- Herbicide use is restricted to periods that minimize human exposure and adverse impacts to 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.
- Applications are restricted to conditions where wind speeds do not exceed 8 km/h.
- Most applications of herbicide are not acceptable during rainfall.

**4.2,  
Protecting  
Community  
Watersheds,  
Section 58(3)(b)(i)**

BC Hydro protects community watersheds as follows:

- Locations of community watershed are verified by accessing the BC Hydro GIS Database, which is updated with government information every six months.
- Herbicides are not stored within a community watershed for more than 24 hours before use, and are removed within 7 days of use, unless they are stored in a permanent structure; No-treatment zones (NTZs) are maintained around all lakes and other water bodies consistent with those listed in Table 2.
- A 100m NTZ is maintained upslope from all licensed water intakes within the community watershed, except when failure to treat weeds could compromise public or worker safety. In these cases, NTZs are consistent with those listed in Table 2.
- Herbicide use is discontinued if herbicide residues or breakdown products are detected at a community watershed water intake. Further use is stopped until the BC Ministry of Health Services (Medical Health Officer) is satisfied that all required measures have been implemented to preserve water quality.

- Before using herbicides, community watershed maps are reviewed to determine if herbicide treatments are within a community watershed or are within 100m upslope of any water intake.

**4.3,  
Protecting Water  
Sources,  
Section 58(3)(b)(i)**

Table 2 lists the minimum no-treatment zones (NTZs) and pesticide-free zones (PFZs) that are followed to protect domestic and agricultural water sources, such as water intakes and wells.

In addition to these protection measures, BC Hydro will make efforts to identify and protect sources of groundwater before applying herbicides. All registered wells are displayed on the BC Hydro GIS Database, which is updated with government information every six months. In addition, contractors are required to survey the NTZ to determine if there are wells present.

**Table 2: NTZs and PFZs for Water Sources**

<b>All Pesticides*</b>	<b>Required Distance</b>
Domestic and agricultural wells and water	30 metre NTZ**
Any body of water or stream	10 metre PFZ
<b>Glyphosate Applications</b>	
A body of water or stream that is fish-bearing and not within an industrial site (as defined by <i>Integrated Pest Management Regulation</i> )	5 metre PFZ
A body of water or stream that is fish-bearing and within an industrial site (as defined by <i>Integrated Pest Management Regulation</i> )	2 metre PFZ***
A permanent body of water that is not fish-bearing at any time of the year	2 metre PFZ
Up to the high water mark of a temporary free-standing body of water that is not fish-bearing and does not drain directly into fish-bearing waters	0 metre PFZ
Dry streams that are not fish-bearing at any time of the year and do not drain directly into fish-bearing water, at any time of the year	0 metre PFZ

\* Aminopyralid will be applied as per label restrictions.

\*\* The 30m NTZ may be reduced if the contractor is reasonably satisfied that a smaller NTZ will ensure no herbicide enters the water supply, intake, or well.

\*\*\* PFZs may be reduced for noxious weed control according to the *Integrated Pest Management Act*, Sections 74 to 77.

**4.4,  
Protecting Fish,  
Wildlife,  
Habitat,  
Section 58(3)(b)(ii)**

In addition to the PFZs specified in Table 2, BC Hydro exercises caution when working with herbicides adjacent to riparian areas and water bodies. A riparian area is land adjacent to the banks of streams, lakes, and wetlands, and often includes belts of trees and shrubs that are needed to protect or buffer the water body.

BC Hydro follows the protocol agreement signed with the federal Department of Fisheries and Oceans (DFO) and the BC Ministry of Environment that describes procedures for working within 15m of a stream, pond, lake, or wetland. This protocol agreement is called the *Approved Work Practices for Riparian Vegetation Management (AWPRV)*.

A 15m NTZ is maintained around riparian features when cleaning or fueling application equipment and refilling herbicide-dispensing equipment.

