BC Hydro
Secured Facilities
Pest Management Plan

For Control of Weeds

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BC hydro

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British Columbia Hydro & Power Authority
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Acknowledgements / Signing Authority:

This document is the responsibility of BC Hydro's vegetation management program**:**

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Notice: Both federal and provincial legislation contain information required and pertinent to this *BC Hydro Secured Facilities Pest Management Plan for Control of Weeds*. As well, many other individuals, organizations, companies, and vegetation experts have cooperated in providing information and sources for this PMP document. This document is essentially a set of best practices and guidelines compiled from knowledgeable and experienced industry and government personnel. It is intended to provide the owner, operator, and contractors with advice regarding the specific topic. The recommendations set out in this PMP are meant to allow flexibility and must be used in conjunction with competent IPM practices and judgment. It remains the responsibility of the user of the PMP to judge its suitability for a particular application. If there is any inconsistency or conflict between any of the recommended practices contained in the IVMP and the applicable legislation requirements, the legislative requirements shall prevail. Every effort has been made to ensure the accuracy and reliability of the data and recommendations contained in the PMP.

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Chapter 1, Introduction to Secured Facilities Pest Management Plan

This document is a Pest Management Plan for the management of weeds within secured facilities operated by BC Hydro & Power Authority. It has been prepared as per the *Integrated Pest Management Act* (the "Act") and Section 58 of the *Integrated Pest Management Regulation* (the "Regulation"). (Note the Regulation subsection references in major headings). The plan is valid from December 2010 to December 2015.

About This PMP

BC Hydro's Secured Facilities Pest Management Plan (PMP) describes:

- the program for controlling weeds within secured facility compounds, using the principles of integrated vegetation management (IVM)
- the process for planning, selecting, using, and evaluating control methods within that program
- the methods for handling, preparing, mixing, applying, and otherwise using herbicides within that program

This PMP is intended to be used by BC Hydro, its agents, and its contractors to conduct weed control programs at all secured facilities.

For the purpose of this PMP, secured facilities mean electrical sites such as substations, communications sites such as microwaves, and sites used for storage of equipment and woodpoles. These facilities consist of structures and buildings usually within a fenced area that has no public access.

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

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

Tom Wells Transmission Vegetation Program Manager 604-699-7406

Geographic Boundaries, Section 58(1)(a)

A BC Hydro secured facility consists of a compound that has no public access and which contains assets that support the generation, transmission, and distribution of electricity. The geographic boundaries of this PMP include the entire province of British Columbia, as BC Hydro manages hundreds of secured facilities throughout the province.

The following are common secured facility types to which this PMP will apply:

- electrical facilities (mostly substations and switchyards)
- communications facilities, mostly microwave sites

A complete list of the specific facilities to which this PMP applies is contained in Appendix 1. Two maps of BC showing the location of most facilities are contained in Appendix 2 (one is a link to a map of electrical facilities, and the other is a map of the communications facilities).

This PMP does **not** cover the management of vegetation in generation facilities outside of switchyards, such as dams, reservoirs, and recreation sites; the management of vegetation on distribution corridors and transmission rights-of-way; or the use of wood preservatives in the Woodpole Test & Treat Program.

Electrical Facilities

All electrical facilities are surrounded by fences to ensure no public access. Contact with high voltage equipment is extremely hazardous and will cause serious injury or death.

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

Switchyards — facilities that receive low-voltage electricity from a generation facility and increase the voltage to an appropriate level for long-distance transmission.

Capacitor stations — sites with equipment that controls system voltage.

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

Communication Facilities

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

Importance of Weed Control

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

For these reasons, buried underneath each 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. It also supports the proper operation of the electrical system by providing a low impedance path for fault currents.

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

Vegetation must also be controlled because it can:

- become a fire hazard or contribute to fires as a fuel source
- lead to power outages by interfering with electrical components
- cover or hide fences, increasing the risk of unauthorized entry and theft
- lead to corrosion of steel equipment
- increase risk of tripping and slipping
- interfere with equipment access and safety inspections
- serve as food and shelter for rodents, ants, termites, and other pests
- degrade appearance of site

Areas outside the facility fence must also be kept clear of all vegetation. For example, nearby trees that act as a fuel source for fire, fall into and damage the site, or drop debris onto the equipment, must be removed.

At communications facilities, trees and tall-growing vegetation can disrupt transmission of microwave and radio signals, and become energized during lightning strikes. Trees that could fall onto the site and damage equipment must be removed. Finally, BC Hydro has a program to remove vegetation that could serve as a fuel source to protect the site from forest fires.

In addition to these safety concerns, the provincial *Weed Control Act* requires the control of noxious weeds, which are any plants that pose a threat to

people, animals, or crops, as designated by the *Weed Control Act Regulation.* The Act requires occupiers of land to control noxious weeds in accordance with the Regulation.

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

Definitions

Integrated pest management (IPM) means a process for managing pest populations that includes the following elements:

(a) planning and managing ecosystems to prevent organisms from becoming pests

(b) identifying pest problems and potential pest problems

(c) monitoring populations of pests and beneficial organisms, damage caused by pests and environmental conditions

(d) using injury thresholds in making treatment decisions

(e) suppressing pest populations to acceptable levels using strategies based on considerations of:

(i) biological, physical, cultural, mechanical, behavioural and chemical controls in appropriate combinations

(ii) environmental and human health protection

(f) evaluating the effectiveness of pest management treatments

A **Pest** is an injurious, noxious, or troublesome living organism, but does not include a virus, bacteria, fungus, or internal parasite that exists on or in humans or animals. For BC Hydro secured facilities, this means undesired vegetation, mostly weeds.

Integrated vegetation management (IVM) is the IPM process specifically for the control of vegetation.

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

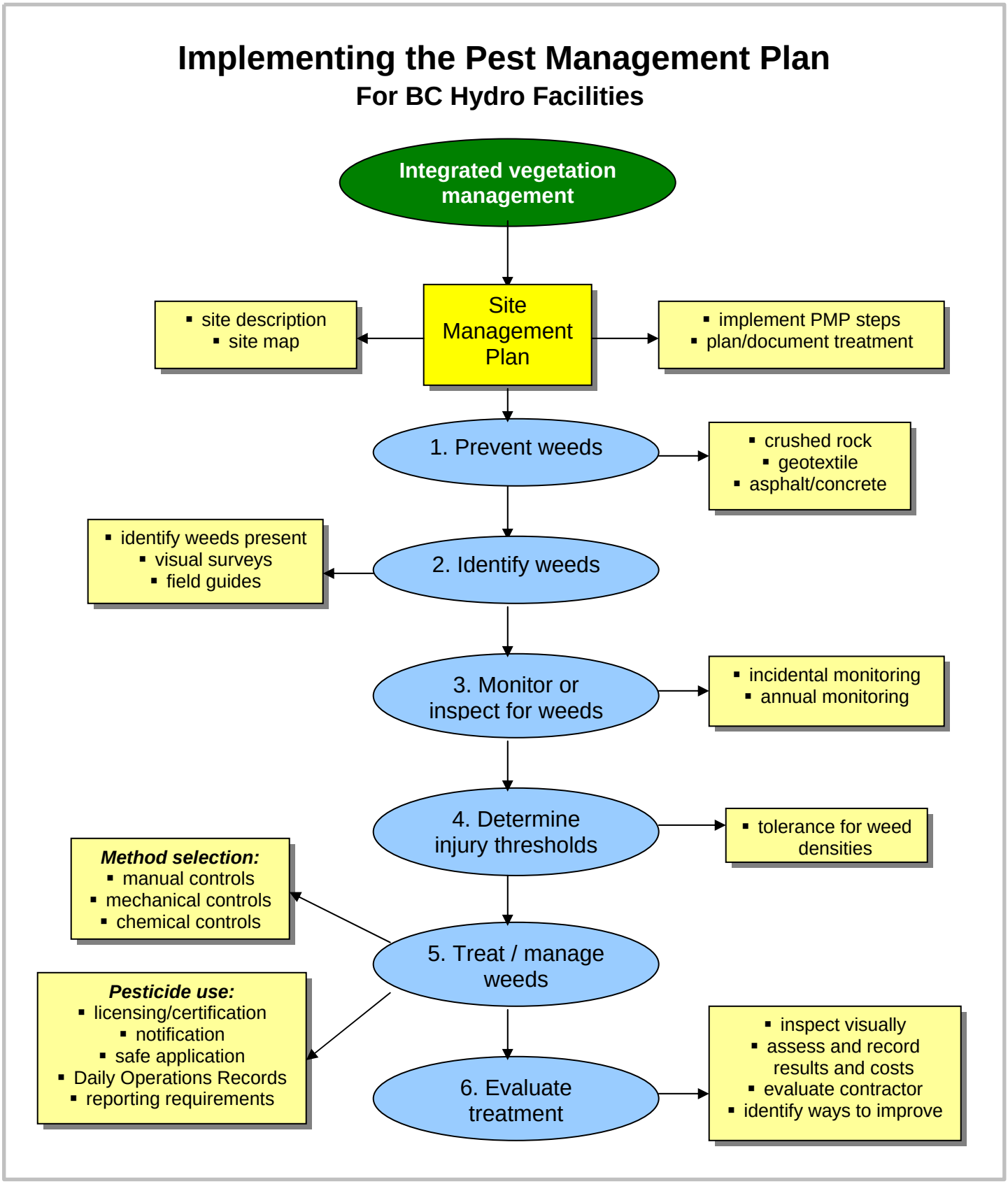
Chapter 2, Elements of Integrated Vegetation Management

This chapter describes BC Hydro's program for control of weeds at secured facilities, as per Section 58 of the *Regulation*, which describes information required for the PMP.

The steps for integrated vegetation management include:

- prevention — 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 — Section 58(2)(e)
- evaluation of treatment — Section 58(2)(f)

This chapter also describes the herbicides that may be used at facilities, how they are applied, and the type of equipment required to apply each, as per Section 58(3)(c) of the *Regulation*.


