Approved Work Practices
FOR MANAGING RIPARIAN VEGETATION

A GUIDE FOR INCORPORATING RIPARIAN ENVIRONMENTAL CONCERNS INTO THE PROTOCOL AGREEMENT FOR WORK IN AND AROUND WATER
Approved Work Practices for Managing Riparian Vegetation

A Guide to Incorporating Riparian Environmental Concerns into the Management of Vegetation in BC Hydro's Transmission and Distribution Corridors

Appendix A
of the Protocol Agreement for Maintenance Work In and Around Water Between BC Hydro Distribution and British Columbia Transmission Corporation, Fisheries and Oceans Canada, and the Ministry of Water, Land and Air Protection
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Foreword

BC Hydro Distribution and British Columbia Transmission Corporation (BCH-BCTC) recognize the vital physical and ecological roles fulfilled by fresh water, marine and riparian ecosystems and, concurrently, recognize the importance of protecting these systems from adverse impacts and ensuring their long-term sustainability. The following document, called the Approved Work Practices for Managing Riparian Vegetation (AWPRV), was developed to ensure the protection and sustainability of these systems while simultaneously streamlining regulatory agency activities. The AWPRV also represents a component of the Protocol Agreement for Maintenance Work In and Around Water (see Appendix A) between BCH-BCTC, the Ministry of Water, Land and Air Protection (MWLAP) and Fisheries and Oceans Canada (DFO).

Specifically, the AWPRV describes the work practices associated with managing riparian vegetation in and adjacent to transmission and distribution Rights-of-Way that are the responsibility of BCH-BCTC.

The main agreements of the AWPRV are that:

• BCH-BCTC agree to apply the following work practices while managing riparian vegetation in and adjacent to their Rights-of-Way; and

• DFO and MWLAP agree that work done according to the AWPRV constitutes accepted practice and requires no additional approvals or notifications. Work proposed, which is not fully consistent with the AWPRV, is subject to further review and may require approvals, acceptance of notification or letters of advice.

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1. STRATEGIC OBJECTIVES

1.1 ELECTRICAL SYSTEM NEEDS

BCH-BCTC are responsible, through the BC Hydro and Power Authority Act, for providing a reliable supply of electricity to customers throughout the province, while ensuring public and worker safety. Contact of vegetation with high-voltage power lines can have serious consequences so, as part of this responsibility, BCH-BCTC manages vegetation near power lines to prevent such contacts from occurring.

When a branch contacts or comes close to a high-voltage power line, electrical current can arc across from the line to the branch resulting in:

- The line tripping out and the power going off;
- Fire, which may burn the branch or cause the line to burn through and fall; part of the line may stay energized and threaten public safety; and/or
- The tree, or portion of it, may become energized, which will create a severe public safety hazard

BCH-BCTC manages vegetation in and adjacent to two different types of Rights-of-Way (ROW). They are:

1.1.1 Transmission Corridors

Transmission corridors are generally managed by British Columbia Transmission Corporation (BCTC), although the transmission infrastructure and some property are owned by BC Hydro and it is generally BC Hydro staff or consultants and contractors who conduct the maintenance work. These corridors move high-voltage electricity (60 kV to 500 kV) between substations or between a power generation facility and a substation. Transmission corridors are wide clearings (up to 200 m wide), usually located on crown lands in wilderness settings. Vegetation management requirements for a transmission corridor are based on the circuit’s “limits of approach” (the distance a person, machine, or conductive material can safely approach energized conductors). The limits of approach are determined by voltage and range from 3 m for 60 kV lines to 6 m for 500 kV lines. In addition, transmission circuits may sag between 2 and 6 m lower than normal operating load sag. This effect, known as the hot curve, occurs during maximum operating loads with a 30°C ambient air temperature. All vegetation in transmission corridors must be managed to the limits of approach for the hot curve of the line. Maintaining these safe limits of approach ensures personal safety, protects the circuit from outages and eliminates the risk of fires.

1.1.2 Distribution Corridors

Distribution corridors are generally the responsibility of BC Hydro Distribution. They are narrow (usually less than 6 m wide) and contain relatively low voltage (less than 60 kV) circuits that normally run parallel to roads and distribute electricity to users. BC Hydro works to a vegetation management standard that identifies hazardous trees for removal, species growth rates and local conditions to ensure that vegetation does not contact the circuit. This standard usually dictates minimum clearances between trees and primary voltage conductors of 3 m vertical (below), 5 m vertical (above) and 3 m side (horizontal). This standard also dictates that hazardous trees, even if they are quite distant from the line, may require removal or modification.

1.2 REGULATORY AGENCY NEEDS

Both Federal and Provincial legislation affect vegetation management practices. Legislation such as the Water Act, Wildlife Act, Forest Practices Code, Forest Act, Waste Management Act and the Pesticide Control Act all provide various levels of protection to land and/or water resources through restrictions
Approved Work Practices for Managing Riparian Vegetation

and/or penalties. However, it is the Federal Fisheries Act that has the greatest impact on BCH-BCTC’s vegetation management practices in riparian areas.

The Fisheries Act defines fish habitat as:

"Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes." (Fisheries Act, sec. 34(l)).

Riparian vegetation benefits adjacent water-bodies by providing sources of large woody debris, bank stability, nutrient cycling, a food source, temperature control, contaminant filtration and biodiversity. As such, fish habitat includes riparian vegetation.

The Fisheries Act protects fish habitat through the following provision:

"It is an offence to harmfully alter, disrupt or destroy (HADD) fish habitat without authorization." (Fisheries Act, Section 35, 1-2).

Therefore, all activities that involve harmful alterations of vegetation considered “fish habitat” require an authorization from the Department of Fisheries and Oceans (DFO). Deviations from the work plans submitted to obtain an authorization can also result in a chargeable offence.

1.2.1 Fisheries and Oceans Review

Fisheries and Oceans Canada (DFO) does not have a formal “permitting” process in that Applications are received and a Permit is issued. Section 35(2) of the Fisheries Act prohibits any work or activity that results in the harmful alteration, disruption or destruction (HADD) of fish habitat – unless authorized by the Minister or subject to Regulation. Therefore, DFO should be notified of any activities that may affect fish or fish habitat to ensure that a HADD does not occur. Notification to DFO can be made either directly, indirectly through an alternate process such as a referral by other Federal Departments or Provincial Ministries, or per an alternate agreement such as a PA.

Once a notification is received, staff review the proposed activities in accordance to the Section 35(2) of the Fisheries Act, and the accompanying Policy for the Management of Fish Habitat. The Policy establishes a process through which work is reviewed and a hierarchy of preferences is applied. This hierarchy is as follows: 1) avoidance of a HADD with possibly the, 2) redesign of the proposal or relocation to a more suitable site; 3) mitigation to reduce the HADD; or, 4) as a last resort provide compensation for the HADD. Where there is the possibility to relocate or redesign the project, DFO may issue a Letter of Advice to the proponent suggesting alternatives to the design to ensure a HADD does not occur. Where it is not feasible to redesign or relocate a particular project, the Minister may provide an Authorization for the HADD, and outline mitigation or compensation requirements. Authorizations may also trigger a review under the Canadian Environmental Assessment Act, which includes a process of evaluation and public input, and could have specific conditions and timelines associated with it.

It is anticipated that BCH-BCTC’s routine riparian vegetation maintenance activities will not constitute a HADD if undertaken in accordance with this document. However, should routine riparian vegetation maintenance activities not fall within the general provisions included here, advice will be given on how to avoid a HADD, or an Authorization will be considered.
1.2.2 Ministry of Water, Land and Air Protection Review

Ownership of water and most streambeds is vested in the Province of B.C. Changes in and about streams have been managed and regulated through legislation for many years to protect and maintain certain values, resources and legal rights associated with streams. A Guide has been developed to help proponents comply with Part 7 of the Water Regulation (under the Water Act) for work in and about a stream (http://srmwww.gov.bc.ca/wat/wrs/brochures/user_guide.pdf).