Endangered wildlife species are protected under the federal *Species At Risk Act (SARA)*. BC Hydro is committed to avoiding and/or reducing the impacts on provincially and federally listed species at risk. If avoiding some impact is not possible, BC Hydro works with regulatory agencies and other stakeholders on recovery planning processes. The level of participation in recovery planning is determined by the degree of known impact that BC Hydro activities have on species at risk, including:

- the listing status of the species and other associated species
- the likelihood and extent of impacts incurred by other stakeholders
- consideration given to species of concern in existing BC Hydro, federal, or provincial processes
- public interest
- identifying specific species at risk as significant aspects in our environmental management system

**4.5,  
Preventing  
Contamination  
of Food,  
Section 58(3)(b)(iii)**

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 attempts to identify areas where there is food intended for human consumption (including berries). Appropriate precautions are taken during weed control operations to avoid contaminating these areas, such as timing applications after the berry-growing season, providing increased buffer zones during herbicide applications, or using alternative, non-chemical methods of control.

**4.6,  
Identifying  
Treatment  
Boundaries,  
Section 58(3)(b)(iv)**

To protect environmentally sensitive areas, BC Hydro records on maps any sensitive areas such as water bodies. These maps are supplied to the contractor and discussed at the pre-job conference. The contractor is instructed to inspect the site before work begins to verify presence of environmentally sensitive areas and flag areas as required. This may include the use of flagging tape to mark off the no-treatment zones and pesticide-free zones.

During the pre-job conference, all crew members are instructed in flagging requirements and precautions. They also review the methodology and procedures for applications and handling of the herbicide.

**Notification Signs**

As per Section 64 of the *Integrated Pest Management Regulation*, notification signs will be posted on land being treated with herbicides. The contractor is responsible for posting notification signs according to regulatory requirements.

Signs will be clearly visible and legible from each approach to the treatment area used by the public. All approaches from highways must be posted. Signs may not be removed for at least 14 days after the herbicides have been applied. Records will be kept on how public notification was given and where notices were posted.

**4.7,  
Weather  
Monitoring,  
Section 58(3)(b)(vi)**

Prior to, and periodically during herbicide applications, weather conditions are measured and recorded, including wind speed and direction, precipitation, temperature, and sky conditions. These are recorded only for foliar herbicide applications using backpacks, powerhose and handguns, and boom sprayers. For wipe on/wick applications, stem, bark and stump applications, only precipitation and temperature are recorded.

Herbicide applications are shut down if:

- the maximum temperature stated on the herbicide label is exceeded
- the wind speed and/or direction cause the application of herbicide to drift and/or miss the weeds
- it begins to rain, increasing the chances of excessive runoff and leaching

**4.8,  
Maintaining  
Herbicide  
Application,  
Equipment,  
Section 58(3)(b)(v)**

All herbicide application equipment used on BC Hydro property will be kept safe, clean, and in good repair. Equipment will be compatible and appropriate for the herbicide being used.

At a minimum, all sprayers will be calibrated once per year prior to use and at regular intervals throughout the season of use.

Personnel will follow these instructions:

- Ensure that equipment used meets with the approval of BC Hydro and meets all applicable regulatory requirements.
- Calibrate application equipment at the beginning of the treatment contract to conform to with the application rates on the pesticide label.
- Repeat calibrations:
  - after 25 hours of use with abrasive formulations (such as wettable powders)
  - when another product is used
  - if application rates are questionable
- Keep a record for each piece of calibrated application equipment showing when it was calibrated and the supporting data.
- Ensure that tools and equipment are in good working order and are properly cared for and stored.
- Replace tools that are prone to failure and carry spares.
- Implement a regular maintenance schedule on each piece of equipment.

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# Chapter 5 – Notification and Consultation

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BC Hydro is committed to providing proper notification and consultation with respect to herbicide use under this PMP.

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## 5.1, Notifications

BC Hydro will, within 7 days of the PMP confirmation date, make available to the public at its local offices a copy of the confirmation and the PMP, along with relevant maps. The PMP will also be available on the BC Hydro website.