Implementing the Pest Management Plan
For BC Hydro Facilities
Integrated vegetation management
Site Management Plan
site description
site map
implement PMP steps
plan/document treatment
1. Prevent weeds
crushed rock
geotextile
asphalt/concrete
identify weeds present
visual surveys
field guides
2. Identify weeds
3. Monitor or inspect for weeds
incidental monitoring
annual monitoring
4. Determine injury thresholds
tolerance for weed densities
Method selection:
manual controls
mechanical controls
chemical controls
5. Treat / manage weeds
Pesticide use:
licensing/certification
notification
safe application
Daily Operations Records
reporting requirements
6. Evaluate treatment
inspect visually
assess and record results and costs
evaluate contractor
identify ways to improve

Prevention, Section 58(2)(a)

Vegetation management at BC Hydro facilities depends primarily on preventive measures that are aimed at stopping the initial growth and spread of weeds. Preventive measures are an important part of integrated pest management because they significantly reduce the need for weed control.

Crushed Rock

The most effective way to prevent the establishment of weeds is to maintain a layer of clean, crushed rock to engineered standards, around areas that have zero tolerance for weeds:

- The crushed rock must completely cover the site, since any areas of exposed mineral soil will serve as sources for weed infestation.
- The rocks must be about 4 to 20mm in size, evenly graded, layered to a depth of 15cm, and fractured on at least two faces. Round rocks reduce drivability.
- The crushed rock must be free from sand, silt, clay, and organic matter.
- The crushed rock surfaces should extend 2 metres outside the facility fenceline to maintain an even layer over the grounding grid, which extends 1.5m outside the fenceline.

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

- impedes vegetation from establishing
- finished, aesthetically pleasing surface
- rapid drainage
- low cost and readily available
- non-flammable and helps to control oil fires in areas around oil-filled equipment
- reduces the spread of oil from a spill, unlike a paved surface where the oil would rapidly spread
- provides a suitable surface for the movement of equipment and vehicles
- controls dust

Over time, the resistivity and effectiveness of crushed rock surfaces will be reduced due to construction activity, traffic, and organic matter build-up that encourages establishment of weeds. BC Hydro has a program to assess sites for condition of the crushed rock and add new material when it is required. In addition, sites may be scheduled for spreader grader work, a process that cleans the existing crushed rock surface layer. All organic matter, including plants, soil, seeds, leaves, and twigs are removed.

Spreader Grader

A spreader grader is a unique tractor-pulled device that tumbles crushed rock and other aggregates. It works by inverting the top layer of crushed rock (contaminated with organic matter) with the cleaner rock just underneath it, similar to how a soil tiller works. This effectively controls any vegetation or weeds that were established on the top layer, and can result in improved control over the long-term.

The spreader grader is effective on large to medium flat areas accessible by tractor. It has some limitations under some electrical equipment or in compact areas.

Crushed Rock Over Geotextile

In areas where there is limited vehicle traffic and away from oil-filled transformers, the effectiveness of crushed rock for excluding weeds can be enhanced with a geotextile layer. Geotextile is a porous sheeting that is laid underneath the crushed rock, or staked to the soil surface in areas without crushed rock.

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

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

Asphalt and Concrete

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

The benefits and limitations of asphalt and concrete include:

- Asphalt is highly weed-resistant and makes an excellent driving surface. It has high resistivity, only slightly less than crushed rock.
- The use of recycled asphalt fits in well with BC Hydro's waste management strategy.
- Both concrete and asphalt cost more than crushed rock.
- They cannot be used around oil-filled equipment because they will cause oil to spread in the event of a spill.
- They provide no drainage.

- Underground work is difficult to carry out.
- Concrete conducts electricity more readily than crushed rock.
- Asphalt will burn at high temperatures.

Grass Seeding

Grass seeding is the manual planting of turf or agricultural grasses, or 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 large undeveloped sites or disturbed areas within the facility, or around the fenceline in areas managed by BC Hydro. Required equipment may include cyclone spreaders, belly grinders, seed drills, and hydro-seeding machines.

The benefits and limitations of grass-seeding are:

- It must be mowed regularly to remove seed heads that will allow the spread of broadleaf weeds. BC Hydro tries to use low-maintenance, slow-growing grasses and legumes.
- It provides good drainage, and is fairly inexpensive to install.
- It prevents erosion.
- It promotes aesthetics.
- The seeded area may have to be irrigated to establish and maintain it.
- There may be safety concerns using equipment around electrical wires and equipment.
- In wetter climates, there are problems with driveability.
- Its ability to exclude weed species is inferior to that of most other methods, especially crushed rock or geotextile.

Managing Surrounding Area

BC Hydro tries to manage the surrounding area to prevent weeds from entering the facility. Therefore, this PMP also covers the removal of hazard trees and the treatment of rapidly spreading weeds that may become established adjacent to the facility.

For example, managing the surrounding area can be done by:

- Landscaping with plants that don't spread rapidly, such as heather or juniper, and ensuring that landscaped areas are kept free of weeds.

Plants that spread by suckering or underground rhizomes or vines, and plants with airborne seeds are generally avoided.

- Maintaining the 2m crushed rock strip covering the ground grid on the outside of the fenceline around most electrical facilities to reduce the spread of weeds inside the facility, especially rapidly spreading species such as blackberry, horsetail, broom, and groundsel.
- Establishing physical barriers, such as solid fences to reduce windborne seeds from entering the site.
- Removing trees growing close enough to the fenceline to drop debris inside the site, especially deciduous species. (Landscape plans specify appropriate tree planting distances from the fenceline.)
- Noting and recommending for removal any hazard trees (defective trees that may fall into the site), or storm-damaged or vandalized trees and shrubs. Herbicides may be applied to the stumps to prevent resprouting.
- Slashing away any branches that overhang into the site.
- Where appropriate, promoting complimentary usage to remove and maintain vegetation, as well as provide the adjacent community with an opportunity to make use of the surrounding area.
- Where feasible, mowing areas around the site to prevent windborne seeds from entering the site.
- Cleaning off any vines or climbing plants from the fence.

Identification, Section 58(2)(b)

Within facilities, all weeds must be controlled. However, accurate identification of weeds present at a facility is necessary because control methods vary depending on the species. For example, the most effective treatment for grass will be different than that for Canada thistle. In addition, certain weed species require specialized herbicide mixtures, which must be planned ahead.

BC Hydro has trained vegetation specialists located around the province with experience in weed management. There are also qualified plant taxonomists on staff. 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. BC Hydro staff and contractors also use field guides to help them identify weeds.

Weed Identification Procedures

For each facility, weed identification procedures include:

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

Weed identification procedures include determining the percentage of weed cover inside the site, and the relative abundance of problem vegetation just outside the site. In addition, the composition of broadleaf versus grasses is estimated.

A list of the common and significant weed species at each site is scheduled to be updated and included in the Site Management Plan (SMP) every five years (which contains detailed information on a particular site, such as its history, vegetation coverage, and environmental concerns).

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

Noxious Weeds

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

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

Monitoring, Section 58(2)(c)

For most electrical facilities, a detailed Site Management Plan (SMP) is prepared. The purpose of a SMP is to identify:

- all site information required for effective integrated vegetation management planning
- current conditions, including surfacing materials and list of weed species inside and outside the facilities

- preventive measures that can be taken
- existing and proposed integrated pest management activities
- environmentally-sensitive areas in and around the site
- public concerns

SMPs also generally include a comprehensive site map.

SMP's will be prepared in advance for major sites, including all substations, and any other critical or large facility. SMPs may be developed for smaller and lower priority sites on an as needed basis, or as time allows, but before any herbicide treatment begins. SMPs will be updated as a result of evaluations.

Monitoring of facilities provides a record of information about weed occurrence and density, and site conditions. SMPs will include information on 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 will be 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.

Monitoring of facilities includes:

- mapping weed occurrence and density and site conditions
- ensuring injury threshold for the acceptable number of weeds are not exceeded
- establishing the best timing for corrective action
- choosing the treatment techniques
- identifying any changes in site and vegetation condition
- identifying species requiring special treatment

All electrical facilities in the province are visited twice a year by weed control crews. Communications facilities are visited less frequently. In addition, sites are also visited periodically by technical staff to conduct a detailed review and update the Site Management Plan and maps.

Monitoring is done visually and documented. Weed control crews are provided with a map of the facility and required to sketch or note on the map:

- areas where weeds are present
- a visual estimate of the total percentage cover for the site
- major species present
- any species that require special treatment such as horsetail

- areas where the crushed rock is becoming too thin or contaminated with organic matter
- hazard trees that pose a threat or large limbs overhanging the fencline
- any recommended changes to pesticide-free zones or residual-free zones
- changes to the layout of the facility due to construction
- provincially or regionally-designated noxious weeds in or around the facility

The contractor should also recommend updates to the Site Management Plan as appropriate.

Injury Thresholds, Section 58(2)(d)

An injury threshold, also called a hazard level, is the point at which treatment for a particular pest is required. The injury threshold for vegetation is the amount of weed coverage, expressed as a percentage of the treatment area, which can be tolerated at a particular site. Anything above the designated injury threshold requires control.

Weeds must not be allowed to exceed the established injury thresholds to ensure safety, system security, and structural integrity. Vegetation management work is more critical for some facilities than others, so the injury threshold for particular weeds may vary for each facility. Injury thresholds for each major type of facility are listed on the following pages (as a percentage of total weed cover, in bold typeface).

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*.

Electrical Facilities

Electrical facilities include substations, switchyards, capacitor stations, and cable termination sites. They can be subdivided into several areas. The acceptable level of weeds in these areas is as follows.

Within Electrical Compounds

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

Maintain a weed-free environment to ensure worker and public safety, site security, aesthetic quality, and a reliable electrical supply. Vegetation control is considered successful when the following areas are weed-free:

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

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

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

Just Inside or Outside Fencelines

For safety reasons, the ground grid often extends beyond the fenceline for 2m. (These areas are surfaced with crushed rock.) Therefore, requirements for vegetation control are the same as those inside electrical compounds. Weed densities will not be allowed to exceed **5%** of the 2m area inside and outside of the fenceline.

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

Designated Roadways

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

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

Undeveloped Areas and Yards

Weeds established in undeveloped areas and yards inside the electrical facility, where there are no buildings or equipment, can rapidly spread to adjacent electrical compounds. Even though electrical hazards are not as

high, BC Hydro cannot leave weed populations unchecked. Control is initiated to ensure that weed levels never reach **10%** density.