In general, the management of vegetation along streams by BCH-BCTC is an approved activity under the Regulation. Prior to work proceeding in streamside areas, where it has been determined that vegetation removal will be “below the top of the bank of a stream”, then a written notification must be made to the Ministry. Where necessary, the designated Habitat Officer for the Ministry of Water, Land and Air Protection (MWLAP) will, upon receiving a satisfactory review of the previous year’s work and/or planned work for the upcoming year, accept a Notification for Changes in and About a Stream (Water Act Regulation 204/88) for vegetation removal “below the top of bank” of a watercourse, and will provide details for the protection of habitat to BCH-BCTC prior to undertaking the work.

1.3 PROTOCOL AGREEMENT AND APPROVED WORK PRACTICES

As described above, the management of vegetation in and adjacent to BCH-BCTC ROWs is undertaken to ensure public safety and protect reliability of the system. In riparian areas, this must be undertaken in full recognition of regulatory agency requirements. Mindful of these potentially conflicting factors, BCH-BCTC, DFO and MWLAP (i.e., the Partners) relate their strategic objectives as follows:

**BCH-BCTC**

To meet our line security and public safety obligations in riparian zones in a manner that preserves the functional integrity of aquatic, marine and riparian ecosystems over the long term.

**DFO**

To work toward safe, healthy, productive waters and aquatic ecosystems for the benefit of present and future generations by maintaining the highest possible standards of service to Canadians.

**MWLAP**

To develop, promote and measure achievement of provincial goals for the conservation of living resources (i.e. biodiversity and ecosystem protection); and to manage protected areas and use of the province's fish and wildlife populations to achieve those goals.

In recognition of these strategic objectives, and the need to ensure the protection and sustainability of aquatic, marine and riparian ecosystems, while streamlining regulatory activities, the Partners have developed and ratified a Protocol Agreement for Maintenance Work In and Around Water (PA). A copy of the PA is provided in Appendix A. The AWPRV forms a sub-component of the PA.

**The main features of the PA are:**
• The Partners agree that the work practice documents appended to the PA (e.g., the AWPRV) represent acceptable activities associated with BCH-BCTC’s routine maintenance activities in and around water;
• BCH-BCTC will endeavour to undertake work according to these work practices; and,
• The Regulatory Partners agree that work done according to these work practices constitutes accepted practice and require no additional approvals or notifications. Work proposed, which is not fully consistent with the appended practices, is subject to further review and may require approvals, acceptance of notification or letters of advice.

The main features of the AWPRV are:
• A definition of riparian vegetation maintenance practices that constitute accepted practices and require no additional notification or approvals;
• When maintenance activities deviate from the AWPRV, this document defines the processes for work requiring additional reviews;
• The commitment to schedule, at a minimum, annual meetings (to be coordinated by BCH-BCTC at or in the vicinity of its five main organizational headquarters: Nanaimo, Vancouver, Vernon, Prince George and Terrace) of the regional or area staff to review:
  ➢ results of monitoring reports of previous year’s work, and associated conditions (if any), conducted under the AWPRV;
  ➢ plans for riparian maintenance work in the upcoming year;
  ➢ site-specific prescriptions for riparian maintenance work that is not fully consistent with the AWPRV; and
  ➢ the general efficacy of the working relationship at the local area level.

2. RIPARIAN VEGETATION MANAGEMENT SYSTEM

2.1 INTRODUCTION
A key component of the AWPRV is a stepwise process that outlines a consistent approach to work in riparian areas. This stepwise process, referred to as the Riparian Management Process, is detailed below and shown as a flowchart in Figure 1. The red section headings in Figure 1 refer to sections in this document. The AWPRV also requires training of BCH-BCTC field staff, consultants and contractors. Details of this training are provided in Section 2.2.

The Riparian Management Process includes the following components:
• An ongoing inventory of the location of riparian areas along power line corridors, including information on the waterbody potentially affected;
• Knowledge of site vegetation and environmental conditions to facilitate selection of integrated site maintenance activities;
• Work prescriptions are developed and applied by choosing the best combination of techniques to meet the environmental and safety requirements of individual sites;
• Annual agency review meetings at the regional level to review proposed BCH-BCTC work;
• Effective inspection during progress of work to ensure compliance with the contract specifications;
• Reviews to facilitate revisions and improvement;
• Review techniques and prescriptions used to assess effectiveness and subsequently improve on future prescriptions; and
Annual management reviews with regulatory agencies at the regional level to determine how well prescriptions were implemented in the field and how well the completed vegetation management contracts satisfied regulatory agency needs.

Figure 1 - The riparian management process

2.2 TRAINING

BCH-BCTC personnel, consultants, and regulatory agency staff will be offered the Managing Riparian Vegetation training program. This course will cover issues such as: 1) how to identify waterbodies including classified drainages and non-classified drainages; 2) appropriate riparian vegetation management practices; 3) techniques to minimize unnecessary disturbances within riparian areas; and 4) how to apply the AWPRV in day-to-day work practices.

BCH-BCTC’s first priority is to train its vegetation management staff and consultants on how to apply the AWPRV. Only trained staff and consultants are then able to implement vegetation contracts under the PA umbrella. BCH-BCTC will also ensure that its contractors are able to properly implement its vegetation management needs in riparian areas. The primary method of achieving this is to provide prescriptions and mapping to vegetation management contractors so they know what to do and where to
do it. A minimum level of contractor qualification can be assured by one or more of the following: 1) reviewing their performance on previous riparian management contracts; 2) requiring that their crew leaders have taken a suitable third-party training course; or, 3) if none of these are suitable, BCH-BCTC will require contractors to take the Managing Riparian Vegetation training program.

Training will include a comprehensive package including a trainer’s manual and information handout. This package will be available to regulatory agencies for review at the annual meeting and can be updated as needed.

Application of the work guidelines outlined in the AWPRV is dependent on training according to the following two criteria:

1. **Only individuals who have participated in the “Managing Riparian Vegetation” training program and are either BCH-BCTC employees or consultants who create vegetation management contracts may assign generic riparian vegetation management prescriptions.** Contractors working on vegetation management contracts in the field may not prepare either generic or site-specific prescriptions; and

2. **Only BCH-BCTC staff and/or consultants with training and expertise in managing riparian vegetation in utility corridors can prepare site-specific riparian vegetation management prescriptions.** This training and experience can include: 1) previous experience preparing riparian vegetation management notification plans for regulatory agencies; and/or 2) participation in the “Managing Riparian Vegetation” training program; and/or 3) membership in the Association of Professional Biologists of British Columbia. BCH-BCTC will evaluate the qualifications of its staff and consultants and will maintain a list of those qualified to prepare site-specific prescriptions. These staff and consultants are referred to as Utility Riparian Experts.

### 2.3 STREAM INVENTORY, DATABASE and MAPPING

BCH-BCTC has inventoried many of the waterbodies located in and around its transmission and distribution circuits. These inventories followed procedures that correspond closely to Resource Inventory Committee (RIC) standards. Additional water bodies will be inventoried over time and/or existing hard-copy data will be entered into an electronic database (described below).

Stream inventory information is stored either in binders housed in regional offices or in one of two database systems, depending on the type of electrical system crossing over the waterbody. If the waterbody is crossed by a transmission system, the data can be electronically stored in LAPMAP/EGIS, or, if the waterbody is crossed by a distribution system, the data can be stored in the Distribution Vegetation Management System (DVMS). The two systems are detailed as follows:

**LAPMAP** is a mapping and database system used to record, store, and analyze inventory and mapping information collected from field surveys and is used to develop prescriptions for the vegetation management process. LAPMAP is not a Geographical Information System (GIS); however, considerable information can be stored in databases and linked to map features such as streams, vegetation polygons and structures. Base maps are the large-scale (1:2500) digital ROW maps that are produced by BC Hydro Survey and Photogrammetry and widely used in Transmission. In areas where this mapping does not

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1 **Generic riparian vegetation management prescriptions** are a set of pre-determined management options that depend on the type of vegetation management practice (i.e., slash, prune, or tree removal) and the degree of vegetation removal required as described in Figure 3 (e.g., P1 - P8). See Section 2.4.3 for more detail.