BC Hydro will immediately report to the Administrator (BC Ministry of Environment) any violation of the *Integrated Pest Management Act and Regulations*, the PMP, or the PMP Pesticide Use Notice.

### ***Agency Notification***

In the first year of the PMP term, BC Hydro will provide written notification to each Regional Administrator of the *Integrated Pest Management Act* before starting the season's vegetation management work. In subsequent years, written notice will be provided two weeks before starting the season's work.

### ***Annual Notification of Intent to Treat***

For each year of the PMP term, BC Hydro will forward to the BC Ministry of Environment a written Annual Notification of Intent to Treat (NIT) for the following year. This NIT will identify which facilities are scheduled for treatment for vegetation management.

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## 5.2, First Nations Engagement

BC Hydro is committed to establishing and maintaining positive relationships with First Nations. BC Hydro engages with First Nations to avoid infringement on aboriginal rights, treaty rights, or cultural values during its vegetation management program. BC Hydro must also attempt to address First Nations concerns and accommodate their cultural interests.

### ***PMP Engagement***

BC Hydro's First Nations engagement plan/process for the Pest Management Plan is outlined below:



- Send a letter to all First Nations that have facilities on or adjacent to their reserve lands, inviting their input into the development of the draft PMP (enclose copy or web link).
- Follow up to ensure that the PMP has been reviewed, and comments, if any, are received.
- Maintain a summary of First Nations engagements, including the names and addresses of those First Nations that were invited to provide input, a description of any concerns or recommendations received (in particular if they related to potential for impacts outside of the facility on reserve lands), and BC Hydro's response.

***Annual Notification***

Once the PMP has been finalized and approved, annual notice of intent to treat (NIT) will be given for planned herbicide treatment in all areas identified during the engagement process as having potential for infringement on aboriginal rights, treaty rights, or cultural values, including areas on or adjacent to First Nations Federal Reserve lands.

BC Hydro will follow these procedures:

- Send a letter referencing the confirmed PMP, and that a facility site inspection has indicated that vegetation management is required. In the letter:
  - describe the methods to be used and why
  - request comments and any concerns
  - offer to meet upon request to review plans
- If treatment is required at facilities within Federal Reserve Lands, request permission to use herbicides, and stress the risks and liability associated with not treating the site to control problem weeds or hazard trees. If permission to treat is not received before the contractor needs access to the site, follow up with the Band Office to obtain permission.
- Follow up to ensure that the letter has been received and to record any concerns. Document all discussions.
- Carry out appropriate follow-up as required, such as sending out a final letter summarizing all previous correspondence and discussions.

# Glossary

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**conifers** — trees with cones.

**crushed rock** — a surfacing material similar to gravel that is used to cover facility areas that have zero tolerance for weeds. Crushed rock has a high level of electrical resistivity, which means it does not conduct electricity, thereby reducing the risk of electrocution over the ground grid.

**deciduous** — trees that lose their leaves during winter.

**evaluation** — a formal assessment carried out after weed control, to determine the effectiveness of the vegetation management program. It takes into account monitoring information, contract results, and SMP requirements. Evaluation results are used to revise SMPs.

**facility** — a well-defined site, owned or leased by BC Hydro, which typically has limited public access. Examples include substations, dams, and generating plants.

**geotextile** — a porous, polypropylene fabric that may be laid underneath a crushed rock surface, to prevent weeds from establishing.

**ground grid** — a grid of bare wires buried underneath substations that provides a common grounding system for electrical and metallic structures. It protects staff and the public from electrocution in case of a system fault, equipment failure, or lightning strike by limiting electrical potentials to safe levels, and it supports the proper operation of the electrical system by providing a low impedance path for fault currents.

**habitat** — a particular environment in which organisms live.

**hazard tree** — a tree that is defective, has an imminent potential to fail, and is likely to hit or damage a person or target (electrical equipment) when it falls.