Managing Surrounding Area

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

Communications Facilities

Communications facilities managed by BC Hydro include microwave facilities. Trees and tall-growing vegetation can disrupt transmission of microwave and radio signals. Any vegetation that may interfere with the proper functioning of these sites must be controlled. In addition, vegetation that could create a fire risk or become energized during lightning strikes should be cut down.

Method Selection, Section 58(2)(e)

BC Hydro uses a variety of treatment methods that may differ depending on the type of vegetation to be controlled. The best method will be chosen by considering the type and density of weeds, the physical locations of the target weeds, and the control objectives.

Timing

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

IVM Decision-Making Flowchart

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

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

Residual Herbicide Use

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

absorbed by plant roots. Residual herbicides are prescribed only for sites that pass soil assessments (to ensure that the soil will hold the herbicide) and site sensitivity assessments (to ensure that waterbodies are not contaminated).

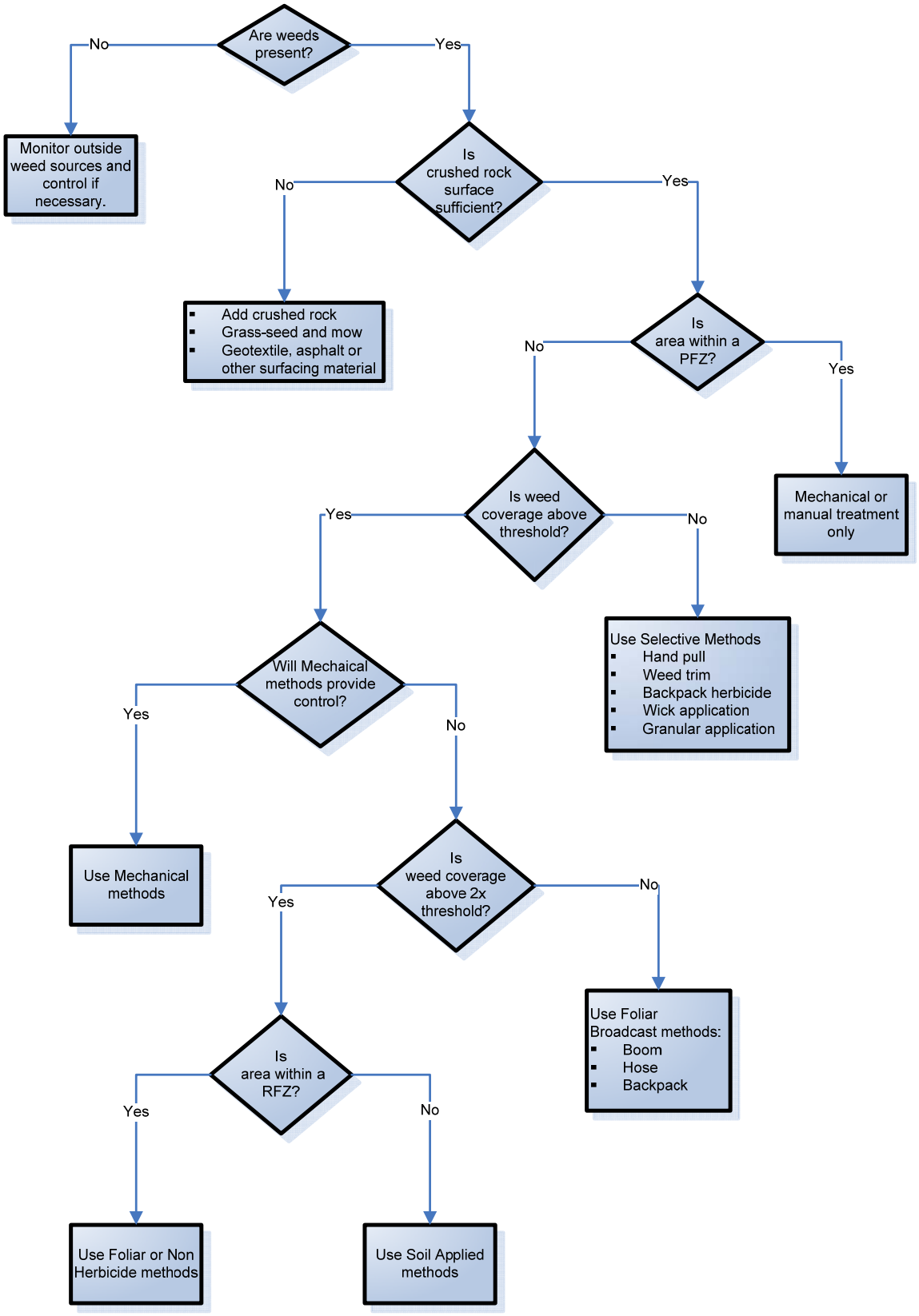
- Residual herbicides are recommended if weeds exceed two times the injury threshold.
- The same residual herbicides will only be used on the same land once per year.

Non-residual Herbicide Use

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

- If weeds are less than two times the injury threshold, a combination of manual or mechanical methods and spot treatment with a non-residual herbicide will be used.
- It may be necessary to use a species-specific herbicide product for difficult to control species such as knapweed or horsetail.
- Non-residual herbicides must not be applied more than three times on the same area in a year.

Decision-Making Flowchart for BC Hydro Facilities Vegetation Management



Manual and Mechanical Methods, Section 58(2)(e)

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

- mowing
- weed trimming
- raking
- hand-pulling
- slashing (manual tree removal)
- girdling

Weeds just outside the facility must be controlled to prevent them from spreading into the site and to protect the ground grid if it extends outside the fenceline.

Mowing

Mowing can be used in undeveloped areas within facilities, especially if they are not covered in crushed rock.

Where feasible, areas around the site are mowed to reduce the spread of windborne seeds into the site. Commercial lawnmowers, garden tractors, or industrial tractors with rotary or flail cutters will be used.

Mowing has the following benefits and limitations:

- Mowing helps control weeds before they go to seed, thereby reducing spread into areas where there is low weed tolerance.
- Mowing promotes aesthetics.
- Mowing is economical, but requires repeated treatments.
- There are some safety risks due to flying debris.

Weed Trimming

Weed trimming removes weeds using power tools such as weed trimmers. Trimming removes seed heads and is a useful method when immediate action is needed. It works best on annuals. It is not useful on species that propagate from stem pieces, and it does not remove roots.

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

The benefits and limitations of weed trimming include:

- It is convenient and economical.

- Flying rocks and debris propelled by the spinning thread or blade may damage windows and equipment.
- It can be a safety hazard to the operator and other staff.

Hand-Pulling

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

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

However, 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.

This method is only recommended for larger, established weeds that can be easily uprooted, such as tree seedlings and broom. Also, it is only effective if there are few weeds on the site (100 or less.) Weed seedlings and grass species are too small and numerous to hand-remove.

The benefits of hand-pulling are:

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

The limitations of hand-pulling are:

- roots regenerate because many species snap off at ground line
- degrades the crushed rock surface and increases organic matter
- exposes soil and seeds
- safety risks to weed-pullers where weeds are in contact with the ground grid
- labour-intensive and costly

Slashing (Manual Tree Removal)

Trees may need to be removed if they are unhealthy and could fall into the facility, causing damage, or if they pose a hazard to nearby electrical equipment. In addition, all tall-growing species that could grow within limits of

approach to powerlines crossing the site must be removed. Trees that could interfere with microwave signals must be removed. Branches hanging over the fenceline that will drop debris into the site will be pruned.

Hazardous trees outside BC Hydro property will be removed only after BC Hydro explains to the owner of the property the hazard of the trees to the safe operation and security of the station. Trees may also be removed to reduce the fire hazard.

Required equipment includes chain saws, circular brush saws, and axes.

The benefits and limitations of slashing are:

- selective (only cuts undesirable species)
- assures electrical safety requirements
- expensive and labour intensive
- deciduous stumps must be removed, ground down, covered, or treated with herbicide to prevent resprouting
- chainsaws, 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 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.

Benefits and limitations of girdling are:

- effective on susceptible tree species with a diameter greater than 5cm
- tools are inexpensive, durable, relatively safe, easy to use, and quiet
- prevents coppicing and sucker growth
- 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
- slow, as trees will continue growing for up to two years
- fast-growing trees may resprout
- possible safety issue if girdled trees are large
- aesthetics negative from dead standing trees

Approved Herbicides and Equipment, Section 58(3)(c)

BC Hydro staff and contractors will only use the approved herbicides described in this section for weed control at secured facilities. Most herbicide use occurs inside the facility; however, any vegetation that may interfere with the proper functioning of facilities must be controlled, whether inside or outside the fenceline.

To control weeds, the selection of herbicides and the timing of their use varies by region.

Benefits and Limitations of Herbicides

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

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

The herbicides that BC Hydro uses were chosen on the basis of highest effectiveness and selectivity, the lowest hazard to health and the environment, and the lowest impact on non-target species. BC Hydro does not use any high-toxicity herbicides. Other benefits and limitations of herbicide use are listed under the various herbicide application methods later in this PMP.

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

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

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

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

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

Research Into Alternative Methods

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

- burning weeds with a torch (does not kill roots, and risk of fire too high for use around electrical equipment and oil-filled equipment)
- steaming weeds or spraying hot water over weeds (only controls shallow-rooted annuals, not deep-rooted weeds or perennials; requires a lot of water, which many facilities do not have; hot water machines have also proven unreliable and expensive)
- mycoherbicides (limited effect; works well on alder species and some aspen, but not on birch and maple)
- infrared light to control seeds and weeds (does not control roots; very expensive)

Herbicide Lists and Tables

BC Hydro will use the following herbicides at secured facilities:

- 2,4-D (2)
- aminopyralid (A)
- chondrostereum purpureum (C)
- dicamba (Di)
- dichlorprop/2,4-D (D2)
- diuron (D)
- flumioxazin (F)
- glyphosate (G)
- imazapyr (I)
- metsulfuron methyl (M)
- metsulfuron methyl/aminopyralid (Ma)
- picloram (P)
- triclopyr (T)

2,4-D (2)

Brand names: 2,4-D Amine 600, 2,4-D Ester 700, or equivalent.

2, 4-D Amine 600 is a phenoxyacetic compound (hormone compound) that is selective depending upon rate and species. It is formulated to rapidly

penetrate the waxy covering of plants. It is of low toxicity to humans and animals. Phenoxyacetic herbicides all have a short soil persistence period.