2 **Site-specific riparian vegetation management prescriptions** address the unique needs at the crossing and are prepared by BCH-BCTC personnel or consultants who are specialists in riparian vegetation and fish habitat management. See Sections 2.4.3 and 2.4.4 for more detail.
Currently exist, 1:20,000 Terrain Resource Inventory Maps are used. Overlaid on the base maps are several layers designed for collecting information including: environmentally sensitive areas (riparian, wildlife and cultural); ROW access; structures; property tenure; and vegetation management.

The Distribution Vegetation Management System (DVMS) is a work management system that combines Geographic Facilities Information System mapping with a graphical Windows-based interface. The system has the capacity to record the type and volume of all vegetation management in any given block and organize the work to facilitate the tendering of contracts or the issuing of work orders. The system allows managers to: enter inventory information about a site, trees, and spans of work; view or maintain system tables; raise, issue or cancel work orders; run inquiries on site, work or contracts; and run pre-defined reports.

EGIS is a GIS-based mapping system that is replacing both LAPMAP and DVMS in a staged rollout across British Columbia. Other than its GIS base for data synthesis, the data entry and retrieval modules remain relatively consistent between LAPMAP and EGIS. As BCH-BCTC moves to a GIS-based mapping and database system for managing resources along its ROWs, the stream inventory information will be imported into the GIS database with no expected loss of inventory and prescription information.

2.4 SITE EVALUATION and PRESCRIPTIONS

Essentially all management of vegetation on BCH-BCTC ROWs is undertaken by contractors who bid for this work through a tendering process or who complete small units of work on an hourly basis. For the former work, pre-tender surveys and/or inventories are undertaken in advance of anticipated work to review the condition of vegetation along the powerline and develop contracts. For the latter, the crew foreman is usually provided with detailed information about where and how to manage vegetation. In both cases, all available information for waterbodies within the corridor to be managed (see Section 2.3) will be provided to the vegetation management contractor.

2.4.1 Waterbody Identification

The first step toward protecting riparian and aquatic resources in BCH-BCTC ROWs is to identify and locate them. BCH-BCTC ROWs are crossed by, or parallel, countless man-made and natural drainage networks, some of which provide fish habitat value and some of which don’t. To reduce the frequency of waterbody mis-classification, an effective and efficient procedure is needed to distinguish between waterbodies within BCH-BCTC’s corridors so that protection is afforded to areas containing fish habitat value.

For all riparian vegetation management work governed by this document, the following definitions will be used to help distinguish among different types of waterbodies. Table 1 also summarizes several definitions that help the delineation of aquatic habitat features.

Wetlands - Wetlands are areas of permanently or intermittently standing water that lack significant channel flow and must contain hydrophilic vegetation, subhydric or hydric soils and may have open standing water depths up to 2 m. Wetlands with a clearly defined surface flow inlet and outlet that pass water flows across a ROW or that span entirely across a ROW shall be managed as streams (see below). Wetlands that do not have clearly defined surface flow inlet and outlet shall be managed to protect wildlife habitat values.

Lakes - Lakes are waterbodies with open standing water depths greater than 2 m. All lakes are considered to be fish bearing.

Streams - For the purposes of protecting riparian values in BCH-BCTC ROWs, streams will be identified in the field with the following criteria: A stream is a waterbody flowing on a permanent,
perennial or seasonal basis having a continuous channel bed, whether or not the bed or banks of the stream are locally obscured by overhanging or bridging vegetation or soil mats, if the channel bed:

1. is scoured by water, or
2. contains observable deposits of mineral alluvium.

The primary feature for determining whether a waterbody with a BCH-BCTC ROW is a stream is the presence of a continuous channel bed from the ROW’s upstream edge to its downstream edge. If a continuous channel bed exists, then either one of two other key features must be present demonstrating fluvial processes; that is, where flowing water has:

1. scoured the channel bed at locations throughout the ROW, or
2. deposited any amount of mineral alluvium within the channel at locations throughout the ROW.

Water flow in the channel may be perennial, ephemeral (seasonal), or intermittent (spatially discontinuous).

All streams are assumed to be fish bearing. The information required for classifying a stream as non-fish bearing, and the riparian management practices suitable for these systems, shall be confirmed in local sub-agreements.

Rivers – Rivers are larger versions of streams that contain multiple or braided channels and seasonally inundated floodplains. All rivers are considered to be fish bearing.

Fisheries Sensitive Zones – These areas include waterbodies that don’t meet the above criteria for wetlands, lakes, streams and rivers but that still provide fish habitat value, and may even be fish bearing. Roadside ditches with surface flow connections to downstream streams or rivers, and that are seasonally inundated with water, are good examples of fisheries sensitive zones. Likewise, natural or man-made drainages that do not meet the above criteria but that connect directly with a watercourse identified as a stream within the ROW (e.g., roadside ditch draining directly into a stream within the ROW) are considered fisheries-sensitive zones. BCH-BCTC staff should work with local regulatory agency staff to identify these areas and incorporate them into annual work plans.

Non-Classified Drainages – These are generally low-lying areas that become seasonally or intermittently wetted but that do not meet the above criteria for a wetland, lake, stream, river or fisheries-sensitive zone.
Table 1 - Stream nomenclature and definitions

<table>
<thead>
<tr>
<th>Stream Feature</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active floodplain</td>
<td>An area of land within a boundary that is indicated by the visible high water mark or water level of a stream that is reached during annual flood events as evidenced by riparian area conditions</td>
</tr>
<tr>
<td>Fish-bearing stream</td>
<td>A stream in which fish are present or potentially present. Fish presence must be assumed in streams intersecting BCH-BCTC ROWs if evidence to the contrary is not provided</td>
</tr>
<tr>
<td>Non-fish-bearing stream</td>
<td>A stream that is not inhabited by fish, but provides water, food and nutrients to a downstream fish-bearing stream or other waterbody</td>
</tr>
<tr>
<td>Ravine</td>
<td>A narrow, steep-sided valley that is commonly eroded by running water and with slope grades greater than 60%</td>
</tr>
<tr>
<td>Top of ravine bank</td>
<td>The first significant break in a ravine slope where the break occurs such that the grade beyond the break is flatter than 50% for a minimum distance of 15 metres measured perpendicularly from the break, and the break does not include a bench within the ravine where the grade is less than 50% for more than 15 m</td>
</tr>
</tbody>
</table>

2.4.2 Riparian Vegetation Management Areas

Aquatic ecosystems will be protected by adjacent Riparian Vegetation Management Areas (RVMA), within which special vegetation management activities can continue while still meeting the needs of both aquatic ecosystems and the electrical circuit. RVMAs extend from the Top of Bank (TOB) in a direction perpendicular to the general orientation of the waterbody. Unless defined in site-specific prescriptions (see Section 2.4.3) prepared for agency review, this distance will always be at least 15 m. Figure 2 displays examples of two different waterbodies and shows the location of their TOB and extent of their RVMA.

- The TOB for wetlands is located at the point where the vegetation shifts from plants adapted to permanently wetted soils (e.g., cattails) to terrestrial vegetation intolerant of this soil type.
- The TOB for lakes (and marine coastlines) is measured from the high-water mark or, if the lake is surrounded by wetland vegetation, the TOB is established at the point where wetland vegetation changes to terrestrial vegetation.
- The TOB of streams, rivers and other fisheries-sensitive zones can be determined in the field from the following features: 1) the upper elevational extent of gravel and cobble point bars on the inside of meander bends (point of active floodplain formation); 2) well defined points of undercutting or bank erosion; 3) a marked change in vegetation such as a change between unvegetated gravel bars and terrestrial shrub and herbaceous species as well as visible signs of erosion at tree roots; 4) visible change in the size distribution of surface sediments such as the change from sand to gravel or fine gravel to cobble; 5) prominent changes in slope between the banks of the stream channel and adjacent floodplain areas; and lines of sediment, lichen, or mosses on stable substrates and bedrock plants.
- The TOB in larger systems is located at the outside edge of an active floodplain (area occupied by standing or flowing water during the 1 in 5 year flood event). In these systems, the floodplain is included within the RVMA.
• The TOB for streams or rivers located within a steep-sided gorge (slope > 60%) is located at the break in slope where the sidewall slope reduces to less than 50%. This point is referred to as the top of ravine bank (See Table 1).