**herbicide** — a pesticide used to control or manage weeds.

**injury threshold** — the point at which weed control becomes necessary, in order to minimize the risk of outages and optimize safety. It is generally expressed as a percentage of the total weed area that can be tolerated while still maintaining the integrity, security, and safety of the site. Any percentage weed cover above the established injury threshold requires a vegetation management action.

**integrated pest management (IPM)** — a decision-making process that uses a combination of techniques to suppress pests and that must include, but is not limited to, the following elements:

- planning and managing ecosystems to prevent organisms from becoming pests
- identifying potential pest problems
- monitoring populations of pests and beneficial organisms, pest damage, and environmental conditions
- using injury thresholds in making treatment decisions
- reducing pest populations to acceptable levels using strategies that may include a combination of biological, physical, mechanical, behavioral, and chemical controls
- evaluating the effectiveness of treatments

**Integrated Pest Management Act** — a provincial Act that regulates the use of pesticides, including the sale, purchase, use, handling, storage, disposal, and transportation of pesticides.

**integrated vegetation management** — the IPM process specifically for the control of weeds at BC Hydro facilities. The primary objectives are to ensure worker and public safety and system reliability.

**monitoring** — a visual assessment of facilities that provides a record of information about weed occurrence and density and site conditions. The percentage of the surface that is covered with identified weed species is estimated, and information recorded on Site Management Plans.

**no treatment zone** — a strip of land between the pesticide-free zone and the pesticide treatment area. Pesticides are not applied directly in the NTZ to prevent entry of pesticides or pesticide residues by drift, runoff, or leachate into the pesticide-free zone.

**non-residual herbicide** — a chemical that breaks down quickly in the soil and leaves little or no residue.

**non-selective herbicide** — a chemical that will effectively control a wide range of species.

**noxious weeds** — plants that are injurious to public health, crops, livestock, land, or other property, and which must be controlled under the BC *Weed Act*.

**pest** — any undesirable organism that should be controlled to ensure the safety and integrity of operating systems. For BC Hydro facilities, this means weeds.

**pesticide** — under the *Integrated Pest Management Act*, any substance or mixture of substances, other than a device, intended for killing, controlling, or managing insects, rodents, fungi, weeds, and other forms of plant or animal life that are considered pests.

**pesticide-free zone** — a strip of land adjacent to bodies of water. Herbicides may not be directly applied to, or allowed to reach the pesticide-

free zone via drift, runoff, or leachate. Specific authorization is needed if the pesticide-free zone is to be less than 10m.

**Pest Management Plan (PMP)** — a legally-binding plan that describes a program for controlling pests or reducing pest damage using integrated pest management, and the methods of handling, preparing, mixing, applying, and otherwise using pesticides within the program. The PMP is the authorization required to use pesticides at BC Hydro-owned or leased property in BC.

**pre-emergent herbicide** — a chemical that controls weed seeds and sprouts before they leave the ground. These are generally residual herbicides.

**post-emergent herbicide** — a chemical that is used directly on growing foliage or plant stems. These can be either residual or non-residual herbicides.

**residual herbicide** — a chemical that tends to persist in the soil for a certain period of time.

**re-sprouting** — the growth of new stems on deciduous trees that have been injured or where manual or mechanical control methods have been applied.

**riparian** — the area of land adjacent to a water body that contains vegetation that is distinctly different from the vegetation of adjacent upland areas due to the presence of water.

**riparian habitat** — vegetation growing close to a water body that is generally critical for wildlife cover, fish food organisms, stream nutrients, and large organic debris, and for streambank stability.

**selective herbicide** — a chemical that is designed to effectively control specific species and not others.

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

**species** — a group of living organisms which are similar in structure and physiology and are capable of producing fertile offspring.

**water body** — any river, stream, creek, lake, pond, marsh, slough, ocean, sea, strait, inlet, bay, or ditch. Also, any temporary or seasonal water body that currently contains water, and any accumulation of water that may discharge into fish-bearing waters.

**weeds** — any undesirable plant, including grass, brush, trees, noxious weeds, or other vegetation.