2, 4-D Ester 700 is an etheyl hexyl ester compound (hormone compound) that is selective depending upon rate and species. It is formulated to rapidly penetrate the waxy covering of plants. It is of low toxicity to humans and animals; however, waterbodies should always be protected. The most common application is foliar, and for best results should be applied when plants have rapid growth, likely May/June and September. Etheyl hexyl ester herbicides have a short soil persistence period.

Aminopyralid (A)

Brand names: Milestone, Aminopyralid, or equivalent.

The active ingredient (aminopyralid) is a selective, post-emergent herbicide that controls a broad spectrum of broadleaf weeds including Canada thistle, knapweeds, oxeye daisy, scentless chamomile, and many others. This herbicide is mildly residual, and uses reduced application rates so to ensure a reduced herbicide load on the environment.

Chondrostereum purpureum (C)

Brand names: Chontrol or equivalent.

This naturally-occurring fungus can be used as a biological control agent. It will only attack deciduous trees and provides best results on alder. Cut stump applications are done by applying the product shortly after the stumps have been cut, and the method is best used in September to October. This product is a fungus organism that slows or stops the re-growth or suckering of targeted plants. The product must be used within two months of manufacturing.

Dicamba (Di)

Brand names: Vanquish or equivalent.

The active ingredient (dicamba) is a selective, post-emergent herbicide generally used to control herbaceous broadleaf invasive plants. However, it is also used for some brush species. It has low to moderate soil residual activity and provides a wide spectrum of broadleaf control on industrial and range lands as it does not affect established grasses.

Dichlorprop/2,4-D (D2)

Brand names: Desormone or equivalent.

The active ingredients in this herbicide are dichlorprop and 2, 4-D. Desormone is a somewhat selective, post-emergent herbicide specifically

used to control woody brush species and some herbaceous broadleaf invasive plants. It has low to moderate soil residual activity and provides a wide spectrum of broadleaf control on industrial sites using a broadcast foliar or basal bark application. It can be mixed with water or oil base products for application.

Diuron (D)

Brand names: Karmex DF, Karmex XP, or equivalent.

The active ingredient Diuron is used as a soil sterilant at higher rates. At lower rates, it is used as a selective, pre-emergent herbicide of seedling weeds and grasses in alfalfa, in some cane bushes such as grapes and blueberries, and some bulb crops such as daffodils. Dandelions are resistant. It works by upsetting photosynthesis within the plant. Diuron requires moisture to move the chemical into the root zone. It is noncorrosive and nonflammable.

Flumioxazin (F)

Brand names: Payload or equivalent.

This herbicide can be used for non-crop selective vegetation control to maintain bare ground areas that must be kept weed free. Its water dispersible granule provides broad spectrum control and can provide season long control on industrial sites. Flumioxazin provides residual control of weeds such as ragweed, dandelion, green foxtail, lamb's-quarters, and various nightshade plant species. This is a low rate, pre-emergent herbicide and provides a new weed resistance alternative for vegetation managers due to its mode of action and class. Flumioxazin can be tank-mixed with glyphosate products.

Glyphosate (G)

Brand names: Roundup, Transorb, HC, Roundup WeatherMAX, Vantage, Vantage Plus Max II, or equivalent.

The active ingredient (glyphosate) is effective for controlling a broad spectrum of weeds such as grasses, broadleaf plants, and re-sprouts of certain deciduous tree species. Effectiveness on tolerant species depends on the rate and timing of application. Glyphosate is applied to the foliage of target weeds and absorbed and translocated up and down the vascular system of the plant. Glyphosate has no or very little residual activity in the soil. It binds tightly to all types of soils independent of the levels of organic matter, silt, clay, and soil pH.

Imazapyr (I)

Brand names: Arsenal or equivalent.

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

The active ingredient (imazapyr) is used to control most broadleaf weeds and annual and perennial grasses. It is applied post-emergence once the plants have had time to sprout. This herbicide is translocated throughout the plant and plant growth stops almost immediately after application. Arsenal is moderately residual and can usually provide season long control on many perennial plants.

Metsulfuron methyl (M)

Brand names: Escort or equivalent.

The active ingredient (metsulfuron methyl) is used to control broadleaf weeds, trees, and brush, and some annual grasses. It stops cell division in the shoots and roots of the plant, causing plants to die. It is applied pro- and post-emergence (before and after growth begins). The herbicide has low to very low toxicity to humans and animals.

Metsulfuron methyl/aminopyralid (Ma)

Brand names: ClearView or equivalent.

The active ingredients (aminopyralid and metsulfuron methyl) combine to create a selective, post-emergent herbicide that controls a broad spectrum of broadleaf annual and perennial weeds including Canada thistle, knapweed, oxeye daisy, scentless chamomile, and many others. This herbicide can be applied for 12-24 months of good control, and uses reduced application rates to ensure a reduced herbicide load on the environment.

Picloram (P)

Brand names: Tordon 22K or equivalent.

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

Triclopyr (T)

Brand names: Garlon Ultra, Garlon RTU, or equivalent.

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

Garlon Ultra can be applied via foliar and basal bark applications, while *Garlon RTU* has a new formulation with lower active ingredient and is generally used for basal bark and cut stump applications only.

Table 1: Herbicides, Methods, and Equipment for Weeds

	Application Method	
Equipment	**Soil-applied**	**Foliar-applied**
Powerhose	**D F I P**	**2 A Di D2 G I M Ma P T**
Mechanized boom	**D F I P**	**2 A Di D2 G I M Ma P T**
Backpack	**D F I P**	**2 A Di D2 G I M Ma P T**
Wick application		**2 D2 G Ma P T**
Granular applicator	**F**	

Table 2: Herbicides, Methods, and Equipment for Trees

Equipment	**Application Method**			
	Cut Surface	**Basal**	**Foliar**	**Injection techniques**
Backpack	**C G T**	**T**	**A C G I M T**	
Squirt bottle	**C G T**			**C G T**
Injection tools				**G**
Brush saw with herbicide	**C G T**			

Herbicide Application Equipment

The following equipment is used to apply herbicides:

- backpack

- mechanized boom sprayer
- powerhose
- wick applicator
- squirt bottle
- injection tools
- brush saw with herbicide
- granular applicator

Backpack

A backpack is a portable, manually operated, pressurized container with a nozzle for spraying herbicides. Directed spray from a backpack unit will selectively control targeted weeds. Backpack spray is effective on established, low-density species, tree seedlings, and noxious weeds.

Mechanized 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.

Powerhose

A hand-held spraygun and hose attached to a portable tank with a motorized pump system filled with herbicide will selectively control a variety of vegetation with directed spray. Sprayguns are efficient for larger scale applications, and can be used for the application of all herbicide liquid mixtures.

Wick Applicator

Wick applicators are used to selectively apply herbicide by wiping it directly onto plants. Wicks are made of rope or absorbent pads. Wipe-on wick application is ideal for areas where no spray drift can be tolerated.

Squirt Bottle / Injection Tools

A squirt bottle is a hand-held, non-pressurized container. Some may have a trigger pump sprayer. Injection tools may be a battery-powered drill or automatic lance that is used to inject capsules of herbicide into stems.

Brush Saw with Herbicide-

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

Granular Applicator

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

Herbicide Techniques, Section 58(2)(e)

Herbaceous plants, grasses, tree seedlings, and mosses or liverworts and woody weeds both inside and outside facilities are controlled using soil-applied and foliar-applied herbicide methods. Both coniferous and deciduous trees must also be removed from around electrical facilities.

Soil-applied Techniques

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

Residual herbicides are usually applied in areas that have no tolerance for weeds, i.e., in and around electrical equipment, using either a powerhose, backpack spray equipment and wand, or a fixed boom sprayer mounted on ATV-type equipment.

The benefits and limitations of soil-applied techniques include:

- highly effective for preventive control of certain species
- reduces treatment interventions required to control prolific seeding species
- risk of spray drift and increased volatilization due to higher volume of mixture being applied
- buffer zones may be required to protect pesticide-free zones
- more labour and cost efficient in larger scale operations
- specialized equipment may be required

Foliar-applied Techniques for Weeds

In foliar applications, a non-residual herbicide is diluted (usually with water) at the ratio recommended on product labels. It is then sprayed directly onto the foliage of target vegetation at a controlled rate. Foliar spraying is used to remove established weeds.

The benefits and limitations of foliar selective spraying include:

- highly selective, with no impact on adjacent desirable species
- effective for spotty weed infestations
- adjustable application rates and dosages
- minimizes risk of spray drift

Basal Bark for Trees

Basal bark treatment uses herbicide to penetrate the bark of the tree from the root collar to a point above ground. A single application is applied with backpack or hand-held sprayers. The herbicide diffuses through the tree and roots.

The benefits and limitations of tree removal by basal bark treatment are:

- most effective in late summer
- selective—used only on trees that must be removed
- can be applied all year, except in wet weather
- cost-effective
- reduces potential for spray drift
- dead foliage is unsightly

Cut-and-Treat for Trees

The cut-and-treat method involves cutting the tree down close to the ground, then applying a herbicide to the stump to prevent resprouting.

Cut-and-treat is effective on trees that sucker from their roots. Without an application of herbicide, the stump will produce numerous resprouts.

The benefits and limitations of cut-and-treat for trees include:

- highly selective, so there is minimal negative impact on the environment
- increased efficiency by treating stumps at the same time they are cut
- labour-intensive

Foliar Application for Trees

Trees controlled by foliar herbicide applications are generally fast-growing deciduous trees.

Herbicides are applied by backpack. Foliar applications are made when target species are fully leafed and actively growing.

Foliar applications are suspended if winds reach speeds of 8km/hr, or in lighter winds if the potential for off site drift becomes apparent. Spraying is also suspended in the fall when more than 15% of the leaves have turned colour.

The benefits and limitations of tree removal by foliar application include:

- more labour-efficient and cost-efficient in larger scale operations
- good selective control realized from foliar applications

Evaluation, Section 58(2)(f)

Results of vegetation management must be evaluated on a site to determine the success and impact of the weed control program.

What's the Difference Between Monitoring and Evaluation?