![Figure 2 - Examples of Top of Bank location and riparian vegetation management area](image)

In special situations where field crews are unable to establish the TOB or floodplain, an experienced fisheries biologist or fluvial geomorphologist will be required to establish these features in the field.

### 2.4.3 Prescriptions for Managing Riparian Vegetation

The main methods for managing riparian vegetation include pruning, slashing, mowing, topping, girdling, hinging and hazard/danger tree removal.

- **Pruning** involves the removal of tree branches away from the lines and is completed on a cycle that varies from 2 to 6 years depending on the growth of the trees. Only vegetation contractors who are trained to work close to power lines can undertake pruning of limbs in close proximity to energized wires. Proper arboricultural practices are used to maximize clearance from the lines using methods that will minimize impacts on tree health. Pruning does not normally kill the tree.

- **Slashing** involves the removal by hand of vegetation that will eventually grow into power lines; it is a commonly used manual vegetation management technique using tools such as chain saws, circular brush saws, or other hand-held equipment. Slashing normally kills conifer trees but usually promotes regrowth of deciduous tree species.

- **Mowing** is the cutting of vegetation with heavy-duty rotary or flail cutters. A tractor, excavator or hydroaxe is equipped with the cutter and driven over the ROW to cut target species. Mowing has similar vegetation control effects as slashing. Mowing normally kills conifer trees but usually promotes regrowth of deciduous tree species.

- **Topping** involves cutting the crown of a tree or shrub above the lowest branches so that the plant remains alive following management. Topping does not normally kill a tree, so it is not considered to be a form of vegetation removal.

- **Girdling** involves removing strips of the tree’s outer cambium layer in complete rings around the tree’s trunk below the lowest-growing branches. This technique only works for certain tree species and its effectiveness changes with trunk diameter and time of year. This technique requires special tools and experienced crews. Girdling is intended to kill a tree but only does so gradually over a period of two to four years, during which time surrounding vegetation regrows. It is therefore, considered to provide partial vegetation removal.

- **Hinging** involves cutting partially through the trunk of a small tree and pushing it over horizontal to the ground. This technique requires experienced crews. Hinging does not normally kill a tree but it...
does significantly reduce crown cover. It is, therefore, considered to provide partial vegetation removal.

- Hazard trees are those that have a potential to fail due to a flaw or defect, are in an environment which may contribute to a failure (e.g., saturated ground), and/or a person or object would be injured or damaged if the tree failed. Danger trees are trees whose geometry is such that, in the process of falling down, the tree would either contact the circuit or pass within the circuit’s limits of approach. Danger trees are often removed from high-priority ROWs where maintaining circuit integrity is paramount.

Instructions to BCH-BCTC vegetation contractors on how to manage riparian vegetation are provided by either generic or site-specific prescriptions. The level of complexity required to protect riparian resources will determine when a site-specific prescription is chosen over a generic prescription.

Where detailed inventories of waterbody crossings are not available prior to letting a vegetation management contract, a single generic prescription may be incorporated into a contract to cover all riparian areas managed by it.

The first priority in managing vegetation within the RVMA is to observe a 15 m RVMA and maintain as much existing shrub and tree vegetation within the RVMA as possible. The latter is achieved by the % retention objective of removing to the ground no more than one-third of woody vegetation cover within the RVMA. Alternatively, up to one-half of woody vegetation cover can be removed from within the RVMA, provided that the area is replanted according to the guidelines in Appendix B (see Figure 3).

Within the constraints of conductor clearance, vegetation stand density and complexity, vegetation management cycle and % retention objectives, the following hierarchical list of management techniques should be followed when managing target vegetation within the RVMA:

1) Pruning;
2) Girdling specific target species that respond favorably to this technique;
3) Tall slashing of small-diameter targets
4) Slashing of specific target species that are normally killed by this technique or that do not respond favorably to girdling;
5) Topping specific targets; and,
6) Mowing selective patches of target species.

If the 15 m RVMA width and % retention objectives outlined above can be met, the work can be prescribed through a generic prescription (see below) prepared by qualified personnel (see Section 2.2), and regulatory agency review of the work (see Section 2.6) is not required.

Alternately, at some locations a 15 m RVMA width and/or vegetation retention objectives cannot be met for effective and safe maintenance of the electrical corridor. Or a riparian area may be very complex, requiring a detailed set of management instructions to safely manage it for the needs of both the aquatic ecosystem and the electrical circuit. In these situations, a site-specific prescription (see below) prepared by qualified personnel (see Section 2.2) is required. If a site-specific prescription involves a RVMA width < 15 m and/or the removal of > 1/3 of woody vegetation without replanting, it must be submitted to regulatory agencies for review (see Section 2.6) prior to implementation.

Submission of prescriptions will occur either at the annual agency review meeting (Section 2.6) or throughout the year as vegetation maintenance work proceeds. If the 15 m RVMA width and 2/3 woody vegetation retention criteria (or ½ woody vegetation retention in conjunction with replanting) can be met in a site-specific prescription, prior regulatory agency review (Section 2.6) is not required.
GENERIC PRESCRIPTIONS – A flow chart is shown in Figure 3 that matches the method of vegetation management and amount of vegetation removal with the appropriate generic management prescription. This flow chart leads to six different generic prescriptions (P1 through P6) and two other categories (P7 and P8) that require additional investigation. While preparing vegetation management contracts, qualified personnel should evaluate each waterbody in the corridor and either assign a generic prescription to the RVMA around the waterbody using Figure 3, or create a site-specific prescription. A single generic prescription can also be assigned to groups of similar waterbodies along an electrical circuit.

In the main, riparian vegetation managed under roadside distribution circuits will be done under the guidance of generic prescriptions (see Fig. 3). Generic prescriptions can also cover riparian sites in transmission corridors and cross-country distribution corridors. However, removal of large-diameter trees (DBH > 15 cm) within these corridors shall not be limited to 3 as indicated in Figure 3, but instead will be limited by the allowable removal of up to 1/3 of woody vegetation cover within the RVMA.

Complex riparian sites with an abundance of target species and limited conductor-to-ground clearance, or several riparian areas in close proximity to each other, in either distribution or transmission corridors, require site-specific prescriptions.

SITE-SPECIFIC PRESCRIPTIONS – In the main, site-specific prescriptions will mostly be used at complex riparian sites in transmission corridors, but may also be required at complex distribution sites. They can involve multi-year management objectives for a single site (see Appendix C) and other special details specific to the site. Utility riparian experts (Section 2.2) should prepare site-specific prescriptions.

2.4.4 Considerations For Site-Specific Prescriptions

Qualified BCH-BCTC personnel or consultants (see Section 2.2) prepare site-specific prescriptions. The protocol for preparing these prescriptions generally involves assessing the biological and physical condition of a site and individual plants are evaluated for their immediate and potential threat to the circuit. Based on the site visit findings, a plan is prepared for the removal of tall-growing vegetation over one or several years to minimize the impact of vegetation management in any one year. Low-impact vegetation management techniques such as girdling, hinging or topping are also prescribed in this plan. Additionally, riparian re-planting, LWD addition or other fish habitat and bank stabilization techniques may also be incorporated into the site-specific prescription. An example of a site-specific riparian vegetation management prescription is provided in Appendix C.

These prescriptions incorporate the unique needs of each ecosystem into the management plan and can include, but are not limited to:

- Vegetation growth rates and conductor-to-ground clearance - can vegetation removal be economically staged to minimize impacts while ensuring line security?;
- The RVMA width required to adequately protect the waterbody. All prescriptions with an RVMA less than 15 m must be identified for submission to regulatory agencies for review prior to implementation;
- Amount of woody vegetation cover requiring removal;
- Girdling, hinging and/or crown reduction versus total tree removal;
- Site access and vegetation removal methods in lands adjacent to the RVMA (e.g., mowing, slash, cut and treat, etc.);
- Considerations to limit machine access to certain parts of the RVMA to avoid ground disturbance;
- Locating a stream crossing to minimize the risks of impacting fish habitat and water quality. A detailed location description such as “only cross the stream directly under the left phase of 5L75” may be required to insure adequate levels of protection. Similarly, consider flagging the location of a stream crossing in the field;
• Bank stability;
• Are fish present, plus timing and location of specific life histories (e.g., is spawning habitat located nearby a proposed work area?);
• Social values;
• Special wildlife needs of habitat (e.g., bird nests; browse habitat; small mammal habitat, migratory corridors, etc.);
• Ability of management options to satisfy needs of electrical circuit in a timely, safe and efficient manner;
• Should the RVMA be flagged so that machine operators can recognize the management area (e.g., flat terrain with dense vegetation cover);
• Wood debris management requirements and special areas to stack, or not to stack, woody debris, and;
• Is a replanting and monitoring program required.

The amount of woody vegetation suitable for removal within a RVMA depends on the amount of target and non-target vegetation within the RVMA. Table 2 provides an example of removal and retention objectives for various densities of target vegetation within the RVMA. Please note that this is only an example and that local experience and regionally specific management techniques should improve upon it.

Table 2 - Example riparian vegetation management options for various densities of target vegetation assuming 100% woody vegetation cover

<table>
<thead>
<tr>
<th>% of woody vegetation cover within RVMA comprised of:</th>
<th>Total % of target woody vegetation cover</th>
<th>% of targets requiring management technique other than complete removal¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>acceptable for complete removal</td>
<td>% of target trees</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>83</td>
<td>40</td>
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<td></td>
<td>66</td>
<td>50</td>
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<td></td>
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<tr>
<td></td>
<td>37</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes:
¹ All target vegetation may be pruned, tall slashed or topped while up to an additional 33% of targets may be girdled or hinged. Alternatively, up to 50% of woody vegetation cover may be completely removed if the site is replanted per the guidelines in Appendix B.

2.4.5 Prioritization of Slash Areas and Tree Removal

One of the main priorities for slash and tree removal in riparian areas is the maintenance of fish habitat and streambank integrity. Target vegetation that is integral to fish habitat and/or bank stability (e.g., the plant’s roots protrude through the streambank) and that is alone by itself along the streambank should not be removed wherever possible and should instead be topped or pruned. If this vegetation must be removed, appropriate measures to maintain fish habitat and bank stability (e.g., aggressive tree replacements and/or in-stream LWD additions) should be addressed as part of a site-specific prescription. Conversely, target vegetation that is integral to fish habitat and/or bank stability can be removed if it is surrounded by abundant woody non-target vegetation that is also integral to fish habitat and/or bank stability.
2.4.6 Special Considerations for Managing Riparian Areas Around Non-Fish-Bearing Streams, Fisheries-Sensitive Zones, Isolated Wetlands and Non-Classified Drainages

**NON-FISH-BEARING STREAMS** – The information required for classifying a stream as non-fish bearing, and the riparian management practices suitable for these systems, shall be confirmed in local sub-agreements.

**ISOLATED WETLANDS** – Isolated wetlands do not have clearly defined surface flow outlets. There are no restrictions on the amount of vegetation that can be removed from the RVMA around isolated wetlands, but attention shall be given to protecting wildlife habitat in these areas such as migration routes, browse habitat, perches and nesting areas. Restrictions on the use of heavy equipment and other measures to prevent ground disturbance near these areas shall also be observed.

**NON-CLASSIFIED DRAINAGES** – Drainages crossing BCH-BCTC ROWs that do not meet the criteria for classification as streams or wetlands are non-classified drainages. Non-classified drainages do not require an RVMA and there is no restriction on the removal of vegetation from around them. The main objective for managing these areas is to prevent heavy machinery from disturbing soft soils around them and preventing erosion and debris from clogging drainage structures.

### 2.5 CONTRACT SPECS and WORK PROGRAM

Contracts will be prepared according to BCH-BCTC guidelines. The following general environmental protection guidelines are included in all vegetation management contracts and must be adhered to while working in or near riparian buffer areas:

- No deleterious substances allowed to enter the watercourse;
- Pesticide use must comply with applicable Pesticide Use Permit;
- Tracks or tires from heavy equipment may not enter the RVMA unless detailed in a prescription;
- No crossing through streams by vehicles and/or heavy machinery (unless at an existing road or ford crossing) is permitted unless detailed as a special provision in a site-specific prescription.
- No debris to remain within the high-water mark or placed into a stream without specific regulatory agency approval;
- No bank disturbance to occur without specific regulatory agency approval;
- No refuelling of hand tools (chainsaws, etc.) within at least 15 m of a waterbody;
- Disturbance of low-growing shrub or grass species is kept to a minimum;
- Trees are directionally felled away from stream banks and aquatic areas to the extent allowed by the need to maintain safe working clearances from the electrical system;
- Required site restoration is completed during optimal seasonal timing (e.g., planting is best done in the spring and fall); and
- Vegetation clearing contractors may only work within 15 m of a waterbody for which a generic or site-specific prescription is provided.

### 2.6 ANNUAL AGENCY REVIEW

As per the PA, BCH-BCTC will meet annually on a regional level with regulatory agencies to discuss where, when and how work will occur for the ensuing year in both transmission and distribution corridors. These meetings will occur in or near BCH-BCTC’s five main regional headquarter offices: Vancouver, Nanaimo, Vernon, Prince George and Terrace. The annual review should represent an opportunity for agency staff to identify temperature-sensitive streams or other similarly impacted streams that will be affected by the ensuing year’s work.
Only riparian areas that cannot be managed with a 15 m RVMA and retention of 2/3 of the woody vegetation cover within the RVMA (or one-half followed by re-planting, per the guidelines in Appendix B) will be discussed in detail at the annual agency review meetings (see Section 2.4). Riparian management work for the ensuing year will be organized by distribution and/or transmission corridor. Riparian management work in transmission corridors will be organized into three groups based on the level of prescription detail available for each site. These groups are: 1) work in riparian areas that have been inspected and prescribed, 2) work in riparian areas that have not yet been inspected but that will be inspected and prescribed prior to letting contract; and 3) those that will not be inspected or prescribed in advance of letting the contract. Site-specific riparian management prescriptions (see Section 2.4) will not be prescribed for the latter sites but instead, generic prescriptions for RVMA width and vegetation retention will be followed.

Overall, the areas where BCH-BCTC must work and the waterbodies affected by this work are the critical pieces of information to be conveyed at the annual agency review meetings.

The general agenda for these annual meetings will include at least the following:
- Purpose of annual review;
- Review previous year’s work, and resolve issues;
- Review the specific objectives and efficacy of site specific prescriptions;
- Review regionally specific concerns such as temperature-sensitive streams and ford crossings;
- Review proposed work areas and prescriptions;
- Amend and modify prescriptions as necessary; and
- Prepare terms and conditions of the issuance of letters of advice / Receipt of Notification.

2.7 FINALIZE and LET CONTRACT
Administer contracts as per BCH-BCTC guidelines.

2.8 INSPECT SITE and CONFIRM OPTIONS
Inspect sites and confirm vegetation management prescriptions per BCH-BCTC guidelines. To facilitate later review of vegetation management contracts that included riparian management work, wherever possible, record separately the following information:
1. the contract number;
2. company name and name of site foreman;
3. name(s) and/or locations of waterbodies affected by contract and the type of prescription applied to each; and
4. contract start and end dates

2.8.1 Environmental Incidents
All environmental incidents reported by the contractor or discovered during the job inspection should be reported to the local BCH-BCTC vegetation maintenance manager, BC Hydro Engineering’s Environmental Services, the Regional Environmental Coordinator and/or the Regional Vegetation Biologist. The appropriate regulatory agency regional office should also be notified within 24 hours of the incident’s occurrence. The job manager must also enter the incident into BC Hydro’s environmental incident reporting system (URL: http://edmssapp1/env_incident_rpt/).
2.9 ANNUAL MANAGEMENT REVIEW

The PA commits the Partners to an annual review of the general effectiveness and workability of this PA, which can include the effectiveness of how the AWPRV is applied at both Provincial and local area levels. This review will be undertaken by a Governance Committee comprised of representatives from each of the Partners. Please see the PA (Appendix A) for more detail.