Monitoring consists of an ongoing assessment of sites. Its objective is to watch for potential problems that may require treatment, and to document the percentage of weed cover and presence of other pests. Monitoring tends to be done *before* treatment (although not necessarily), and treatment decisions often result because of monitoring observations.

Evaluation is more formal, and is done *after* treatment, to determine the effectiveness of the pest management program. It takes into account monitoring information and results of control programs.

Treatment program evaluations will be based on visual estimates of the percentage of weed cover.

To evaluate the results of the weed control, all relevant information is collected, such as previous monitoring data and current site conditions. Both formal and informal assessments may be completed. The information collected from the evaluation will be measured against vegetation management objectives for the site. Notes on the yearly evaluation will be included in the Site Management Plan as needed (if the site has one), and results will be used to improve future vegetation management programs.

Information to Collect

When evaluating the results of vegetation work on a site, BC Hydro will consider and gather information on the following:

- amount of organic matter content in the crushed rock
- current surrounding land use, such as agriculture, and the proximity to residences, schools, public areas, and all other sensitive areas
- effectiveness of the treatment program in controlling the undesirable species
- percentage of weeds still present and percentage mortality estimate
- need for follow-up or touch-up treatments
- amount of herbicide used to determine if increases or decreases are necessary
- cost-effectiveness of the treatment program and of follow-up treatments (if necessary)
- impact of the treatment program on the surrounding area
- recommendations for enhanced preventive measures
- recommendations for future treatment programs
- whether the technique was the most appropriate one for the job
- any recommended changes to pesticide-free zones or residual-free zones

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

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

Chapter 3, Use and Handling of Herbicides

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

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

Responsible Use of Pesticides

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

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

Responsibilities of Personnel

Applications will be performed or supervised by a Certified Pesticide Applicator (“Industrial Vegetation and Noxious Weeds” category). The name and certificate numbers of the applicator(s) who will supervise the work must be recorded on the DOR.

The Certified Pesticide Applicator must:

- be in continuous attendance at the work site while herbicides are being applied

- supervise no more than four uncertified individuals at one time
- maintain continuous contact, auditory and/or visual, with each uncertified individual being supervised
- be within 500m of persons being supervised
- have proof of certification at or near the treatment location so it is readily available for inspection during herbicide use (if possible, the certificate should be kept at the mix site, in the vehicle used by an application crew during a treatment, or on the applicator's person at all times, such as in a wallet or pocket; the certificate can be a copy to avoid loss or damage of the original)

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

The following are requirements that personnel must adhere to for transportation of herbicides, as per the *Integrated Pest Management Regulation:*

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

- Persons transporting dangerous goods must hold a valid *TDG Certificate of Training* or be under the direct supervision of someone who is trained and certified.

- Ensure that the herbicide is properly secured during transport so that accidental discharge or unauthorized removal is prevented, and also to prevent contamination of food or drink intended for animal or human consumption, household furnishings, toiletries, clothing, bedding, or similar items transported with the herbicide.

- Keep herbicides in their original containers and with original packaging and labelling affixed, or in appropriate containers with the trade name, name of active ingredient, concentration of active ingredient, and pesticide registration number affixed.

- Be familiar with the product label and *Material Safety Data Sheet* outlining the transportation requirements for each regulated product used by BC Hydro.

- Keep in the vehicle a first aid kit, fire extinguisher, *Spill Response Contingency Plan,* and spill contingency kit (with WorkSafe BC-regulated contents). Vehicle operators will be trained to handle spills.

- Inspect containers for defects prior to transport. Transfer any defective packages to empty pesticide containers of the same type, or secure any

defective containers into secondary containment vessels for transportation.

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

The following are requirements that personnel must adhere to for all storage facilities for herbicides, as per the *Integrated Pest Management Regulation, Section 66*:

- Keep herbicides in their original containers and with original packaging and labeling affixed, or in appropriate containers with trade name, name of active ingredient, concentration of active ingredient, and pesticide registration number affixed.
- Keep herbicides in storage facilities that are locked when unattended, and accessible only to authorized persons. Facilities must be clean, well-marked, and ventilated to the outside.
- Storage facilities may be permanent, temporary, or mobile. Building materials will be fire-resistant wherever possible.
- Mark storage facility in block letters "WARNING: CHEMICAL STORAGE – AUTHORIZED PERSONS ONLY" so signs are visible to persons approaching each door providing access to the facility.
- Keep storage facilities separate from work and living areas, flammable materials, and bodies of water.
- Within 60 days after starting to store herbicides at a location, provide notice of the permanent storage location to the fire department closest to that location.
- Keep a herbicide inventory log book, current product labels, and Material Safety Data Sheets at the storage facility.
- Keep at the storage facility a first aid kit, fire extinguisher, Spill Response Contingency Plan, and spill contingency kit (with WorkSafe BC-regulated contents.). Persons storing herbicides will be trained to handle spills.
- Store fumigants and other pesticides that release vapours or bear a poison symbol on the label in a storage facility that is not attached to or within a building used for living accommodations.
- Store herbicides separately from food intended for human or animal consumption.

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

The following are requirements that personnel must adhere to when mixing and loading herbicides, as per the Integrated Pest Management Regulation.

- Ensure that persons mixing or loading herbicides are Certified Pesticide Applicators, or are directly supervised by same and will use proper protective equipment and clothing.
- Before mixing, read the product label and Material Safety Data Sheet, and follow all safety precautions and mixing instructions.
- Ensure that emergency wash facilities, first aid equipment, spill kits, and emergency phone numbers are close at hand.
- Use clean water free of any suspended particles. All water used to mix with herbicides must be filtered with an appropriate filtration system.
- Conduct mixing and loading in areas selected to prevent any spilled herbicides from entering the pesticide-free zones for waterbodies, wells, and water intakes and in a location that will minimize the potential for spills entering a body of water (e.g., on flat terrain with a non-porous substrate).
- Mix herbicides in well-ventilated areas outdoors, under low wind conditions. Ensure there is adequate light and stand upwind to avoid contaminating yourself.
- Use appropriate procedures to prevent backflow of herbicides into the water source.
- When drawing water from a body of water or an irrigation system into a container for herbicide use, maintain a gap between the herbicide and the equipment to prevent herbicide from entering the body of water or irrigation system.
- Do not wash or submerge in a waterbody any container used to prepare, mix, or apply herbicides.
- Keep containers well below eye level to prevent splashing or spilling herbicides in the face or eyes.
- Pre-mix wettable powders with water to reduce airborne dust.

Herbicide Application Procedures, Section 58(3)(b)(iii)

Personnel will follow these instructions to apply herbicides:

- Hold a pre-job meeting at the site for the Spray Crew Supervisor to advise the Site Supervisor of the following:
  - intended work schedule
  - work plan for the site
  - types of herbicides being used
  - intended length of time to be on site
- Herbicides will be generally applied during periods of low staff or public presence, in the early morning or evening, or on weekends if necessary.
- Whenever possible, herbicides will be applied when target species are at their most susceptible stage.
- Use the most practical, suitable, target-specific application techniques, possible for the application. These may include any of the approved methods of application.
- State the herbicides to be used, application rates, timing, quantities, treatment area, and species to be controlled on the Daily Operations Records, and closely follow all specifications.
- Follow directions and restrictions on product labels and Material Safety Data Sheets for all herbicides.
- Do not apply any herbicide within a pesticide-free zone or no-treatment zone.
- Follow the *Stop Work Conditions* on page 46.

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

The disposal of herbicides and herbicide waste is governed in British Columbia by the *Environmental Management Act* and *Hazardous Waste Regulation*. Personnel must adhere to the following:

- Pre-mix only enough herbicide to use each day. Plan all applications carefully to minimize excess and waste. Any leftover herbicide mix should be saved for future use, disposed of in an appropriate manner.
- Triple-rinse empty containers before disposal. Rinse sprayers and containers well away from any body of water or well.

- Do not puncture or break pre-mixed containers. Puncture or break non-recyclable containers so that they cannot be reused.
- All empty containers are to be disposed of at an approved sanitary landfill, or returned to BC Hydro if requested.

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

Personnel must ensure that an appropriate spill containment kit (and spill contingency plan) is at the application site.

If a herbicide spill occurs, personnel will follow these instructions:

1. Ensure the safety of workers and public by limiting access to the area, protecting people from exposure, and ensuring wash facilities are nearby.
2. Put on protective equipment before cleaning up the spill, including protective clothing, respirators, and eye protection.
3. Contain the spill.
4. Report spills to the BC Hydro representative immediately.
5. Clean up the site.

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

Personnel must ensure that equipment used to apply herbicides is approved by BC Hydro and meets all applicable regulatory requirements. Approved, operating flow meters and pressure gauges must be incorporated into the spray system.

- Nozzles must be working properly or be replaced, and hose connections must not be leaking.
- 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.

Equipment Calibration

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

In general, equipment should be calibrated:

- for each individual applicator using hand-held or backpack equipment
- at the beginning of each season
- at the start of each treatment job
- after 25 hours of use with abrasive formulations (such as wettable powders)
- if application rates are questionable
- any time the application equipment type is changed, such as a change in size or type of nozzle
- any time the pesticide or formulation of a pesticide is changed

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

Calibration Records

For each piece of the licensee's pesticide application equipment that requires calibration, the Certified Pesticide Applicator must complete a calibration record. The calibration record lists the date of each calibration, and the data upon which its calibration was based.

Chapter 4, Environmental Protection

This chapter covers the following, as per Section 58 of the *Regulation*:

- protecting community watersheds and water sources — Section 58(3)(b)(i)
- protecting fish, wildlife, and habitat — Section 58(3)(b)(ii)
- preventing contamination of food — Section 58(3)(b)(iii)
- boundary marking procedures — Section 58(3)(b)(iv)
- weather monitoring — Section 58(3)(b)(vi)

Riparian Definitions

Riparian area – 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 waterbody.

Pesticide free zone (PFZ) — an area of land that must not be treated with pesticides, and must be protected from pesticides moving onto it. PFZs are measured by the horizontal distance from the high water mark. PFZs will be flagged before starting any herbicide treatment.

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

No treatment zone (NTZ) — an area of land that must not be treated with any herbicides.

Waterbody — any watercourse or waterbody, such as a stream, river, wetland, or lake, but not including a human-made, self-contained body or structure of water.

Measures to Protect the Environment

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

Certain areas must remain free of herbicides at all times, and additional areas must exclude residual herbicides. All herbicides categorized as residual in this PMP are soil-applied. The SMP map will show clearly-marked pesticide-free zones (PFZ) and residual-free zones (RFZ).

BC Hydro follows these guidelines to ensure that herbicides do not leave BC Hydro facilities:

- prevent herbicides from being applied in PFZs and RFZs
- where practical, collect soil samples to verify there is at least 1% sufficient organic matter to hold residual herbicides in the soil
- track weather patterns prior to application
- refrain from applying herbicides during rain
- where practical, use rainfast surfactants on residual applications
- carry out a visual evaluation to monitor any possible movement offsite

In addition, Imazapyr applications must be kept away from areas where tree roots may extend into the treated area or in locations where the chemical may be washed or moved into contact with their roots. Maintain a distance from the tree equal to at least twice the distance from the tree trunk to the dripline.

Residual-free Zone Restrictions

Residual-free zones apply to soil-applied herbicides only. See Table 1 for a listing of soil-applied and foliar-applied herbicides. Note that some products such as imazpyr and picloram can be applied using both modes of application.

- No residual herbicides will be used in oil contaminant pits.
- In unterraced facilities, if the overall slope of the facility is more than 10%, a 5m RFZ will be established along the downslope side of the fence.
- No residual herbicides will be used within 5m of a slope where the land slopes away steeply (greater than 30%) on the outside of the fence.
- No residual herbicides will be used on any soils saturated with water, or when heavy rainfall is predicted or occurring.
- No residual herbicides will be used within 10m of a ditch, even if it is dry at the time of treatment.
- Foliar-applied herbicides (non-residual) may be applied up the edge of perimeter ditches, provided that: they are dry at the time of treatment, removal of vegetation will not increase erosion, and the ditches do not lead directly to fish-bearing waters.

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

The locations of any water sources, intakes, or wells will be clearly marked on the facility's SMP map, both those within the facility and those within 30m of the fenceline.

No-treatment zones (NTZs) and residual-free zones (RFZs) will be maintained around water intakes and wells used for domestic and agricultural purposes that are located adjacent to BC Hydro facilities.

Table 4: Water Protection Table

Section	Permitted Application*	NTZ/PFZ	Exception
All Applications			
71(3) Reg	Potable domestic and agricultural wells and water intakes, including all methods and pesticides.	30m NTZ	NTZ may be reduced if reasonably satisfied that a smaller NTZ will ensure no pesticide enters well or intake (70(4) Reg).
Non-glyphosate Applications			
73(1) Reg	Around or along a waterbody or dry stream and classified wetland using any pesticide except glyphosate, subject to label restrictions and including all application methods.	10m PFZ	Glyphosate applications
—	Catch basins (subsurface drainage intakes).	2m PFZ	No herbicides
Glyphosate Applications			
71(3) Reg	Non-potable wells and water intakes, including all methods and pesticides.	10m NTZ	
74(1)(c) Reg	Along or around a waterbody if the waterbody is: • not fish-bearing at any time of the year • does not drain directly into a fish-bearing waterbody	2m NTZ	
74(2) Reg	Up to the high water mark of a temporary free-standing waterbody and dry stream, that is: • not fish-bearing at any time of the year • does not drain directly into a fish-bearing waterbody	0m NTZ	
74(1)(a) Reg	Along or around a waterbody or a classified wetland that is: • fish-bearing, or • that drains directly into a fish-bearing waterbody, or • along or around a dry stream that when wet is fish-bearing or drains directly into a fish-bearing waterbody	2m PFZ	
Noxious Weed and Invasive Plant Management			
77(2) Reg	Targeted application of glyphosate to noxious weeds and invasive plants if a selective application is used between 1m and 10m above the high water mark.	1m PFZ	

* When herbicide label restrictions are more limiting than the above conditions, the labels will take precedence.

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

In addition to the PFZs specified in Table 4, BC Hydro exercises caution when working with herbicides adjacent to riparian areas and waterbodies.

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

Most treated facilities have a Site Management Plan that generally includes a comprehensive map. Although there is little or no wildlife habitat within BC Hydro secured facilities, any intensive wildlife use outside the fenceline will be noted in the SMP, and appropriate precautions taken. The SMP also describes any environmentally-sensitive areas that should be monitored and protected.

Work in riparian areas will be carefully planned in advance through an inventory and Site Management Plan process. These general precautions will be followed when working around waterbodies:

- Applicators will adhere to PFZs and RFZs, as per Table 4 above.
- As much vegetation as possible will be retained around waterbodies.
- Herbicide use will not remove vegetation that is needed to prevent erosion of a streambank.

- No deleterious substances will be allowed to enter the watercourse, including herbicides, fuels, debris, sawdust, or sediment.

Wildlife and habitat will be protected as follows:

- Control noxious weeds (as designated under the *Weed Control Act).*
- Identify and protect non-hazardous wildlife trees.
- Ensure that herbicide use is directed only at target vegetation.
- Minimize soil erosion caused by vegetation management activities to reduce impact on desirable plants or wildlife.

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

BC Hydro identifies surrounding vegetation in the Site Management Plan (SMP). There is no food gathering within any fenced compound.

BC Hydro attempts to identify areas outside the fenceline 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. Signs are clearly posted and remain up for 14 days to inform the public that herbicides have been used at the site.

Any adjacent farm fields will be noted. Herbicides will not be sprayed on areas used for agricultural crop production.

It is the responsibility of organic farmers to ensure an adequate buffer zone is maintained between their farm and a facility fenceline.

Before Work Starts

Personnel must ensure that the work area is properly defined and inspected before work begins, in accordance with the following:

- Check the *Notice of Intent to Treat* to ensure that the proposed treatment locations, the proposed treatment (including the herbicide and its method of application), and the total area of the treatment areas are correct.
- Ensure that the herbicide used is registered for the intended use as described on the herbicide label.

- Keep onsite the detailed map showing the proposed treatment areas and pesticide-free zones (PFZs) and residual free zones in the work area.
- Identify the boundaries of the treatment area, especially the areas outside the fenceline and ensure that pesticide-free zones are properly identified and marked. Each facility must be field-checked prior to work to ensure that construction has not changed aquatic boundaries in a manner that would require a buffer zone or pesticide-free zone change.
- Post all herbicide use signs required for the treatment area.
- Check for the presence of staff or visitors on site and inform them of the work.
- Inspect the treatment area to ensure that regulatory requirements and standards can be met when herbicides are applied.
- Ensure that domestic and agricultural water sources and soil used for agricultural crop production are protected.
- Perform a field check to look for drinking water sources, especially if there are houses in the vicinity, and flag any unregistered water intakes or wells.
- If work is being conducted in an area where biological control agents have been released to control noxious weeds, make reasonable efforts to identify these sites and prevent harm to these organisms.

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

- boundaries of the treatment area
- requirements for personal protection
- herbicide use procedures required to protect human health and the environment
- the target species to be controlled and the desirable species that are to be protected during treatments and how to identify these plants/trees

During Work

During work, personnel must ensure that:

- The facility map showing the proposed treatment areas and pesticide-free zones is kept at the facility.
- The area of treatment specified on the *Notice of Intent to Treat* is not exceeded.

- Precautions are taken to prevent unprotected human exposure to herbicides.
- Precautions are taken to ensure that domestic water sources, agricultural water sources, and soil used for agricultural crop production are protected for their intended use.
- Precautions are taken to avoid the use of pesticide over vertebrate wildlife or domestic animals that are visible to the user.
- Any changes to the original treatment plan are recorded and/or mapped.
- Any complaints regarding the herbicide applications by anyone are promptly referred to the BC Hydro Representative.

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

Personnel will carefully monitor weather and weather forecasts at the beginning and on a daily basis throughout the treatment program. Information will be collected from Environment Canada and other official sources.

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

Personnel will check the product label for guidelines for applying herbicides under various weather conditions.

To monitor and measure weather conditions, the following actions are also recommended:

- Measure weather conditions at or near the facility.
- Measure before treatment starts each day.
- Re-measure during the day if changes in environmental conditions occur.
- Re-measure at the end of any workday.
- Note the presence or absence of precipitation and its relative intensity in qualitative terms (e.g., heavy rain, light drizzle, etc.).
- In addition to the weather conditions listed in the regulation, monitor other conditions as required by the product label or site considerations.
- Ensure weather information is complete.

Stop Work Conditions

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

- temperatures exceeding 30°C or below freezing
- raining steadily (water running consistently down the lateral stems)
- ground wind speed exceeds 8km an hour (for foliar applications), i.e., gentle breeze, leaves and twigs in constant motion
- foliage is covered by ice or frost, or water is flowing on the foliage
- overall conditions favour herbicide drift

Work crews will:

- Not use a residual herbicide on water-saturated soil, during heavy rainfall, or if heavy rainfall is imminent.

- Apply herbicides only between 30 minutes before sunrise and 30 minutes after sunset.

- Regulate nozzle pressure to eliminate drift outside the facility.

Appendices

Appendix 1 – List of BC Hydro Facilities

Below is a list of facilities that are subject to the requirements of this Pest Management Plan, as they pertain to herbicide use for integrated vegetation management. This list may change as sites are developed or decommissioned, or as BC Hydro agrees to manage additional sites for BC Hydro or others over the five-year term of the plan. For an up-to-date list, check this online link: http://www.bchydro.com/safety/vegetation_and_powerlines/substation_weed_control.html.