3. GLOSSARY OF TERMS

AWPRV – Approved Work Practices for managing Riparian Vegetation. The document summarizing BC Hydro Transmission and Distribution’s approach to managing riparian vegetation within the scope of its Memorandum of Understanding for work in and around water with Fisheries and Oceans Canada and BC’s Ministry of Water, Air and Land Protection.

BCH-BCTC – BC Hydro Distribution and British Columbia Transmission Corporation

DFO – Fisheries and Oceans Canada

Limits of approach - the distance a person, machine, or conductive material can safely approach energized conductors

PA – Protocol Agreement for Maintenance Work In and Around Water. This document has been prepared in partnership with the Department of Fisheries and Oceans (DFO) and the Ministry of Water, Air and Land Protection (MWALP). The PA and AWPRV are consistent with BCH-BCTC’s environmental strategy, especially the last key component mentioned above, because they allow BCH-BCTC to manage riparian vegetation on their own recognizance. They also address other key aspects of the strategy, such as training of staff and monitoring of activities to ensure performance and compliance.

MWLAP – BC’s Ministry of Water, Land and Air Protection

ROW – Rights-Of-Way. A term used to describe limited interests in land which provide the right to utilize the property, for specific purpose(s), without having full ownership.

RVMA – Riparian Vegetation Management Area

TOB – Top of Bank – The point adjacent to a waterbody where the waterbody’s RVMA begins. See Section 2.4.2 for more detail.
Figure 3 – Vegetation management decision matrix for generic prescriptions

### NO

<table>
<thead>
<tr>
<th>WHEN THE PRIMARY LINE THREAT IS GROWTH FROM BELOW OF SMALL-DIAMETER TREES (i.e., DBH &lt; 15 cm) AND LARGE SHRUBS. ALSO INCLUDES LARGE TREES (DBH &gt; 15 cm) IN TRANSMISSION AND CROSS-COUNTRY DISTRIBUTION CORRIDORS. DEBRIS TO BE HANDLED ACCORDING TO A DEBRIS MANAGEMENT PLAN.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SLASH</strong></td>
</tr>
<tr>
<td>- When the primary line threat is growth from below of small-diameter trees, branches can be redirected away from the lines in a way sufficient to maintain the block cycle.</td>
</tr>
<tr>
<td><strong>PRUNE</strong></td>
</tr>
<tr>
<td>- When the primary line threat is from side growth of stable trees, branches can be redirected away from the lines in a way sufficient to maintain the block cycle.</td>
</tr>
</tbody>
</table>

### YES

<table>
<thead>
<tr>
<th>WHAT WORK IS NEEDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRUNE</strong></td>
</tr>
<tr>
<td><strong>Prescription P2</strong></td>
</tr>
<tr>
<td>- Do required pruning</td>
</tr>
<tr>
<td>- Remove all debris to a location above the waterbody’s high-water mark</td>
</tr>
<tr>
<td>- Follow all precautions</td>
</tr>
<tr>
<td>- Explore techniques to prevent resprout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>REMOVE &lt;1/3 OF WOODY VEGETATION COVER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prescription P3</strong></td>
</tr>
<tr>
<td>- Slash/girdle target vegetation</td>
</tr>
<tr>
<td>- Remove all debris to a location above the waterbody’s high-water mark</td>
</tr>
<tr>
<td>- Follow all precautions</td>
</tr>
<tr>
<td>- Explore techniques to prevent resprout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>REMOVE 1/3 – 1/2 OF WOODY VEGETATION COVER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prescription P4</strong></td>
</tr>
<tr>
<td>- Slash/girdle target vegetation</td>
</tr>
<tr>
<td>- Remove all debris to a location above the waterbody’s high-water mark</td>
</tr>
<tr>
<td>- Replace area following planting guidelines in Appendix B</td>
</tr>
<tr>
<td>- Follow all precautions</td>
</tr>
<tr>
<td>- Explore techniques to prevent resprout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>REPAIR &gt;1/2 OF WOODY VEGETATION COVER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prescription P5</strong></td>
</tr>
<tr>
<td>- Cut tree down but do not remove stump</td>
</tr>
<tr>
<td>- Remove all debris to a location above the waterbody’s high-water mark</td>
</tr>
<tr>
<td>- Follow all precautions</td>
</tr>
<tr>
<td>- Explore techniques to prevent resprout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>REPAIR 1/3 – 1/2 OF WOODY VEGETATION COVER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prescription P6</strong></td>
</tr>
<tr>
<td>- Remove debris to a location above the waterbody’s high-water mark</td>
</tr>
<tr>
<td>- Follow all precautions</td>
</tr>
<tr>
<td>- Explore techniques to prevent resprout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TREES REMOVAL</strong> (ROADSIDE DISTRIBUTION CORRIDORS ONLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- When trees (DBH &gt; 15 cm) pose a threat from the side or from below a distribution line because of an indication of a visible hazard of the whole tree or by a branch, both of which are likely to lead to failure.</td>
</tr>
<tr>
<td>- Would also include instances where other methods are unsafe, impractical or environmentally inappropriate.</td>
</tr>
<tr>
<td>- Debris may be used as Large Organic Debris (LOD) on land, if appropriate.</td>
</tr>
</tbody>
</table>

### GETTING HELP

<table>
<thead>
<tr>
<th>WHAT IS THE EXTENT OF THE WORK NEEDED?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Significant Impact</strong></td>
</tr>
<tr>
<td>- Potential impacts are sufficient enough to require consultation with appropriate regulatory agencies (MWALP and/or DFO) prior to undertaking the work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Prescription P8</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Is there an underlayer of soil present consisting of a dense and complex mix of diverse woody plant species?</td>
</tr>
<tr>
<td>- How many significant trees?</td>
</tr>
<tr>
<td>- How many must be removed?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Prescription P9</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Is it possible to remove no more than 3 target trees and release conifers, desirous lower-growing species or juvenile deciduous tree?</td>
</tr>
<tr>
<td>- Can the tree be made into a wildlife tree or topped?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Prescription P10</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Do no work prior to seeking assistance from qualified personnel or submit notification letter to regulatory agency (MWALP and/or DFO) and await approval</td>
</tr>
</tbody>
</table>

### MISSION CRITIQUE

- **No work required**
- **Remove >1/2 of trees**
- **Remove 1/3 – 1/2 of trees**
- **Remove <1/3 of trees**
Appendix A
Protocol Agreement for Maintenance Work in and Around Water
Appendix B - Riparian Planting Standard

The following planting standard is to be used in conjunction with the Approved Work Practices for Managing Riparian Vegetation (AWPRV). The standard will be applied when the Utility Riparian Expert determines that a riparian ecosystem will be compromised as a result of vegetation maintenance requirements.

The planting standard is designed to maintain riparian zone function. In cases where tree removal negatively impacts the site, replanting will occur in a well-planned and efficient way. When planning total tree removal that may directly effect stream function, the goal of the planting will be to create stable, low growing plant communities that still produce shading, bank stability and input of organic debris.

Planting Design / Planting Criteria:

- Where planting is to be carried out, the Utility Riparian Expert will advise on specific planting layout. The planting layout will depend on what is required to reestablish or enhance an existing riparian zone; i.e., species selected, density of plants, mature plant heights and planting system: linear, random, grid etc.
- Where possible, choose native plant materials. Local stands of willow or other suitable species are already well suited to the climate, soil conditions and available moisture and they make good candidates for survival. Cost efficiencies are possible using on-site native materials because plant costs are limited to labor for harvesting and handling. Do not remove plants from neighboring riparian habitats or from lands within Federal or Provincial Parks without prior approval. If a good local source is only found within Park boundaries, contact the area parks supervisor for approval.
- To produce on-site biodiversity, a mix of suitable species should be planted in a random layout design leaving gaps so that natural biodiversity can be produced. Modify existing tall vegetation by crown reducing, as this will produce shrub trees that in most cases grow more laterally than vertical.
- Arrange planting programs in late fall (September to November) or early spring (March to April) as planting is most effective when installed during the dormant season.
- When choosing live material, remember that young (less than 1 year old) wood or suckers will often sprout easier under optimum conditions, but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout and the older wood is much stronger.
- Either plant cuttings immediately or soak for a minimum of 24 hours and plant immediately following removal from the soaking bath.
- Tree stock should be a minimum of 0.5 meters in height when purchased. The quantity of stock planted should ensure at least 80% take, or replanting will be required.