BC Hydro Secured Facilities List for PMP	
LOWER MAINLAND	
Facility Name	**Location**
Alouette Hydro Generation Facility Switchyard	Stave Lake
American Creek Capacitor Station	Hope
American Creek Passive Repeater	near Hope
Annacis Substation	Annacis Island
Arnott AC Substation	Tsawwassen
Arnott HVDC Terminal	Tsawwassen
Atchelitz Substation	Atchelitz
Balfour Substation	Langley
Barnard Substation	Burnaby
Black Tusk Microwave Station	Garibaldi Park
Boston Bar DGS Switchyard	Boston Bar
Boston Bar Substation/Yard	Boston Bar
Boundary Bay Electrode	Delta
Bowen Island Microwave Station	Bowen Island
Brittania Substation	Britannia
Burrard Thermal Generation Facility Switchyard	Burrard Inlet
Cambie Substation	Richmond
Camosun Substation	Vancouver
Canoe Pass Cable Terminal	Delta
Cape Cockburn Cable Terminal	Nelson Island
Cape Cockburn Passive Repeater	Texada Island
Capilano Substation	North Vancouver
Chapmans Series Capacitor Station	Spuzzum
Cheakamus Hydro Generation Facility Switchyard	Squamish
Cheekye 230 Kv Substation	Squamish
Cheekye 500 Kv Substation	Squamish

BC Hydro Secured Facilities List for PMP	
Cheekye Passive Repeater	near Squamish
Chevron Substation	Burnaby
Chilliwack Substation	Chilliwack
Clayburn Substation	Abbotsford
Cloverdale Substation	Surrey
Clowhom Falls Hydro Generation Facility Switchyard	Sechelt
Como Lake Cable Terminal	Coquitlam
Como Lake Substation	Coquitlam
Coquitlam Substation	Coquitlam
Creekside Capacitor Station	Mt. Curry
Creekside Passive Repeater	near Pemberton
Cypress Substation	West Vancouver
D'Arcy Microwave Station	D'Arcy
Deas Tunnel Cable Terminal NW	Richmond
Deas Tunnel Cable Terminal SE	Ladner
Deep Cove Substation	North Vancouver
Electra Microwave Station	Vancouver
English Bluff Cable Terminal	Tsawwassen
Forest View Substation	Powell River
Function Junction Substation	Whistler Village
Furry Creek Substation	Furry Creek
George Dickie Substation	Vancouver
Gibsons Substation	Gibsons (0.25 mile East of Hwy 101 on North Rd,)
Glenmore Substation	North Vancouver
Gloucester Substation (and road)	Langley
Grief Point Substation	Powell River
Haney Substation	Maple Ridge
Harvie Road Substation	Surrey
Hill Ave. Cable Terminal	Burnaby
Hillcrest Substation	West Vancouver
Hope Substation	Hope
Horne Payne Sub (Station only)	Burnaby
Horseshoe Bay Substation	Horseshoe Bay
Ingledow Substation	Surrey
Inkawathia Passive Repeater	near Spuzzum
Jarvis Microwave Station	Fraser Valley
John Lawson Substation	West Vancouver
Kent Substation	Aggasiz
Kidd #1 Substation	Vancouver
Kidd #2 Substation	Richmond
Knight St. Cable Terminal	Vancouver
Lake Buntzen Hydro Generation Facility,	Port Moody

BC Hydro Secured Facilities List for PMP	
LB1 and LB2 Switchyards	
Lions Bay Substation & Cable Terminal	Lions Bay
Lougheed Substation	Burnaby
Lynn Valley Substation	North Vancouver
Mainwaring Substation	Vancouver
Malaspina Passive Repeater	near Madeira Park
Malaspina Substation	Madeira Park
Maple Ridge Substation	Maple Ridge
McLellan Substation	Langley
Meridian Substation	Coquitlam
Mission Substation	Mission
Mount Lehman Substation	Abbotsford
Murrin Substation #2	Vancouver
New Westminster Substation	New Westminster
Newell Substation	Burnaby
Nicomekl Substation	Surrey
Norgate Substation	North Vancouver
North Vancouver Substation	North Vancouver
Pemberton Substation	Pemberton
Pender Harbour Substation	Pender Harbour
Pocahontas Microwave Station	Texada Island
Port Kells Substation	Langley
Port Moody Microwave Station	Port Moody
Porteau Substation	Porteau Cove
Rainbow Substation	Whistler Village
Richmond Substation	Richmond
Rosedale Substation	Rosedale
Royal Substation	New Westminster
Ruskin Hydro Generation Facility Switchyard	Maple Ridge
Ruskin Passive Repeater	Maple Ridge
Saltery Bay Substation	Saltery Bay
Scott Substation	Surrey
Sea Island Substation	Richmond
Sechelt Substation	Sechelt
Slollicum Microwave Station	Fraser Valley
Sperling Substation	Vancouver
Spuzzum Substation	Spuzzum
Squamish Sub	Squamish
Stave Falls Hydro Generation Facility Switchyard	Mission
Steveston Substation	Stave Lake
Stokke Microwave Station	Fraser Valley
Strawberry Hill Substation	Surrey
Sumas Mountain Microwave Station	Sumas Mountain

BC Hydro Secured Facilities List for PMP	
Sumas Way Substation	Sumas
Surrey Substation	Surrey
System Control Centre	Langley
Texada Cable Site East	Texada Island
Texada Cable Site West	Texada Island
Texada Reactor Site	Texada Island
Texada Passive Repeater	Texada Island
Tisdall Switch	Whistler
Tsawwassen Beach Cable Terminal	Tsawwassen
Tsawwassen Substation	Tsawwassen
Upper Harrison Terminal	Harrison Lake
Wahleach Hydro Generation Facility Switchyard	Hope
Walters Substation	North Vancouver
Whalley Substation	Surrey
White Rock Substation	White Rock
NORTHERN	
Facility Name	**Location**
Ah-Sin-Heek DGS Switchyard	Bella Coola
Aiyansh Substation	Aiyansh
Anahim Lake DGS Switchyard	Anahim Lake
Atlin DGS Switchyard	Atlin
Babine Lake Substation	Granisle
Barlow Substation	Quesnel
Bear Mountain Terminal	between Chetwynd and Dawson Creek
Beaverley Substation	Prince George
Bella Bella DGS Switchyard	Shearwater
Boulder Microwave Station	near Chetwynd
Bullhead Microwave Station	near Hudson's Hope
Burns Lake Substation	Burns Lake
Canreed Substation	Prince George
Chetwynd Substation	Chetwynd
Chief Lake Substation	Prince George
Clayton Falls DGS Switchyard	near Bella Coola
Colebank Substation	Hixon
Copper Mountain Microwave Station	near Kitimat
Dawson Creek Substation	Dawson Creek
Dease Lake DGS Switchyard	Dease Lake
Diana Lake Substation	Rainbow Summit
Dokie Terminal Substation	near WAC Bennett Dam
Dragon Microwave Station	Quesnel area
Eddontenajon DGS Switchyard	Iskut

BC Hydro Secured Facilities List for PMP	
Falls River Hydro Generation Facility Switchyard	Big Falls Lake
Firth Microwave Station	north of Prince George
Foothills Substation	Prince George
Fort Nelson Gas Turbine Generation Facility Switchyard	Fort Nelson
Fort St. James II Substation	Fort St. James
Fort St. John II Substation	Fort St John
Fox Creek Substation	Fort St. John
Fraser Lake Substation	Fraser Lake
G.M. Shrum Hydro Generation Facility Switchyard	near Hudson Hope
Gavin Lake Substation	near McLeese Lake
Gibraltar Capacitor Station	near McLeese Lake
Glenannan 230kV & 500kV Substation	near Fraser Lake
Glenannan Microwave Station	near Fraser Lake
Green River Substation	Rainbow Summit
Grouse Microwave Station	near Houston
Hazelton Substation	New Hazelton
Houston Substation	Houston
Isle Pierre Substation	near Prince George
Kalum Substation	Terrace
Kennedy Capacitor Station	north of Prince George
Kennedy Passive Repeater	north of Prince George
Kennedy Substation	north of Prince George
Lytton DGS Switchyard	Lytton
Marguerite Substation	Marguerite
Masset DGS Switchyard	Masset
McEwan Substation	near Prince George
McLeese Capacitor Station	McLeese Lake
McLeese Microwave Station	McLeese Lake
Meziadin Substation	Meziadin Junction
Minette Substation	Kitimat
Morfee Mountain Microwave Station	MacKenzie
Morfee Substation	MacKenzie
Oldfield Substation	Prince Rupert
Patricia Substation	Prince George.
PCN Passive Repeater	Hudsons Hope
Peace Canyon Hydro Generation Facility Switchyard	Hudsons Hope
Pineview Substation	Prince George
Port Edward Substation	Prince Rupert
Portage Pass Substation	WAC Bennet Dam
Prince George Substation	Prince George
Quesnel Substation	Quesnel
Red Bluff Substation	Quesnel
Red Rock Microwave Station	north of Hixon

BC Hydro Secured Facilities List for PMP	
Rupert Gas Turbine Switchyard	east of Prince Rupert
Rupert Substation	near Prince Rupert
Salmon Valley Substation	Prince George
Sandspit DGS Switchyard	Sandspit
Sheraton Microwave Station	near Burns Lake
Sinkut Microwave Station	near Vanderhoof
Skeena Substation	Terrace
Smithers Substation & Pole Yard	Smithers
Soda Creek Passive Repeater	near Soda Creek
Soda Creek Substation	Soda Creek
Stewart Substation	Stewart
Sukunka Switching Station	Chetwynd area
Tabor Microwave Station	near Prince George
Tachick Substation	Vanderhoof
Taylor Substation	Taylor
Telegraph Creek DGS Switchyard	Telegraph Creek
Telkwa Microwave Station	Telkwa
Telkwa Substation	Telkwa
Terrace Microwave Site	Terrace area
Terrace Substation	Terrace
Toad River Switchyard	near Fort Nelson
Topley Substation	Topley Junction
Trapline Microwave Station	near Terrace
Tumbler Ridge Substation	Tumbler Ridge
Upper Fraser Substation	Upper Fraser
Vanderhoof Substation	Vanderhoof
Wescup Substation	Fort Nelson
Williams Lake Substation	Williams Lake
Williston Substation	Prince George
SOUTH INTERIOR	
Facility Name	**Location**
100 Mile House Substation	100 Mile House
Aberfeldie Hydro GS & Switchyard	Ft. Steele-Wardner Hwy
Armstrong Substation	Armstrong
Ashcroft Substation	Ashcroft
Ashton Creek Substation	Ashton Creek
Athalmer Substation	Athalmer
Avola Substation	Avola
Baker Microwave Station	near Cranbrook
Barriere Substation	Barriere
Blizzard Microwave Station	near Seven Mile
Bone Creek Terminal	North Thompson area

BC Hydro Secured Facilities List for PMP	
Blue River Substation	Blue River
Bridge River #1 Switchyard	Chalath
Bridge River #2 Switchyard	Chalath
Bridge River Cable Terminal	Chalath
Britt Creek Switch	Elkford
Brocklehurst Substation	Kamloops
Canal Flats Substation	Canal Flats
Carquille Substation	Cache Creek
Carson Microwave Station	near Kelly Lake
Chase Substation	Chase
Clearwater Substation	Clearwater
Clinton Substation	Clinton
Cranbrook Substation	Cranbrook
Douglas Street Substation	Kamloops
Elkford Substation	Elkford
Elkford Tap Station (Elkford Switch)	Elkford
Elko Hydro Generation Facility Switchyard	Elko
Enderby Substation	Enderby
Fairmont Substation	Fairmont
Fernie Substation	Fernie
Fort Steele Substation	Fort Steele
Fred Laing Microwave Station	Revelstoke
Golden Substation	Golden
Goldstream Microwave Station	Revelstoke
Guichon Capacitor	near Kamloops
Hall Lake Microwave Station	Kimberley
Hamilton Microwave Station	near to Merritt
Heffley Creek Substation	Kamloops
Highland Substation	Merritt
Illecillewaet Substation	Revelstoke
Invermere Substation	Invermere
Joseph Creek Substation	Cranbrook
Kamwood Substation	Kamloops
Kelly Lake Passive Repeater	Clinton
Kelly Lake Substation	Clinton
Kimberley Substation	Kimberley
Kootenay Canal Passive Repeater	between Castlegar and Nelson
Kootenay Canal Substation	Castlegar
La Joie Hydro Generation Facility Switchyard	Gold Bridge
Lumby #2 Substation	Lumby
Marysville Substation	Marysville
Merritt Substation	Merritt

BC Hydro Secured Facilities List for PMP	
Mica Hydro Generation Facility Switchyard	upper Columbia River
Mission Mountain Microwave Station	Shalath
Mission Mountain Microwave Site #2	Mission Mountain near Bridge River
Monashee Substation	Needles
Monte Lake Substation	Monte Lake
Morrissey Ridge Microwave Station	Morrissey Ridge
Mount Savona Microwave Station	Savona
Moyie Substation	Moyie
Nakusp Substation	Nakusp
Natal Substation	Sparwood
Nelway Passive Repeater (2 passives)	Nelway
Nelway Substation	Nelway
New Denver Substation	New Denver
Nicola Substation	Merritt
Okanagan Mountain Microwave Repeater Station	Oliver
Parson Substation	Parson
Pavilion Substation	Pavilion
Radium Substation	Radium Junction
Revelstoke Hydro Generation Facility Switchyard	Revelstoke
Revelstoke Passive Repeater	Revelstoke
Sale Microwave Station	near Revelstoke
Salmon Arm Substation	Salmon Arm
Savona Substation	Savona
Scaia Microwave Station	near Edgewood
Selkirk Passive Repeater	near Fruitvale
Selkirk Substation	near Castlegar
Seton GS and Substation (Lillooet)	Lillooet
Seven Mile Hydro Generation Facility Switchyard	Castlegar
Seven Mile Passive Repeater	near Trail
Seventy Mile House Substation	Seventy Mile House
Shuswap Falls Hydro Generation Facility Switchyard	north of Lumby
Sicamous Substation	Sicamous
Silver Star Microwave Station	near Vernon Terminal
Skookumchuk Substation	near Cranbrook
Slocan Ridge Microwave Station	near Kootenay Canal
Sorrento Substation	Sorrento
South Interior Control Centre	Vernon
Sparwood Substation	Sparwood
Spences Bridge Substation	Spences Bridge
Spillimacheen Hydro Generation Facility Switchyard	between Radium and Golden
Steeples Substation	Cranbrook
Thynne Microwave Station	near Coquihalla summit

BC Hydro Secured Facilities List for PMP	
Timothy Microwave Station	near Timothy Lake
Tuktakamin Microwave Station	Falkland
Tyax Substation	Gold Bridge
Valemount Substation	Valemount
Valleyview Substation	Kamloops
Vaseux Lake Terminal	near Oliver
Vaseux Passive Repeater	near Oliver
Vavenby Substation	Vavenby
Vernon Terminal Substation	Vernon
Walter Hardman Hydro Generation Facility Switchyard	Revelstoke
Wardner Substation	Ft. Steele-Wardner Hwy
Westbank Substation	Westbank
Westwold Substation	Westwold
Whatshan Hydro Generation Facility Switchyard	Needles
Winsor Substation	Elko
Woods Lake Substation	Woods Lake
VANCOUVER ISLAND	
Facility Name	**Location**
Ash River Hydro GS Switchyard	Great Central Lake
Bruce Peak Microwave Station	Saltspring Island
Burnett Road Cable Terminal	Victoria
Campbell River Substation	Campbell River
Colwood Substation	Victoria
Comox Substation	Comox
Cottle Hill Microwave Station	Nanaimo
Dunsmuir 138 Kv Switchyard	Qualicum Bay
Dunsmuir 500 Kv Substation	Qualicum Bay
Esquimalt Substation	Victoria
Galiano Island HVDC Cable Terminal	Galiano Island
Galiano Substation	Galiano Island
George Tripp Substation	Victoria
Gold River Substation	Gold River
Goward Substation	Saanich
Great Central Lake Substation	Great Central Lake Rd
Harewood Substation	Nanaimo
Harewood West Substation	Nanaimo
Horsey Substation	Victoria
Jeune Landing Substation	Port Alice
Jingle Pot Substation	Nanaimo
John Hart Hydro Generation Facility Switchyard	Campbell River
Jordan River Hydro Generation Facility Switchyard	River Jordan
Keating Substation	Saanich

BC Hydro Secured Facilities List for PMP	
Keogh Substation	Port Hardy
Koksilah Substation	Duncan
Ladore Substation (upper and lower yard)	near Campbell River
Ladysmith Substation	Ladysmith,
Lake Cowichan Substation	Lake Cowichan
Lantzville Substation	Lantzville
Long Beach Substation	Long Beach
Maracaibo AC Cable Terminal	Saltspring Island
Montague Harbour AC Cable Terminal	Parker Island
Nile Creek Cable Terminal	Qualicum
Northfield Substation	Nanaimo
Oyster River Substation	Campbell River
Parker Island Cable Terminal	Parker Island
Parksville Substation	Parksville
Pike Lake Substation	Victoria
Port Alberni Substation	Port Alberni
Port Hardy Substation	Port Hardy
Port McNeil Substation	Port McNeill
Prevost Substation	Duncan
Puntledge Hydro Generation Facility Switchyard	Courtenay
Qualicum Beach Sub	Qualicum area
Sahtlam Substation	Sahtlam
Saltspring Substation	Saltspring Island
Sansum Narrows Electrode Site	near Maple Bay
Shawnigan Lake Substation	Shawnigan Lake
Sidney Substation	Sidney
Sooke Substation	Sooke
Strathcona Hydro Generation Facility Switchyard	near Campbell River
Tahsis Village Substation	Tahsis
Taylor Bay AC Cable Terminal	Galiano Island
Trincomali Cable Terminal (2)	Saltspring Island
Vancouver Island Terminal	Duncan
Victoria Microwave Station	Saanich
Woss Substation	Woss

Appendix 2 – Location Maps

Click this link to display the BC Hydro Transmission system map showing all substations and other major facilities:
http://transmission.bchydro.com/NR/rdonlyres/7B479C14-D451-4FFA-BC36-0F7E2C5A0BFB/0/2009_transmission_system_map.pdf

The Microwave system map is below.

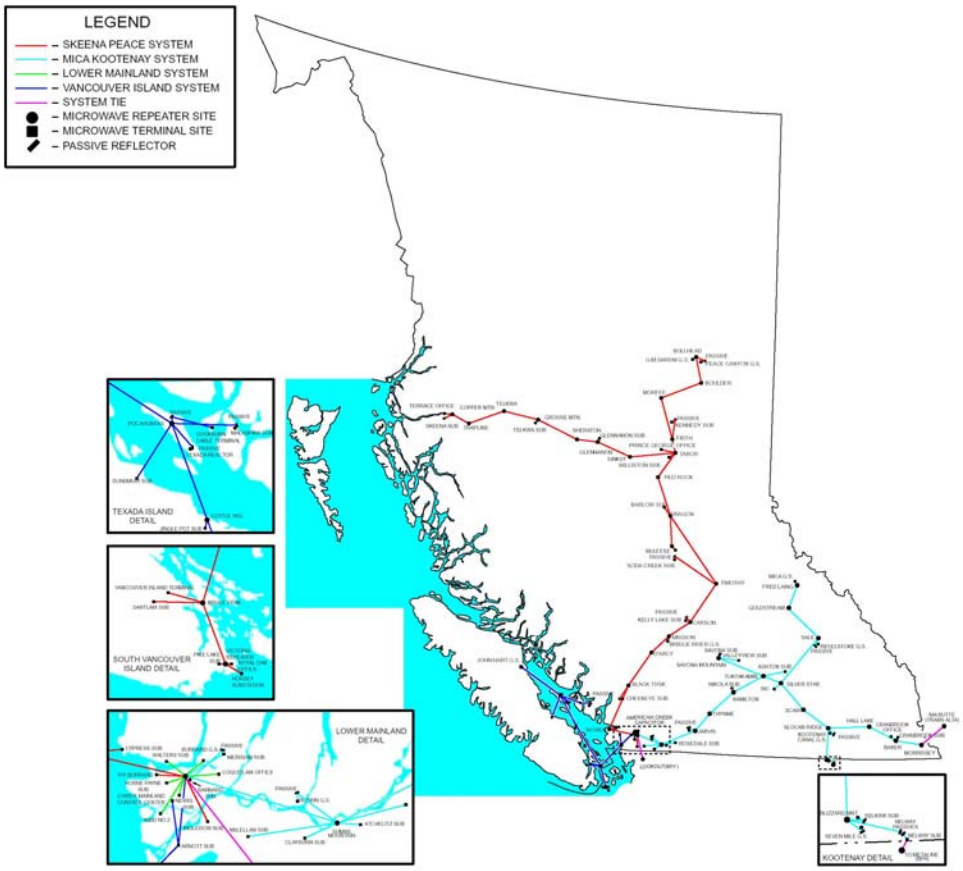


Fig 1: Microwave System Map