Plant Species

The following species are recommended for use in riparian replacement planting. Not all species can be successfully harvested from local conditions and can be used in a live staking program. Where ever possible collecting local plant material will help with survival because that specific provenance will be best adapted to local conditions. The following table summarizes the riparian plant species that grow best in the three generalized regions of British Columbia.
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Coastal</th>
<th>Southern Interior</th>
<th>Northern</th>
</tr>
</thead>
<tbody>
<tr>
<td>alder, green</td>
<td>Alnus crispa ssp. crispa</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>alder, mountain</td>
<td>Alnus incana ssp. tenuifolia</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>alder, Sitka</td>
<td>Alnus crispa ssp. sinuata</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>beaked hazelnut</td>
<td>Corylus cornuta</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>black twinberry</td>
<td>Lonicera involucrata</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>cascarilla</td>
<td>Rhamnus purshiana</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>common snowberry</td>
<td>Symphoricarpus albus</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>devil’s club</td>
<td>Oplopax horridus</td>
<td>X</td>
<td>X</td>
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<tr>
<td>elderberry, blue</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>elderberry, red</td>
<td>Sambucus racemosa</td>
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<tr>
<td>hardhack</td>
<td>Spiraea douglasii ssp. douglasii</td>
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<td></td>
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<tr>
<td>hawthorn, black</td>
<td>Crataegus douglasii</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hawthorn, red</td>
<td>Crataegus spp. (includes C.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>columbiana, C. macracantha, C.</td>
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<tr>
<td></td>
<td>chrysocarpa)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>highbush cranberry</td>
<td>Viburnum edule</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Indian plum</td>
<td>Oemleria cerasiformis</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>maple, Douglas</td>
<td>Acer glabrum var. douglasii</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>maple, vine</td>
<td>Acer cincinnatum</td>
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<td></td>
</tr>
<tr>
<td>Pacific ninebark</td>
<td>Physocarpus capitatus</td>
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<td>Wet-belt S of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shuswap Lake only</td>
<td></td>
</tr>
<tr>
<td>red osier dogwood</td>
<td>Cornus stolonifera</td>
<td>X</td>
<td>X</td>
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<tr>
<td>stink currant</td>
<td>Ribes bracteum</td>
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<tr>
<td>northern black currant</td>
<td>Ribes hudsonianum</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>black gooseberry</td>
<td>Ribes lacustre</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>red swamp currant</td>
<td>Ribes triste</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>rose, Nootka</td>
<td>Rosa nootkana</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>rose, prickly</td>
<td>Rosa acicularis</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>felt-leaved willow</td>
<td>Salix alaxensis</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>little-tree willow</td>
<td>Salix arbusculoides</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bebb willow</td>
<td>Salix bebbiana</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pussy willow</td>
<td>Salix discolor</td>
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<tr>
<td>Drummond willow</td>
<td>Salix drummondianna</td>
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<td></td>
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<td>sandbar/coyte willow</td>
<td>Salix exigua</td>
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<td>grey-leaved willow</td>
<td>Salix glauca</td>
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<td></td>
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<td>Hooker willow</td>
<td>Salix hookeriana</td>
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<td>QCI only</td>
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<tr>
<td>Mackenzie willow</td>
<td>Salix prolicia</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>balsam willow</td>
<td>Salix pyrifolia</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sitka willow</td>
<td>Salix sitchensis</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>salmonberry</td>
<td>Rubus spectabilis</td>
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<tr>
<td>Saskatoon</td>
<td>Amelanchier alnifolia</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Amelanchier florid</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sitka mountain ash</td>
<td>Sorbus sitchensis</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>smooth sumac</td>
<td>Rhus glabra</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>thimbleberry</td>
<td>Rubus parviflorus</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>wolf-willow</td>
<td>Elaeagnus commutata</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Western yew</td>
<td>Taxus brevifolia</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

* denotes fruit-bearing species used by birds or wildlife
# denotes a species which may have locally adapted habitat needs; check before use in planting area
^ denotes a species that can grow more than 8 m tall in certain conditions; check for adequate line clearance
LIVE CUTTINGS

Definition:
- Live cutting planting involves the insertion and tamping of live, vegetative cuttings into the ground in a manner that allows the stake to take root and grow. Live cutting requires the selection of plant species suitable for cutting (e.g., willow sp., dogwood, etc.) because not all shrub species are suitable for this technique.

Purpose:
- Using a system of live cuttings creates a root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture.
- Live cutting performs an important function of stabilizing and modifying the soil and stream banks serving as a pioneer species until other plants become established.
- Live cutting enhances conditions for natural invasion and the establishment of other plants from the surrounding plant community.
- Plant establishment can improve aesthetics and provide fish and wildlife habitat.

Planning Consideration:
- Live cutting harvest and installation should be performed during the dormant season, late fall to early spring (November to April). Do not over-harvest the parent plant sources and discourage the transplanting of whole shrubs.
- Use site reconnaissance to identify species, growth form, soil and site conditions on adjacent sites and compare their conditions to the planting site. Planting will be more successful as soil, site and species selected match stable, vegetated nearby sites. If the native species that you want to plant are not found in the vicinity, using live cuttings may not be a good option.
- Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins.

Harvesting:
- Special approvals are needed for harvesting cuttings from parks, ecological reserves and private land so establish the property condition of all donor sites prior to harvesting.
- Cuttings shall be harvested and planted when the chosen species, are dormant. When harvesting cuttings, select healthy, live wood that is reasonably straight. This period is generally from late fall to early spring (November to April), or before the buds start to break.
- Use live wood at least 1 year old or older. Avoid suckers of current year’s growth as they lack sufficient stored energy reserves to sprout consistently. The best wood is 2-4 years old with smooth bark that is not deeply furrowed.
- Make clean cuts with unsplit ends. Trim branches from cutting as close as possible to the main stem. The butt end of the cutting shall be pointed or angled and the top end shall be cut square.
- Identification of the top and bottom of a cutting is accomplished by angle cutting the butt end. The top, square cut, can be painted by spraying the top 1-2 inches (2.5 - 5 cm) with a latex paint (navy blue is preferred). This procedure will assure the stakes are planted with the top up, and makes the stakes more visible for subsequent planting evaluations.

Diameter:
- Cuttings should generally be ¼ inch (2 cm) in diameter or larger depending on the species. Highest survival rates are obtained from using cuttings up to 2 inches (5 cm) in diameter. Larger diameter cuttings (3 inch or 7.5 cm) are needed for planting in rocky conditions.

Length:
- Cuttings of small diameter (up to 1½ inches (4 cm)) shall be 18 inches (0.5 m) long, minimum. Thicker cuttings should be longer. (0.5 to 1 meter)
- It is imperative that cuttings should be long enough to reach into the mid-summer water table.
• Cuttings should be cut so that a terminal bud scar is within 1-4 inches (2.5-10 cm) of the top.
• At least 2 buds and / or bud scars shall be above the ground after planting and at least 3 buds planted below ground

**Installation:**
• Cuttings must not be allowed to dry out. If cuttings will not be planted the same day they are harvested, they should be soaked in water for a minimum of 24 hours. Soaking significantly increases the survival rate of the cuttings.
• Cuttings must be planted with butt-ends (i.e., angled cut) into the ground. Leaf bud scars or emerging buds should always point up.
• Within the planting plan layout, plant stakes 0.5 to 1m apart.
• Set the stake as deep as possible into the soil, preferably with **80 percent of its length into the soil** and in contact with mid-summer water table.
• It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting.
• Use an iron stake or bar to make a pilot hole in firm soil.
• Do not damage the buds, strip the bark or split the stake during installation.
• Split or damaged stakes shall be removed and replaced.

**Inspection and Maintenance:**
• Periodic inspection, repair and maintenance will be required during the first two years or until the vegetation is established.

**GROUND SEEDING:**
Ensure that all seed mixes do not contain seeds of designated noxious weeds. If ground seeding is required due to the disturbance of the area around where trees and or vegetation have been removed, one of the following mixes should be used to encourage a tight competitive grass growth to restrict the amount of unwanted tall growing tree seedlings. Do not use these seeding mixtures within Federal or Provincial Park boundaries without first consulting the area park manager.

• Seeding reduces surface erosion, enhances the soil's absorption and retention of water and promotes establishment of suitable soil conditions for larger plants. Generally, a combination of 2-5 species of sod-forming grasses, bunch grasses and nitrogen-fixing legumes are required, depending on soil type, climate, soil moisture and species compatibility.

General-purpose seeding mixtures specific to the three main regions of BC would include:

<table>
<thead>
<tr>
<th>Richardson Coastal Reclamation Mix</th>
<th>Dawson’s Coastal Reclamation Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>35% Creeping red fescue; 20% Orchard grass; 10% Perennial ryegrass; 10% Timothy; 10% Italian ryegrass; 8% Alsike clover; 5% White clover; 2% Browntop</td>
<td>20% Creeping Red fescue; 10% Orchard grass; 18% Wild ryegrass; 10% Annual ryegrass; 10% Meadow fescue; 5% Meadow foxtail (coated); 2% Redtop; 10% White clover; 10% Alsike clover</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Northern Interior Reclamation Mix</th>
<th>Southern Interior Reclamation Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>30% crested wheat grass; 30% crested red fescue; 20% timothy; 5% white clover; 5% red clover; 10% sweet clover</td>
<td>15% Mobite Orchardgrass; 10% Crested Wheatgrass; 15% Tall Fescue; 10% Alma Timothy; 15% Creeping Red Fescue; 3% Kentucky Bluegrass; 2% Redtop; 10% Meadow Foxtail (Coated); 5% White Clover (Green-Kot); 5% Alfalfa; 5% Red Clover; 5% Alsike Clover (Green-Kot)</td>
</tr>
</tbody>
</table>

1 Note that Alsike is not always available and some substitutions are made from 5% Alsike to 0% with Red Clover increasing from 5% to 10%.
Seeding
- Seed area during early spring or after 15 August to within 2 weeks of freeze up. This is a general rule of thumb to ensure a time period when ground moisture is at its highest providing the greatest chance for good seed uptake.
- Sow half of the required amount of seed in one direction and the remainder at right angles.
- Incorporate seed into a minimum depth of 6 mm (1/4”) simultaneously or within one hour after seed operation. Mix carefully into the soil with a light chain harrow or wire rakes.
- If practical water with a fine spray, avoiding washing out of the seed. Apply enough water to ensure penetration of a minimum 50mm (2”).
- Adjustments to the seeding mixture should be incorporated site-specific needs and local human uses of land. For example, fescue should be omitted from the reclamation mixture near planted agricultural fields.

Seeding Rate
- Grass-legume ratio should be 70:30 in wet areas and 80:20 in dry areas.
- Dry seeding should be done at a minimum rate of 80 kg/ha. Seeding in the Southern Interior works best at 60 kg/ha
- In coastal areas, fertilize with 19-20-12 or 18-18-18 at a minimum rate of 300 kg/ha. Take necessary precautions to prevent entry of fertilizer into adjacent aquatic systems.
- In the southern interior, fertilize with slow release fertilizer with varying concentrations of Nitrogen, Phosphorus, and Potassium such as 18-18-18, 16-32-6, 23-11-11, and 16-20-15. Take necessary precautions to prevent entry of fertilizer into adjacent aquatic systems.

Additionally:
- Legumes species should be inoculated when mixed.
- Seed immediately on disturbed area and do not allow the surface to become compacted.
Appendix C - Example of Implemented Site-Specific Prescription for Management of Riparian Vegetation adjacent to Nile Creek, Vancouver Island

Power Line:  5L29/31 (Transmission)

Setting:  The stream-side vegetation surrounding the 185 m section of Nile Creek, near Qualicum Beach, B.C., where it crosses underneath power line 5L29/31, is a productive riparian ecosystem. However, it is also an area where vegetation must be maintained to ensure the flow of power to Vancouver Island is never interrupted. At this crossing site, tall growing vegetation is dominated by deciduous species including bigleaf maple, red alder and black cottonwood. In addition, the site has tall coniferous species that include hemlock, western red cedar and Douglas fir. Currently, the tallest of the red alder, black cottonwood, hemlock and Douglas fir are reaching heights of between 10 to 15 m, bringing some within the transmission line’s limit of approach. The dense lower canopy of the site is dominated by salmonberry, elderberry, bitter cherry, ferns and other berry species.

Nile Creek is classified as a S2 stream, utilized by coho and chum salmon as well as resident trout species. The section of creek flowing through this site, has a gradient of <2.0%, exhibits predominantly run-riffle habitat (with few pools) and substrate dominated by large gravel and cobble. In the upstream 90 m of the crossing the stream demonstrates multiple channels and good habitat complexity. However, the remaining 95 m of the crossing the creek remains in a single channel, has ample shading but lacks habitat complexity. To compensate for this, enhancement activities have involved placing large organic debris (LOD) within the stream or cabling it to the stream bank.

Nile Creek has significant social value. This area is readily accessible and heavily utilized by both sport fishers and hikers. The crossing lies within the traditional lands of the Qualicum Indian Band. In addition habitat conservation is also a major concern of the Nile Creek Hatchery Society.

Rationale:  The following work is planned for the area which falls within the 50 m riparian zone around this S2 stream. Over an 8-year (figure 1) period, the current tall growing largely deciduous riparian community will be altered into a mixed low-growing deciduous and taller-growing coniferous community. This plan will maintain the current functions of the riparian community but will lead to less frequent and drastic incursions into the area. In addition, developing the largely coniferous stream side community will contribute to hydraulic stability and habitat complexity (through the natural addition of LOD). In the future, riparian zone vegetation management will involve removal of hazard trees from the site rather than major site disturbance.

Procedure:  1  Prepare a site work plan including access, planting strategies and goals for the site, which is discussed with work crews during all tailboard meetings.
2  Girdle 1/3 of tallest deciduous trees throughout the site with priority given to the tallest and those clumps which provide the best natural regeneration.
3  Selectively crown reduce (by up to 1/2) all coniferous trees, >20m tall.
4  Do not modify species that will not grow tall enough to enter limits of approach.
5  Prepare and implement a plan that maintains biodiversity at the site including;
a) Enhancing willow, red elderberry, Indian plum and other native low to medium height deciduous species found at the site,
b) Where appropriate and beginning directly adjacent to the high water mark of the stream, plant minimum 1 m tall acceptable conifer species.
c) Monitor site and ensure good survivals
6 Ensure no machinery enters stream or damages banks.
7 Selectively create wildlife trees where safe, practical and effective.

<table>
<thead>
<tr>
<th>Year</th>
<th>Task Description</th>
</tr>
</thead>
</table>
| Year 1 | 1) Girdle 1/3 of riparian deciduous trees  
         | 2) Crown reduce coniferous trees (>20m)  
         | 3) Selective planting where required |
| Year 2 | 1) Girdle 1/3 of riparian deciduous trees |
| Year 3 | 1) Girdle 1/3 of riparian deciduous trees |
| Year 4 | 1) Monitor planted site  
         | 2) Girdle selected vegetation |
| Year 5 | 1) Monitor site |
| Year 7 | 1) Monitor site |
| Year 8 | 1) Girdle selected vegetation  
         | 2) Monitor site |

Proposed Schedule for Vegetation Management in the Riparian Area of Nile Creek